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-Semi-Annual-

HISTORY

NUMBER SEVEN

VOLUME ONE

NARRATIVE

JUNE 1954

PREPARED BY
THE DIRECTORATE OF
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HEADQUARTERS
AIR DEFENSE COMMAND

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SEMI-ANNUAL HISTORY

June 1954

Prepared by
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PREFACE

This is the seventh semi-annual History prepared by the Headquarters, Air Defense Command Historical Office. It was written at the direction of and in compliance with Air Force Regulation 210-3.

The History consists of two, self-sufficient parts. Book I treats of the major activities within the Command during the six-month period ending June 1954. The purpose of this part is three-fold: To serve as an introduction or guide to the detailed operational and organizational information contained in the January-June 1954 histories of the Air Defense Forces, Air Divisions (Defense), Defense Wing, and special units; to provide a convenient reference to the status of the forces for air defense, both actual and programmed, during the period; and to round out the story of activities within ADC during the period through the inclusion of information and documentation not available to the historians of the lower echelons.

Book II is a monographic study of an especially important aspect of air defense operations. The attempt was made in this work to synthesize the data and documentation on the particular subject previously submitted in the lower echelon and Command semi-annual histories, and any additional data which for reasons of time, oversight, or security never found its way into the periodic volumes. At the request of the Directorate of Operations and Training, Hq ADC, this study was separately bound and distributed throughout the Command for orientation and reference.

Book I of the Report, with the exception of Appendices VI through IX, was prepared by the undersigned with the research assistance of the other members of the Historical Office. Dr. George Montagno wrote the aforementioned appendices. Book II was prepared by Mr. Lydus H. Buss. Mrs. Izella E. Bach and Mrs. Betty Terry performed the manuscript typing. Security and reproduction details incident to the compilation of the volumes of supporting documents were handled by A/1C Robert E. Rusnock.

Colorado Springs
1 December 1954

Thomas A. Sturm
Director of Historical Services

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REFERENCE NOTES:

Detailed tables of contents are included with each separate Book of the narrative.

Supporting documents are numbered separately by book. In Book II, documents are numbered consecutively within Parts One and Two, and consecutively within each appendix.

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HEADQUARTERS, AIR DEFENSE COMMAND

SEMI-ANNUAL HISTORY NUMBER SEVEN

June 1954

BOOK I

<u>OUTLINE HISTORY OF THE PERIOD</u>

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LISTING OF PUBLICATIONS INCLUDED IN VOLUME II

I. Headquarters ADC, Command Data Book, June 1954

II. ADC Station List: 1 August 1954

III. Headquarters ADC, Operations Order 3-54, 1 April 1954

IV. Headquarters ADC, Operations Plan 4-54, 15 June 1954

V. Headquarters ADC, DCS/O Project Reports, 1 August 1954

VI. Headquarters ADC General Orders, January through June 1954

VII. Headquarters ARAACOM, Statistical Data Book, Apr-June 1954

VIII. Headquarters ADC, Statement of Effectiveness, July 1954

IX. Headquarters ADC, Procedure for Executive Control, 1 May 1954

X. Headquarters ADC, Annual Report, Fiscal Year 1954

XI. Headquarters ADC, Organizational Booklet, 1 October 1954

XII. Headquarters ADC, Program, 1 July 1954

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PART ONE

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CHRONOLOGY

Date	Event
1 January	Final Report of APGC operational suitability test of the F-94C Squadron, held at Otis AFB in late 1953, received in Hq ADC on or about this date. (See Chapter IV).
11 January	Gap-filler radar, 3d phase augmentation, GCI computer, and Texas Tower requirements approved and portions thereof budgeted for by Hq USAF. (See Chapter II).
15 January	First AA battalion began conversion to NIKE on or about this date. (See Chapter II).
1 February	Weapons training began at Yuma. (See Chapter IV and Book II).
4 February	EADF instructed to establish interim corridor identification system in the New York-Atlantic City area. (See Chapter III).
9 February	Reduced fighter interceptor alert requirement and intensive training program extended an additional thirty days. (See Chapter III).
15 February	531st AAA Bn (Skysweeper) became operational at Ellsworth AFB, So. Dakota on or about this date. (See History of CADF, Jan-Jun 1954, pp 204-209).
16 February	444th Fighter Interceptor Squadron activated at Charleston AFB, So. Carolina and equipped with F-86Ds. (See History, 35th Air Div, Jan-Jun 1954, p 2).
25 February	Phase II of APGC operational suitability test (F-86D Squadron), conducted at George AFB, completed. (See Chapter IV).
27 February	The COSAMO operation discontinued by order of General Chidlaw. (See Vol III, document 2).

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Date	Event
27 February	Functions and manning review of ADC organizations through Air Division (Defense) level completed and final report forwarded to Hq USAF. The findings of the boards established throughout ADC to conduct the review supported prior ADC manpower analyses that its administrative and command staffs were already operating with minimum manning. The initial reply from higher headquarters to the ADC report appeared to support this evaluation. (See Chapter II).
1 March	326th Fighter Interceptor Squadron transferred from Fairfax Field, Kansas City, Mo. to Grandview AFB, on the outskirts of that city. (See History, 33d Air Div, Jan-Jun 1954, p 167).
1 March	4712th AEW&Con Squadron activated at Otis AFB, Mass. Transferred to McClellan AFB, Calif. on 25 May. (See Appendix III).
4 March	Last of F-86Ds grounded in December 1953 for T. O. compliance returned to flying status. (See Appendix V).
10 March	Move of Hq CADF from downtown Kansas City, Mo. to Grandview AFB, Mo. completed about this date. (See History of CADF, Jan-Jun 1954, pp 204-209).
15 March	Project PULL OUT, a program for modification of the F-86Ds, placed underway on or about this date. (See Appendix V).
18 March	460th Fighter Interceptor Squadron activated at McGhee-Tyson Airport, Knoxville, Tenn. (See History, 35th Air Div, Jan-Jun 1954, p 2).
18 March	4713th, 4617th and 4754th Radar Evaluation (Electronic Countermeasures) Flights (RDE) activated at Griffiss AFB, N.Y., Hill AFB, Utah, and Hamilton AFB, California, respectively. (See Appendix I).
18 March	Aircrew authorization in F-86D squadrons reduced from 2.0 to 1.5 crews per aircraft. (See Appendix V).
1 April	Interceptor Force ordered to an increased alert status. (See Chapter III).

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Date	Event
1 April	539th Fighter Interceptor Squadron activated at Stewart AFB, N.Y. (See Appendix V).
1 May	8th Air Division (AEW&Con) activated at McClellan AFB, California to supervise the build-up of the AEW&C force. Colonel Kenneth H. Gibson assumed command on 19 May. (See Appendix III).
1 May	Air Defense Identification Zone (ADIZ) boundaries altered in EADF and CADF areas. (See Chapter III).
3 May	APGC Project WOLFPACK -- established to investigate the problem of multiple intercepts against multiple bombers -- began at George AFB, California, employing the 94th FIS. (See Chapter IV).
11 May	Three-day conference of Air Defense Force commanders, their Deputies for Operations, and key Headquarters ADC personnel began at Colorado Springs. (See Vol III, document 5).
15 May	SKYSCAN, a nation-wide study to determine the effectiveness of the GOC under alerted conditions, got underway on or about this date. (See Chapter IV).
31 May	440th FIS at Geiger AFB, Washington and 496th FIS at Hamilton AFB, California, both F-86D squadrons, reassigned to Landstuhl and Hahn airbases in Germany on or about this date. This action reduced the fighter interceptor force to fifty-five squadrons on forty-one bases, where it remained through June. (See Appendix V).
2 June	Requirement for second weapons training center (similar to the one at Yuma) submitted to higher headquarters. (See Chapter IV).
4 June	Interim Maneuver Identification System (IMIS) put into operation in New York area. (See Chapter III).
10 June	Request made to higher headquarters that all interceptor and radar squadrons and their integral support elements (including the Yuma Weapons Training Center) be placed in Precedence Category II. (See Vol III, document 6).

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PART TWO

NARRATIVE SUMMARY

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CHAPTER I

SURVEY OF THE PERIOD

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ADC Intelligence estimated that the Soviet Long Range Aviation force in early 1954 consisted of about 1,220 TU-4s manned with experienced and aggressive crews. There was a good possibility that this force was backed-up with some short-range, air-launched pilotless aircraft and perhaps a number of the Type 31 heavy bombers that had appeared in the July 1951 Soviet air show. There was no knowledge of how many atomic bombs the Soviet's had stockpiled; that would depend on the yield or design of the bombs which they had elected to amass. It could be safely assumed, however, that they had a goodly store of the weapons on hand. So far as electronic jamming was concerned, ADC accredited the Soviet crews with a high capability in the art.[1]

Deployed against this force, ADC, at the end of June 1954, had fifty-five interceptor squadrons and operational control over sixty-four battalions of antiaircraft weapons plus the fighter forces of SAC, TAC and the other major Air Force Commands and the Navy. The assigned fighter squadrons, the majority of which had only recently converted to jet all-weather fighters, were at a low level of combat proficiency. The fighter forces

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1. Hq ADC, Operations Order 3-54, 1 Apr 1954, Annex A. (See Vol II).

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of the other Air Force organizations and the Navy, for the most part, were either flying aircraft unsuited for all-weather combat or were so deployed as to render their employment doubtful during the initial phase of a surprise attack.

The warning and fighter control forces consisted of the radar stations of the Alaskan Air Command, the Northeast Air Command, and the Canadian Air Force Air Defence Command, and the eighty-nine radar stations assigned to ADC. In support of the radars were the Ground Observer Corps posts, facilities whereby Soviet attack forces detected by forest rangers, Canadian Mounties, ships at sea, etc., could be reported into the system, and a few "augmentation" radars owned by the other Air Force agencies and other services.

In the final analysis, then, neither the threat nor the U. S. forces deployed to meet it changed much during the first half of 1954. It remained a transitional period, during which time the Soviets continued to stockpile weapons and develop better bombers and ADC pressed toward its goal of first a "minimum" air defense structure and second a system adaptable to the introduction of new weapons as necessary to keep pace with improvements in the Soviet strike force.

II

A "minimum" air defense system was once regarded as one comprised of enough radar stations and equipment to detect aircraft from the ground up and as many all-weather jet interceptors as

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the national economy could afford. Through the years the requirement has been more specifically defined so that by mid-1954 it could be conceived in terms of the men, equipment and stations actually programmed the Air Defense Command by 1957. By that time, if everything came off as scheduled, sixty-nine squadrons of jet all-weather aircraft, between 170 and 200 manned radar stations, and some 300 unmanned gap-filler radar stations would be in operation in the continental U. S. air defense system. To extend the warning and control capability seaward, Texas Towers and picket vessels would be stationed offshore and a fleet of airborne early warning and control aircraft in operation over the ocean approaches. To give the system greater warning of impending attack from the north, a line of detection devices would be erected across the mid-section of Canada. With these facilities, plus the automatic system for transmitting combat data which the Lincoln Laboratory had under development, the air defense system, for the first time in its history, would have a fighting chance to detect, identify, intercept and destroy an attacking force before it reached its targets.

Having once attained this "minimum" defense establishment, ADC's work will have just begun rather than just finished. The advent of Soviet high-speed and high-flying jet bombers, for example, would negate the warning value of the mid-Canada line; the new bombers would be through it and onto their targets while ADC's crews were still struggling into their G-suits. This meant

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that sometime before the Soviets modernized their Long Range Aviation, ADC would have to push its early warning line far closer to the Arctic circle. Too, as the Soviet strike force grew in speed and numbers ADC's weapons system would also have to expand in size and fire power.

III

By mid-1954, construction of many of the stations of the semi-mobile portion of the warning and control expansion programs was underway. The airborne early warning and control force, too, was beginning to take shape. Siting, budgeting and other preparatory actions were being taken on the remainder of the programs.

At the very close of the period, ADC published its plans for the operation of the system once these forces were in place and, in the same paper, depicted the system's requirements as they would exist through 1960. The appearance of this publication, termed the Air Defense Requirements study for 1954-1960, was a high-water mark of sorts in the overall history of ADC. For the first time, ADC's needs over the years to come, posed in terms of the mounting threat, were clearly and succinctly set down in one package for higher headquarters and the other services to perceive and, it was hoped, support.

On the operational side of things, the subject which probably commanded the most attention during the period was that of learning how to maintain and operate the new jet all-weather interceptors. Conversion to the new aircraft, which began back in early 1953,

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was completed by all but six squadrons by the end of June 1954. The vast majority of the new aircraft were single-place F-86Ds, genially described by one ADC commander as "a fine airplane for a two-headed fellow with four arms."[2] The remainder were the dual-place F-94Cs and the F-89Ds. As with all new aircraft, there were a lot of "bugs" in them, and programs for returning the F-86Ds and F-94Cs to the factories and materiel centers for structural and equipment changes got underway during the period. Exceptionally difficult maintenance problems remained, however, particularly with the electronic fire control systems. These were exceedingly complex systems, and it would be a long time before ADC and the Air Force as a whole would have trained persons in the numbers needed to keep them in the absolutely tip-top condition required for 90 degree beam collision course intercept operations.

After the pilots had transitioned to the new aircraft and the planes placed in fully operational order, the real difficulties began. Gone were the days of the "heads-up" fighter pilot, with his few instruments to follow and the seat of his pants to fall back on when something went wrong. The jet all-weather pilot flew by the radar scope and the beam given him by his co-partner, the radar director on the ground. An error on the part of either member of the team and the enemy would slip away unharmed into

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2. Maj.Gen.M R Nelson, CG EADF, to members of the New York Bar Association on January 28, 1954. As reported in EADF History for July-December 1953, p 127.

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the night or fog. Perhaps never before in the history of combat aviation was the success of a mission so dependent on ground-air teamwork as it was in air defense intercept operations.

On the first of December 1953, ADC dropped its fighter alert requirements to a new low to free as many interceptor aircraft as possible for aircrew-director proficiency training. The intensive training period was to last through February. In December, however, the F-86Ds were grounded for Tech Order compliance, and it was March before they were all back in the air again. Consequently, the intensive training period was extended another month. Much was accomplished as the result of this subordination of the alert requirement to the training requirement, but at the end of June the Command as a whole was far below the safety mark in terms of combat proficiency. This came as no surprise to commanders; in fact, it was anticipated when the decision was made a year and some months before to proceed full speed ahead with conversion to the all-weather fighters. But it was still an uncomfortable feeling to have one's right arm in a sling when at any moment he might be attacked.

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IV

In all, then, four activities -- implementation of the expansion programs, the completion of the Requirements study, conversion to the new interceptors, and intensive system training -- stood out during the period. Of course, such important matters as individual training, improving the quality of the gear assigned

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the radar squadrons, refining the interim system for data display and transmission, etc., also continued to receive first attention. Finally, a host of important events took place. The first F-89Ds arrived in the system. The first NIKE missiles were received by the antiaircraft defenses. The 8th Air Division was activated at McClellan Air Force Base, California to supervise the build-up of the airborne early warning and control forces. Three new fighter interceptor squadrons were activated, manned and equipped and two of the older squadrons lost to overseas assignments. Project PULL OUT, under the terms of which all of the F-86Ds were scheduled for return to the factory for overhaul, got underway. Controller and rocketry firing training began at the Yuma Weapons Training Center. And a new corridor identification system was placed in operation in the New York area.

The sum total of these activities and events did not appear to be an increase in the combat potential. In fact, if anything, the adverse was true. Throughout the ADC household, however, there was a feeling of forward movement in the air. Everything was on the verge! The interceptor force, for the first time in its history, was on the verge of being fully equipped with the type of planes it needed to do its job. The radar net was on the verge of receiving the last of its primary gear. The radar expansion programs were underway. The scientists at the Massachusetts Institute of Technology were pressing forward on a "crash" basis to provide ADC with an automatic means for rapidly passing combat

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data from lower to higher echelon combat centers. And the aircrews and their teammates in the direction centers were fast becoming familiar with the new aircraft. The "show" which had gone on the road in early 1953 was very definitely on the move in mid-1954.

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CHAPTER II

EVOLUTION OF THE STRUCTURE

I

By the end of June 1954 the area defenses of the twenty-four hour operational air defense structure were comprised of eighty-nine radar stations[1] and fifty-five interceptor squadrons on forty-one bases.[2] Sixty-four battalions of antiaircraft weapons were deployed for the point defense of twenty critical target complexes.[3] This was an increase of one interceptor squadron and two antiaircraft battalions over the December 1953 defenses.

The two ADC-manned Canadian stations which were still operating with interim search radars in January received their programmed FPS-3s early in the year. Too, several more of the continental U. S. radar stations that had been making shift with temporary or back-up height finding gear were on the air with their programmed FPS-4 height finders by the end of the period. Other than these few changes, the equipment status of the radar

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1. See Part Four, Table II for a listing of the radars in operation at the end of June 1954, their location, and the type of primary equipment installed in each.

2. See Part Four, Table V for comparable information on the interceptor force.

3. See Hq ARAACOM, Statistical Data Book, 1 April-30 June 1954, in Vol II.

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net remained the same in June 1954 as it had been six months before.[4]

It was a far different story in the interceptor force. The new jet all-weather fighters continued to flow into the system at an almost indigestible rate throughout the first six months of 1954. At the end of June, all but six of the fifty-five squadrons were equipped with one or the other of the new aircraft. Thirty-six squadrons were flying F-86Ds and ten F-94Cs. Three squadrons -- the 438th at Kinross, the 497th at Portland, Oregon, and the 18th at the Minneapolis-St. Paul airport -- had converted to F-89Ds, which began to arrive in the system in January. Three of the remaining six squadrons were equipped with F-89Cs and the rest with F-86F day jets.[5]

The big event in the point defenses was the addition of NIKE to the antiaircraft arsenal. The guided missiles began to arrive in January and by the end of June six battalions -- three in the vicinity of New York City, one at Washington, D. C., one at Chicago, and one at Detroit -- had converted to them.[6] For the first time, the Central Air Defense Force came into possession

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4. See Appendix I for more detailed information on radar equipment changes during the period.

5. For more detailed information on the changes in the interceptor force during the first half of 1954, see Appendix V. See Vol III, document 7 for information on the characteristics of the new F-89D.

6. See Part Four, Table IX.

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of antiaircraft defenses when the 531st AAA Battalion went on site at Ellsworth AFB with Skysweeper in February.[7]

Progress in the build-up of the network of ground observer posts was very marked during the first half of 1954. The number of active observer posts increased from 3,794 to 5,383 during the months of January through May. The number of civilian observers actively participating in the program grew from 104,709 to 130,744.[8] General Chidlaw expressed ADC's appreciation of the fine work these patriotic citizens were doing on the second anniversary of SKYWATCH. "It is one thing to watch our combat strength grow gradually," the General said, "to watch our radar warning net thicken, and to watch our warning line creep northward....but it is...inspirational to see these Americans who have other jobs, other responsibilities, and other interests...allot a certain portion of their time on a regular basis to help plug the holes in our warning system."[9]

II

The Command continued to grow in manpower strength during the period. At the end of June, there were 82,242 persons assigned -- 8,747 officers, 64,697 airmen, and 8,798 civilians. Authorized strength increased from 73,685 to 77,752.[10]

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7. History of CADF, Jan-June 1954, pp 240-247.

8. See Part Four, Table IV.

9. Remarks by General Chidlaw, the Mayflower Hotel, Akron, Ohio, 14 July 1954, p 2. As reported in History of EADF, Jan-June 1954, p 31.

10. Bi-weekly Status Report, (in AGF Mgt 7-2).

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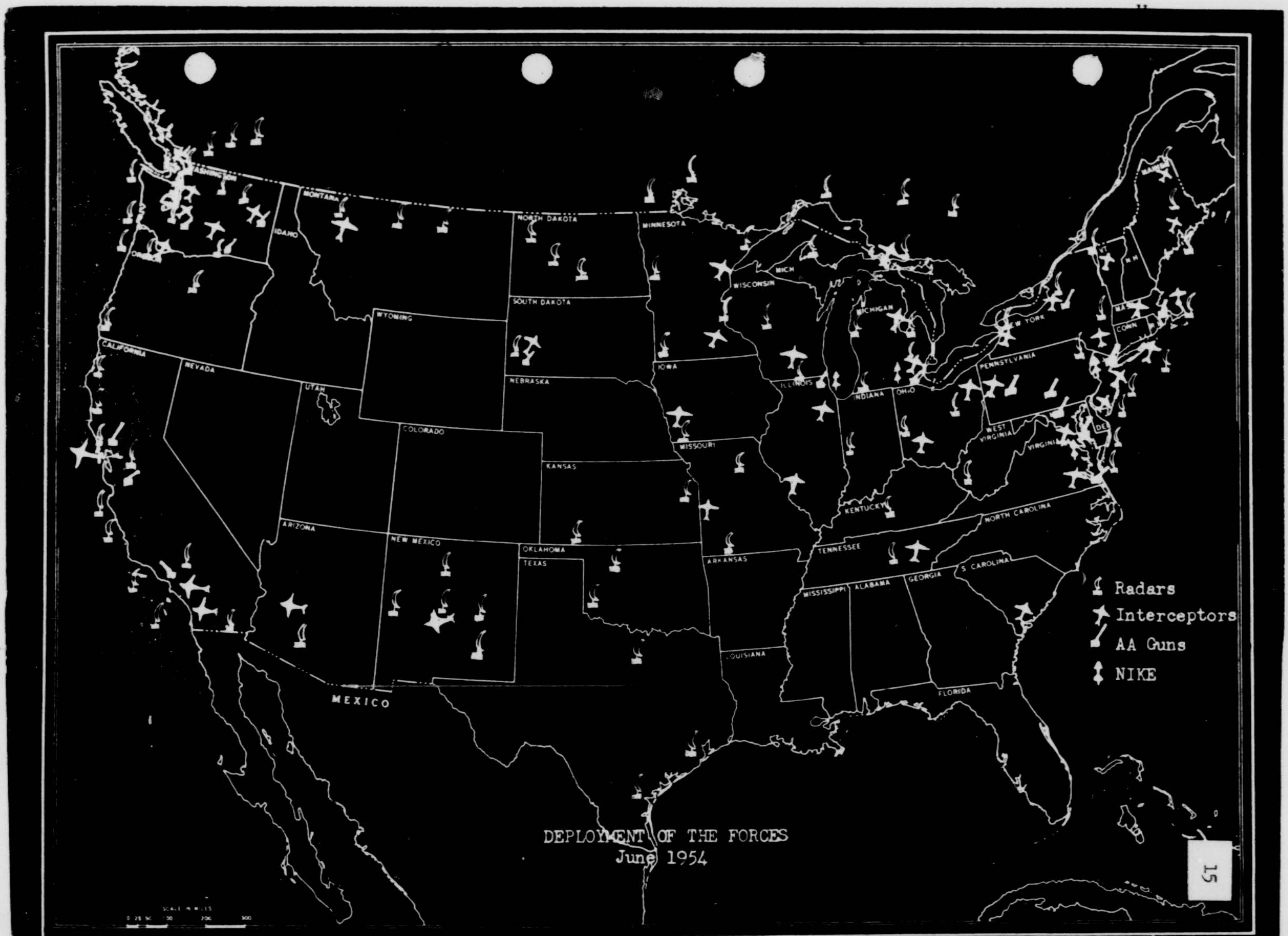

DEPLOYMENT OF THE FORCES
June 1954

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Despite the surplus of individuals assigned, the tactical units were still seriously undermanned in certain skill specialties. In May, effective manning in the interceptor squadrons and in the operational team positions in the radar squadrons was about eighty-one percent.[11]

About the only way in which the skilled personnel shortage could be alleviated was through on-the-job training and to this activity the Command continued to devote considerable time and effort. In March, a request was submitted for spaces for a training officer and a non-commissioned officer in each Defense Wing, Defense Group, and tactical squadron to supervise the on-the-job program. In April, higher headquarters passed approval on it to the extent of granting such specialists to the interceptor squadrons. Further action for improving the constancy and quality of on-the-job training programs were the inclusion of a slot for an executive officer in each fighter squadron manning document,[12]

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11. Hq ADC, Command Data Book, June 1954, pp 3.4-3.7, in Vol II. The "effective manning" figure was derived by dividing the sum total of persons assigned a unit by authorized primary AFSC, those working in authorized AFSCs who held the AFSC as a secondary skill, and those in training status working into an authorized AFSC who were considered qualified by the command by the total number of persons authorized. "Operational team positions" were the controllers, air traffic service officers, ground electronics officers, ECM officers, AC&W operators, and radio and radar repairmen.

12. Hq ADC, Statement of Effectiveness, June 1954, p 13, in Vol II.

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and the waiver by Headquarters USAF of the restriction that top three graders with conventional aircraft maintenance skills could not be retrained in jet maintenance duties.[13]

On the manpower scene USAF-wide, the austerity program initiated in 1952 continued in force throughout the period. If the Air Force were to meet its June 1957 expansion goals it had to pare manpower authorizations in support echelons and organizations to the bone.[14] At the direction of higher headquarters, ADC, in late 1953, had embarked on a survey of the efficiency of its manning in the several headquarters staffs through Air Division (Defense). The conclusion which ADC reached, after devoting considerable time to the project, was that there was no "fat" in its organizational hierarchy. The initial review of the survey report by Headquarters USAF indicated that that organization agreed, for the most part, with this finding.[15]

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13. Hq ADC, Staff Notes, 6 Mar 1954, p 5, (in AGF).

14. In early January 1954, the approved Air Force expansion goal was from 115 Wings in June 1954 to 137 Wings by June 1957. Overall personnel strength of the USAF at the end of May 1954 was 939,798 officers and airmen. Total personnel authorized under the 1957 program was to be 975,000. At the same time ADC and the other operational commands were increasing in strength, the Air Training Command and the other support forces were being reduced in size. This emphasis on the operating forces was to continue through 1954 and the first half of 1955. (Hq USAF, Summary Control Statements, for 26 Feb and 25 Jun 1954).

15. See Vol III, documents 2 and 3.

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III

Construction of radar stations programmed under the semi-mobile portion of the warning and fighter control expansion program was underway at the close of the period. Further, two squadrons of airborne early warning and control were undergoing training on the West coast. In early January, ADC's requirements for low altitude gap-filler radars, additional semi-mobile stations, and Texas Towers was approved by Headquarters USAF and portions thereof provided for in Fiscal Year 1954-1955 budgeting.[16]

Late in 1953, the 4701st Airborne Early Warning and Control (AEW&C) Squadron was activated at McClellan AFB in California. By the end of the year, two RC-121Cs, minus their radar gear, and thirty-four pilots were assigned the outfit. Until fully equipped aircraft were made available, the mission of the unit was to be training only. Originally, the plan was to place the first operational AEW&C units at Otis AFB, Massachusetts, but due to crowded conditions at that installation, which could be corrected only through further construction, it was decided in early 1954, that the first build-up of the AEW&C forces would be made at McClellan. To oversee the build-up the 8th Air Division (AEW&Con), under the command of Colonel Kenneth H. Gibson, was activated at McClellan on 1 May and the 4701st Squadron assigned to it. The 4712th squadron, which had been activated at Otis AFB earlier in the year, was assigned to the 8th and

16. See Vol III, document 6.

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physically transferred to McClellan in May. After the AEW&C program was fully operational on both coasts, the 8th Air Division would be inactivated and its administrative and operational responsibilities assumed by two Wing headquarters.

At the end of June, four RC-121Cs were in operation at McClellan, but the units were still in a training capacity.[17]

Thirteen construction contracts on the forty-four radar sites included in the first phase of the semi-mobile program had been awarded at the end of June, and ADC was in the process of training the personnel scheduled to occupy the sites when they were completed. The training was being done at presently operational radar stations in the areas where the new stations were being built. All told, ninety-nine stations were to be constructed under the terms of the semi-mobile program. This included the third phase stations whose construction was approved by higher headquarters early in the year. The reduction of the overall number of stations programmed came about as the result of the policy not to build a station in an area where a low altitude, unmanned radar could perform the job just as well. According to end June 1954 programming, construction on forty-two of the semi-mobile stations would be completed before the end of the year with the remainder to be completed by December 1956.[18]

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17. See Appendix III for further details on the AEW&C program. The histories of the Eastern and Western Air Defense Forces as well as the histories of the AEW&C squadrons and the 8th Air Division provide considerable additional information on the status and manning of the AEW&C units during the period.

18. See Appendix II for additional data on the status of the semi-mobile program during the period.

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Higher headquarters, in its January 1954 action, approved the addition of 323 low altitude gap-filler radars to the air defenses and placed the construction of 125 of them in 1954-1955 budget programs. These first stations were to be deployed on the outer perimeters of the continental defense area and were to be built by early 1956. The remainder of the stations would be set up within the double perimeters in such a manner that an intruder aircraft flying at 500 feet and at 250 miles per hour would not be out of radar surveillance longer than four minutes.[19] By mid-1957, ADC hoped to have 225 of these radars in operation.[20]

The approved Texas Tower program called for five of these facilities to be built in the northeast Atlantic sea area by mid-1957. At the end of June 1954, ocean floor borings were being conducted to determine the most suitable locations.[21]

IV

There were no changes in Air Defense Force "region" or Air Division (Defense) "sector" boundaries during the period. A few "subsector" changes were made in the mid-west as a result of the realignment of Air Defense Identification Zones in EADF and CADF,

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19. Hq ADC, Program, Section III, p 9, in Vol II.

20. See Appendix IV for additional data on the status of the low altitude gap-filler program during the period.

21. Hq ADC, DCS/O Project Reports, 1 Aug 1954, p 192, in Vol II. It was estimated that 27-30 personnel would be required to man each of the Texas Towers. The total capital investment for each site was estimated at $440,000. (Hq ADC, Briefing, May 1954, p 50).

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but these changes did not alter the organizational breakdown of the territory for air battle as it had existed in late 1953.[22]

The extension of teletype facilities to the Alaskan Air Command, Northeast Air Command and the Royal Air Force Air Defence Command at St. Hubert was the only event of consequence which took place in the information network during the period. Teletype telling was initiated in ADC in June 1953 and soon proved its worth. Until the manual system was replaced by the automatic system under development in the Lincoln Laboratory,[23] teletype telling was destined to remain ADC's primary means for dispatch of combat information through the system.

During the latter half of 1953 the installation of teletype lines was completed throughout ADC, the necessary number of reperforators and selectors was determined through experimentation, and tentative procedures for operating the network were established. By the end of the year, ADC had submitted a requirement for extending teletype facilities to the Canadian defenses, NEAC and Alaska, and action was underway to publish an ADC procedural manual.

Authorization for the expenditure of some $12,500 for the purchase of special teletype equipment from Western Electric Co. to be used for transmitting track information between Alaska and the continental defenses came down from higher headquarters in early 1954.[24]

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22. See Histories of EADF and CADF, Jan-June 1954, pp 47 and 174-175, respectively.

23. See Appendix VII for information on developments on the Lincoln Transition System during the period.

24. Hq ADC, Diary, 21 May 1954.

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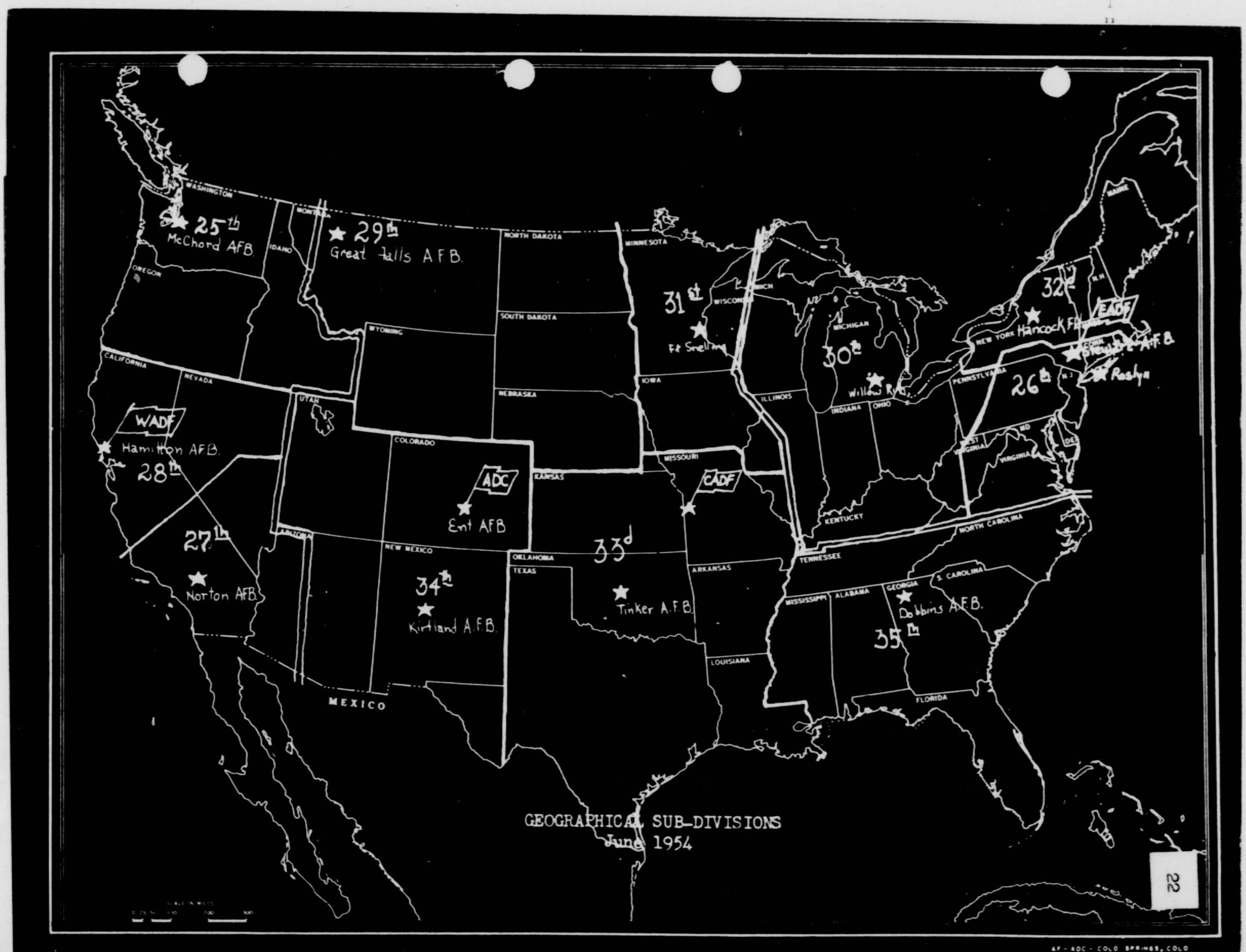

GEOGRAPHICAL SUB-DIVISIONS
June 1954

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By the end of June, the ADC Combat Center was receiving track information from Alaska via the 25th Air Division tie-in. Similar lines had been installed between NEAC and the RCAF/ADC and the 32d Air Division. These latter systems were in an interim status, however, with coordination still underway with AT&T in New York for their completion.[25]

After the ADC-wide summer exercise scheduled for July was over, the teletype system was to be extended to the AAC's two Divisions in Alaska and to the 12th Air Defense Group at Vancouver.[26]

The manual on data reporting (ADCM 55-3) was published on 1 May. It was divided into two parts. The first section was devoted to the new reporting procedures to be followed under the teletype system of operation. The second portion, which was written by AT&T representatives, contained instructions for operating the new equipment.[27]

V

While a fairly large number of changes took place at tactical level during the period, then, the organizational structure of the Command through Defense Wing headquarters level was not altered. Changes in the upper strata of the organizational hierarchy were

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25. Hq ADC, DCS/O Project Reports, 1 Aug 1954, p 1, in Vol II.

26. See document 13, History of WADF, Jan-Jun 1954.

27. A copy of the manual is included in Vol III, as document 10.

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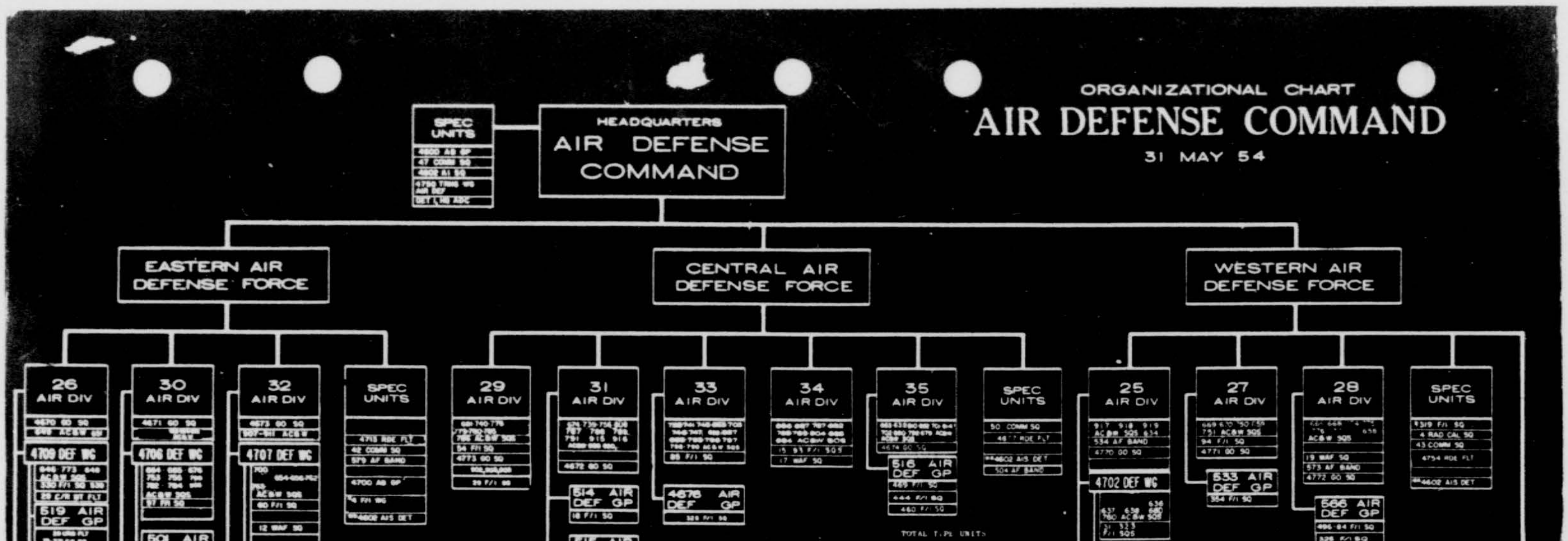

TOTAL T.P. UNITS

	EADF	CADF	WADF	ADC	TOTAL
Air Def Force Hq	1	1	1	0	3
Air Div Hq	3	5	4		12
Air Def Wing Hq	6	0	[illegible]	0	8
Air Def Gp Hq	14	5	6	0	25
Air Base Gp Hq	1	0	0	1	2
AC&W Gp (Mobile)	1	0	0	0	1
AC&W Sq (Permanent	28	27	20	0	75
AC&W Sq (Mobile	12	26	4	0	42
AC&W Sq (R.E.P. (Canadian)	3	3	2	0	8
Ftr Sq	31	13	13	0	57
GOC Sq	3	3	3	0	9
C/R Boat Flts	6	0	2	0	8
Comm Sqs	1	1	1	1	4
WAF Sqs	1	1	1	0	3
AF Bands	2	1	2	0	5
Radar Eval Flts	1	1	1	0	3
AISS Sqs	0	0	0	1	1
AISS Dtchs	1	1	1	0	3
AEW&C Sqs	0	0	2	0	2
Acft Control Sqs	1	0	0	0	1
Training Wing	0	0	0	1	1
Hq ADC, Det 1	0	0	0	1	1
TOTAL	116	88	68	5	277

Note Totals include only units shown in this chart

* DS - FEAF
** COMMAND OPNL CONTROL - 4602 AI SQ (HQ ADC)

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just around the corner, however, in view of the impending expansion of the radar warning and control network.

By mid-1956, ADC felt that it would require sixteen Air Division (Defense) headquarters, an increase of five over the number presently operational. Later, sometime in 1960, with the advent of the Lincoln Transition System, it would be possible to operate with only nine Air Divisions. ADC spelled out its plans in this regard in considerable detail in a letter to its forces in May.[28]

ADC would undoubtedly make many changes in the details of its future organization plans as conceived in early 1954. By the same token, however, certain principles of air defense organization had been worked out in the five or more years since the initial establishment of the air defenses, and it would be to the disinterest of both efficiency and economy to organize in any manner that refuted them. These tenets, which in sum amounted to a sort of philosophy of air defense organization, were set down as follows in the May letter:[29]

> Air Division Commanders should have control of all air defense tools in his area which are necessary for the active air defense.
>
> With minor exceptions, one man on each ADC operated base should have command of all ADC units located thereon.

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28. See Vol III, document 11.

29. Ibid. See also, Vol III, documents 12-15 for additional information on future organization matters.

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Wings should be injected between the Air Divisions and operating units when a reasonable span of control is exceeded. Because of the homogeneity of ADC units, a maximum of sixteen units is considered satisfactory in some cases.

ADC owned and operated bases will be operated by an Air Defense Group.

Austere manning standards preclude authorization of full staffs at all levels of command.

Under the Lincoln Transition System a subsector (Direction Center) should in most cases be at Wing level.

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CHAPTER III

ACTIVE AIR DEFENSE OPERATIONS

I

Fighter alert requirements were reduced to a new low on 1 December 1953 to facilitate conversion to the new aircraft and to free crews and planes for system training with the ground radar directors. The intensive training period was originally scheduled to last only through February, at which time ADC hoped to be over the hump, so to speak, so far as proficiency training of the combat team was concerned. In late December, however, the F-86Ds were grounded and the carefully planned training program went up in smoke. As a result of this disruption of schedules, ADC elected to extend the reduced alert schedule for another month. The official instructions to the Air Defense Force Commanders stated that they were to "use this additional time to advantage thereby insuring maximum combat readiness by the start of the critical period."[1]

On 1 April, ADC followed its usual custom of stepping up the number of aircraft to be kept on alert. The increase ordered, however, compared to the numbers kept on alert during previous critical periods, was very slight. At single squadron bases, the day requirement was not changed -- i.e., two aircraft were placed on five minute alert and four on one hour alert. At night, on the

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one squadron bases, two planes were placed on five minute alert, two on fifteen minute alert, and two on one hour alert. The remainder of the aircraft on these bases were placed on "Reserve" or three-hour alert. On the bases where two squadrons were stationed, two aircraft were placed on five minute alert and eight on one hour alert during the day. At night, or during non-duty hours, the requirement was the same as for one-squadron bases with the exception that eight aircraft were placed on one hour alert.[2] The alert schedule, ADC stated, "did not represent the optimum desired" but it was the best that could be drawn up under the circumstances.[3]

This alert requirement remained in force through June. Precisely how many aircraft were on alert at any one time was difficult to say since Air Defense Force and Air Division commanders were extended greater latitude than ever before to make exceptions to the requirement. Formerly during the critical periods squadrons undergoing conversion had stood alerts in the aircraft being replaced until twelve aircrews had become qualified in the new types or an arbitrary time limit had been reached. In mid-April, ADC changed this to the extent that commanders could relieve converting units completely from alerts for a period commencing fifteen days before receipt of the first aircraft and

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2. Hq ADC, Operations Order 3-54, 1 April 1954, in Vol II. See also ADC Regulation 55-5, 26 Mar 1953, (Vol III, document 17) for an explanation of alert terminology.

3. Hq ADC, Staff Notes, 5 Apr 1954, p 5. (in AGF).

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ending seventy-five days later.[4] Too, when a squadron from a two-squadron base departed for training at the Yuma Weapons Center, the remaining squadron stood the one squadron base alert schedule. It was left up to the Air Defense Force commander how to handle alerts at single squadron bases when the squadron departed for Yuma. As an example of how this worked, when the 48th Squadron deployed to Yuma from Langley, the 46th at Dover added the Langley alert to its own schedule. Again, when the 37th Squadron sent planes and crews to a gunnery meet at Otis AFB in April, three F-94Cs were deployed from Griffiss to Burlington to help share the alert load.[5]

The rocket-armed interceptors were operated with a full combat load on all missions except rocketry training to insure their immediate readiness in the event of attack.[6] The only exception to this case was when the 18th Squadron, which was converting to F-89Ds, was permitted to fly unarmed training missions because of the hazards which arose from the lack of electrical circuit testing equipment. The equipment problem was rapidly overcome, however, and the waiver was rescinded in early April.[7] In the squadrons still flying gun-armed aircraft, the planes were operated with hot guns except when the aircraft was being used for transition training

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4. Hq ADC, Operations Order, 1 April 1954.

5. See History of EADF, Jan-June 1954, p 77.

6. As in fn 4, above.

7. See History of CADF, Jan-June 1954, p 188.

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or for cross-country hops. The T-33s were equipped with guns and gunsights and as much ammunition as they could safely carry.[8]

II

No unusual problems in keeping the search radars turning were experienced during the period. Except when undergoing necessary periodic maintenance, each station maintained a twenty-four hour vigil to the best of its capability. When, for one reason or another, a station had difficulty in operating round-the-clock it made certain that it put its best effort forward during the hours immediately preceeding and following sunrise and sunset.[9]

Between eighty-five and ninety percent of the aircraft detected were identified as friendly through correlation with the flight information received through the CAA and military flight service agencies.[10] All in all, the processing and handling of flight plan data seemed to be steadily improving. As one Division reported: "The delayed passage of flight information between agencies continued bothersome, although there appeared to be fewer occurences during this period than in past periods."[11]

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8. As in fn 4, above.

9. Ibid.

10. Determined from review of figures in Air Defense Force statistical summaries contained in the histories of those organizations for the period.

11. History of 31st Air Div, Jan-June 1954, p 175.

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The most common reason for late flight plans in this particular sector "was attributed to personnel error rather than to procedural flaws or in-flight service center operations."[12]

In May, a slight adjustment was made in certain of the Air Defense Identification Zone boundaries in EADF and CADF "to conform with increased radar coverage, practical experience, and changes in the defense force boundaries which had occurred in early 1953."[13] In early July, Headquarters ADC issued a new directive (ADCR 55-12) which standardized the procedures for the handling of air movements information and the classifying of tracks. The map on the following page shows, in general outline, the location and extent of the ADIZs at the end of the period, and the regulation, which is appended, traces the procedures applicable throughout the system at the end of the period for the identification of air traffic within these zones.[14]

In June, an Interim Maneuver Identification System (IMIS) was put into operation in the New York-Atlantic City area for the identification of oceanic air traffic putting down in that area. In the spring of 1953, EADF had attempted to establish a regular multiple corridor identification system area similar to

12. Ibid. A test of the feasibility of identifying GOC tracks at the filter centers was run at the Sacramento Filter Center in January-February 1954. For the results of this test, see Vol III, document 19.

13. History of CADF, Jan-June 1954, p 174.

14. See Vol III, document 18.

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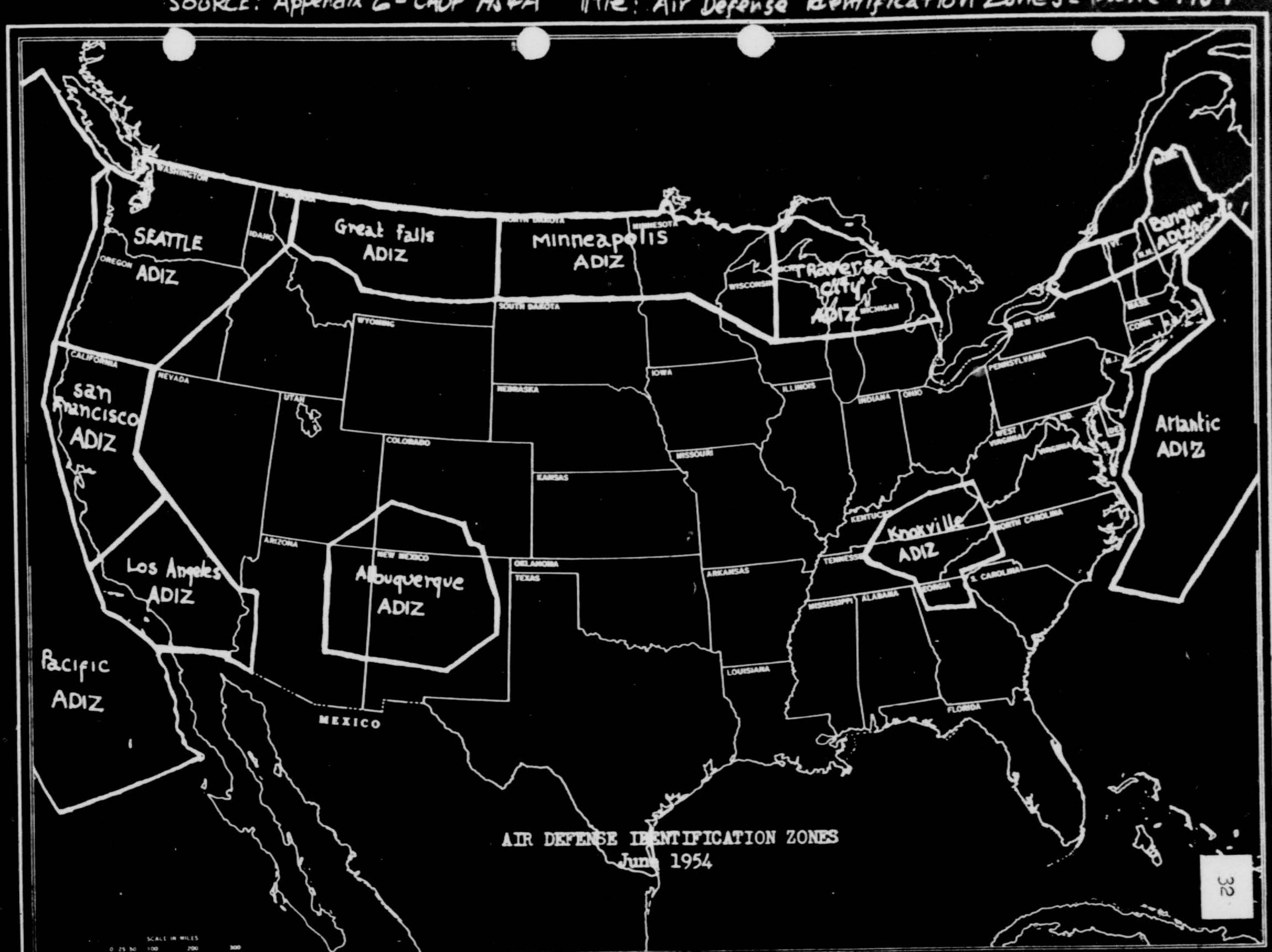
SOURCE: Appendix 6 - CADF A54A Title: Air Defense Identification Zones - June 1954



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those already in operation in the Nantucket-Yarmouth, San Francisco and Los Angeles areas in this area. Equipment problems and jurisdictional disputes with the Navy forces operating in the area forced the abandonment of the project at that time. Early in 1954, ADC directed EADF to go ahead once again with the plan.[15] The problems previously encountered were still troublesome, but EADF managed to put the interim system into operation by mid-year. After its first month in operation it was pronounced a definite success. It was estimated that the introduction of the new corridor system and the refinements which had been made in the Nantucket corridor system had reduced the number of active air defense intercepts in the EADF region by about twenty percent from what they had been in early 1954.[16]

The success with the corridors at San Francisco and Los Angeles had been equally phenomenal. The former had shown a 99.6 percent identification capability and the latter a 99 percent capability.[17] At the close of the period, ADC was seeking to make participation in the corridor procedure mandatory for all air traffic.[18] Action was also underway to establish a fifth corridor system in the

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15. See Vol III, document 20.

16. See History of EADF, Jan-June 1954, pp 39-51.

17. See Vol III, document 21.

18. See Vol III, document 22.

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Pacific Northwest for identifying air traffic coming in from Hawaii and Alaska.[19]

There were two occasions for alarm during the period, both resulting from the labeling of SAC flights as unknown. Because of the size of the formations and their headings, they created considerable concern among the defenders. Both incidents took place in the WADF region.

In March, four B-29s and nine B-50s on a flight from Honolulu to Biggs AFB, Texas penetrated the Pacific and Los Angeles ADIZs. Nine of the bombers were declared unknown and eleven interceptors scrambled to meet them by the radar station on Santa Rosa, Island. What happened was the lead ship of the first SAC group to penetrate, made up of four B-29s, called in the position report and estimated time of penetration for all four planes, the information being that the planes were in formation. The "formation," however, was such that the planes were as much as 100 miles apart. The rest of the aircraft, flying in similar pattern, came in and announced their arrival in the same fashion.[20]

The correspondence forwarded to Headquarters ADC on the matter by the radar station and Headquarters WADF was hot to the touch. "The situation...could have precipitated a valid state of Air Defense Readiness," WADF stated. "In addition, the actual expenditure of

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19. Vol III, document 23. Two corridors, one centered at Neah Bay and the other at North Bend, Washington, were planned for this new MCIS. (Hq ADC, Diary, 12 Mar 1954).

20. See History of WADF, Jan-June 1954, pp 86-88.

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air defense effort is not considered justified in the face of the combination of procedural errors committed by the SAC aircraft commanders."[21] The question WADF asked was why SAC pilots, operating over these waters, could not voluntarily use the multiple corridors? They had worked wonders in reducing the number of scrambles on commercial airliners working the same route, and the SAC crews had as much navigational gear and know-how as the civilian pilots.

Headquarters ADC sent the report of the incident to SAC with the request that SAC pilots, in the future, make use of the multiple corridors. The reply, signed by Brigadier General William H. Blanchard, SAC's Deputy Director of Operations, stated that such an incident would not happen again under the same circumstances. The promise was made that SAC aircraft, whenever it was possible, would use the corridors. When this was not possible, sufficient information would be provided to enable the air defenses to make positive identification.[22]

The ink had barely dried on this report when SAC bombers again breached procedure, this time on a flight down from the North into the 25th Air Division's sector of responsibility. During a SAC-ADC training exercise in the Northwest in May, the 25th received word from the Canadian system that unknown aircraft had been detected over Canada on a southerly heading. The route

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21. See Vol III, document 24.

22. See Vol III, document 25.

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information on the oncoming force did not match any of the exercise routes mapped out for the SAC strike forces. General Old of SAC was called by the Headquarters ADC Combat Center and asked to attempt to make contact with and identify the force. This he tried to do but without success. Shortly thereafter, the 25th Air Division declared an Air Defense Readiness. Fortunately, before an Air Defense Warning Red was sent out to the military and civilian centers in the area, the 25th identified the flight as SAC's.[23] Headquarters WADF, as in the March incident, minced no words in its report of the affair:[24]

> The conduct of SAC aircraft in this exercise constituted a dangerous breach of air defense and air traffic control procedures which might easily have resulted in the declaration of a red warning by the Air Division Commander.
>
> It appears likely that if this situation is not rectified, and unless appropriate action is initiated to Headquarters Strategic Air Command, eventually a combination of circumstances similar to those of 10 May will lead to tragic consequences. It is conceivable that a pattern of action and lack of information combined with the penetration of priority target areas could result in a justified state of Air Defense Warning Red, Guns Free, the implementation of SCATER and subsequently a very severe and public criticism of the United States Air Force in general.

In the future, Headquarters ADC told its units, formal reports of violations were to be submitted on such incidents.[25] SAC and

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23. For details on the rules and procedures for air defense preparedness and warning see Vol III, documents 42-46.

24. See History of WADF, Jan-June 1954, pp 88-89.

25. Such reports were to be prepared and submitted under the terms of ADC Regulation 55-24, 12 Oct 1954, in Vol III, document 26.

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its pilots were aware of the gravity of the air defense mission and ADC had and would continue to cooperate as fully as possible with SAC training requirements.[26] That being the case, future incidents such as these would not go unreported, and unpunished if the pilots were found to have violated established procedure.

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III

In all, about 5,588 tracks were declared unknown in the system during the first half of 1954. About seventy-five percent of them were scrambled or vectored on.[27] The identification by interception record in the 25th Air Division sector was typical of this activity: Some 270 tracks which could not be identified within the three minutes granted for their establishment and identification by flight plan correlation were declared unknown by the 25th during the period. Twenty-nine of them were identified as friendly before fighter action was taken. Another 103 were identified as friendly before the fighter pilot made contact (through correlation with late flight plans, and revised progress reports, authentication

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26. SAC's 15th Air Force protested in late 1953 that it was having difficulty in meeting the dictates of AFR 60-22 and, at the same time, conducting realistic training. It asked permission to deviate from the flight plan procedure of 5 minutes and 20 miles to the extent that it could be anywhere within 100 miles of the indicated flight plan and 30 minutes of the time estimated for penetrating the ADIZ. This request was deemed too unrealistic by WADF. (History of WADF, Jun-Dec 1953, pp 157-163). WADF was willing, however, to compromise, and procedures whereby single SAC aircraft in reconnaissance missions might be granted leniency was under consideration in 1954. (History of WADF, Jan-Jun 1954, pp 81-85).

27. Hq ADC, Command Data Book, October 1954, p 8.2, (in HRF 903).

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with a correlation maneuver, or director's decision). That left 138 unknowns. Sixty-four of them were successfully intercepted and identified as friendly. The remaining seventy-odd passed through the sector's defenses unidentified. Lost radar contact accounted for sixty-two of the mission failures.[28]

While the number of intercepts attempted in many of the other Division sectors was considerably lower than that in the 25th Division -- due to below minimum weather conditions, non-availability of aircraft, etc., -- the end result was about the same command-wide. That is to say, some forty-five to sixty percent of the intercepts attempted were successful; the remainder had to abort primarily as the result of loss of radar contact. In the final analysis, then, the system, in spite of its expensive and oft-times hazardous resort to interception for recognition purposes, failed to identify about half the aircraft labeled as unknown by the radar stations.

On daylight active air defense intercept missions with the new jet all-weather aircraft, the intercept director positioned the aircraft about fifteen miles from his target and in position for a ninety degree beam attack. The pilot informed the director when he had made positive radar contact with the target and then, at no less than five miles from the target, converted from the beam to the stern attack. If the pilot was unable to establish positive radar contact before closing to five miles, he so

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28. History of 25th Air Div, Jan-Jun 1954, document 14.

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notified the director who placed the aircraft in the stern attack position.[29] After that, assuming that visual contact was established at a mile or more separation, the interception was completed according to the carefully established routine for such missions.[30]

The restrictions imposed on active air defense interceptions under night and instrument conditions -- necessary because of the lack of separation and rate of closure data on the E-4, 5 and 6 fire control system scopes -- were eased somewhat in March. Formerly, interceptors were held to a maximum overtake speed of 100 knots and were required to breakoff at 1500 yards or 10 seconds-to-go if visual contact had not been made. The new order directed that such intercepts be made in a cone 60° wide centered on the stern of the target aircraft and "at a slow closing rate."[31] Visual contact could be tried up to the point of minimum radar range by the F-94C and F-89D crews and up to the firing signal for the F-86D pilots. EADF noted its approval of this change as follows:[32]

> The insertion of the phrase 'slow overtake speed' is considered more appropriate than the current restriction of 100 knots maximum. A pilot making actual identification passes will be at least alert qualified, and

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29. See 27th Air Division Regulation 55-49, 14 Jan 1954, appended as document 44 to that organization's History for Jan-June 1954.

30. The procedures for these missions were set down in ADC Regulation 55-21, included in Vol III, document 27.

31. See Vol III, document 29. See also, ADC Operations Order 3-54, 1 Apr 1954, in Vol II.

32. See document 325, History of EADF, Jan-June 1954.

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> as such, should be capable of controlling his rate of closure and recognizing a hazardous situation from his radar presentation. In many instances, it becomes necessary to increase closing speed to over 100 knots until within at least two to three miles of the unknown aircraft to insure expeditious identification. To obtain a tail number or observe aircraft type requires a slow rate of closure in the final phases of the intercept; therefore, the 100 knots restriction is not appropriate. Even though an extreme closing rate was used on a stern attack, at the firing signal, a minimum distance between target and interceptor of approximately 2100 to 2400 feet will be available for breakoff.

By the end of June, action was underway to incorporate the "Dover Modification" into the fire control systems of the new interceptors. Developed by the 46th Fighter Interceptor Squadron, based at Dover AFB, which explains its nomenclature, the modification would give the pilot the type of range, overtake speed, and elevation data that had appeared on the old E-1 scope, thereby enabling him to fly a true pursuit course on recognition missions.[33] Delivery of the kits for making this modification was expected to begin in February 1955.

When necessary, spotlights continued to be used at night to obtain the registration numbers of aircraft under interception. In connection with the long-standing problem of reading the identification numbers at night, an experiment was conducted during the period in the use of Scotchlite, a reflective sheeting, on the numbers. The material was placed on the numbers of a C-47 which was then intercepted at various angles and distances by a T-33. By the light

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33. A copy of the 46th's study of the Dover Modification, with diagrams, is included as document 30 in Vol III. For additional data on the modification and plans for its use see Vol III, documents 31 through 38.

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of a 4-cell flashlight, the numbers proved very readable. USAF was queried as to the possibility of applying the substance to the numbers on all military aircraft and a broad hint was made to the CAA on its possible use on civil aircraft.[34]

The scramble times of the F-94C squadrons were well within the five minute time limitation. The average time in the 354th Squadron at Oxnard AFB, for example, hovered right around three minutes throughout the period. It was different with the F-86Ds, however; at one point in the period the 25th Air Division despaired of meeting the five minute limit with them. It took about five minutes and twenty-three seconds, the 25th reported, to warm up the electronic fuel controls and flight instruments and perform all the required checks on the Ds. The time could be reduced to four minutes and thirty-three seconds by performing the lock-up check before the plane was placed on alert, but this allowed no time for safety checks. It looked to the 25th as if five minutes from Standby to scramble and seven minutes from Readiness to scramble was a more realistic and safer scramble requirement for these aircraft.[35]

WADF Headquarters did not agree with this finding, however. Using the 25th's own figures on the F-86D scramble problem to bolster its argument, WADF stated that it believed that "a pilot who is unable to safely accomplish portions of the cockpit check

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34. Hq ADC, Staff Notes, 6 Mar 1954, p 4. (in AGF).

35. See History of 25th Air Div, Jan-June 1954, document 18.

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while taxiing is not sufficiently proficient to be placed on alert." The five minute requirement from Readiness to scramble for the F-86Ds remained in effect. It was a difficult standard to meet sometimes, certainly, but with sufficient practice and adequate procedures it could be done.[36]

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IV

The ADC directive on the control of interceptor aircraft during air defense operations went unchanged during the period.[37] So, too, did the directive governing ADC and RCAF cross-border operations.[38]

While the two regulations on fighter interceptor rules of engagement (ADCR 55-9 and 55-10) were scrapped and their contents reissued in a single directive in May, no important procedural changes resulted.[39] Rather, the intent here was simply "to more clearly reflect the responsibilities and authorities of personnel and commands concerned."[40]

At the end of the period the directive on antiaircraft rules of engagement was in the process of revision to incorporate the changes which would have to be made in those procedures once the

36. See History of WADF, Jan-June 1954, pp 237-239.

37. See ADCR 55-30, in Vol III, document 39.

38. See ADCR 55-35, in Vol III, document 41.

39. See ADCR 55-10, in Vol III, document 40.

40. Hq ADC, DCS/O Project Reports, 1 Feb 1954, p 16. (in HRF 908).

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Inner Defense Areas (IDAs) came into being. The latest word on the status of ADC's recommendation to set up the IDAs was that the proposal had been cleared by the Air Staff and forwarded to the Chief of Naval Operations for coordination. If the Navy had no objections to it, it would be sent to the Department of Defense for final concurrence.[41]

41. Ibid., p 1 Aug 1954, in Vol II.

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CHAPTER IV

SYSTEM EVALUATION AND TRAINING

I

The grounding of the F-86Ds during January and a good part of February, the high conversion rate in the interceptor force, the requirement to send the F-86Ds to the factory and the materiel centers for overhaul, and the twenty-four hour fighter alert requirement exacted a large toll of the number of aircraft available for training. Equipment problems at the Yuma Weapons Training Center continued to interfere seriously with familiarization in that last but all important phase of the air defense operation -- rocket firing.[1] At the end of the period, it looked as if the Command had succeeded in part to close the gap between technological development and operational know-how, but it would be another six months to a year, at the least, before the new aircraft and the men who maintained, directed and flew them were truly combat ready.

No nation-wide air defense system exercises took place during the period. As part of the intensive training program introduced in late 1953, however, an unusual number of sector exercises which

1. See Book II for the story of the build-up of the Yuma gunnery camp into a Weapons Training Center and an account of the training conducted there during the period.

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tested all elements of the system within the particular area were conducted.[2] Additionally, the Air Proving Ground, in its Lock-on tests, completed a detailed examination of the base, personnel and operational requirements of the F-94C and F-86D squadron. Finally, a test of the GOC, designated SKYSCAN, was held in each Air Defense Force region during late May and early June in an effort to determine the present effectiveness of the corps under alert conditions.[3]

II

In its Lock-on tests, the Air Proving Ground Command sought to isolate the major problems interfering with the ability of the F-94C, F-86D and F-89D squadrons to perform their missions with their presently authorized manning, equipment and facilities.[4] The test of the F-94C squadron began in late 1953 and was completed in November of that year. It was conducted at Otis AFB

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2. Full accounts of these exercises will be found in the histories of the Air Defense Forces and Air Divisions (Defense) for the period. For information on the routine training carried on between ADC forces and SAC, APGC and ATRC forces see Vol III, documents 54, 56 and 57.

3. The initial report on the results of this test would not be ready until August 1954.

4. The major items to be investigated during the tests were listed as follows in one Hq ADC publication: "(1) Percentage of successful intercepts under various bomber conditions....(2) The limit or breakdown of control when employing multiple fighters against multiple targets. (3) The determination of the maximum number and the techniques for employing lead collision course fighters in snake-climb and subsequent attack; (4) The adaptability of the aircraft to present accepted methods of recovery; (5) Evaluation of adequacy of ground and aircrew training received in established schools; (6) Evaluation of airfield organization and facilities requirements in support of all weather

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using the 58th Squadron. The F-86D test, employing the 94th Squadron at George AFB, was completed in March 1954. The F-89D test was scheduled to begin in November 1954 with the 438th Squadron at Kinross AFB.[5]

APGC's major conclusion, following completion of the F-94C and F-86D phases of the test, was that neither of the squadrons, as presently constituted, trained and equipped, was capable of performing its mission.[6] This did not come as a surprise to ADC, although the magnitude of some of the problems uncovered was greater than expected. As General Chidlaw put it, "the major conclusions of the APGC report were a reaffirmation of general knowledge and serve as a strong substantive justification for corrective actions already attempted."[7]

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4. (Con't.) interceptors engaged in wartime operations; (7) Evaluation or determination during the course of the tests of -- the adequacy of TO&Es, ECIs, UALs, BALs, etc., the adequacy of test equipment required to maintain the aircraft and fire control systems, recommended criteria for training, capabilities and limitations of the aircraft to accomplish the ADC all weather interceptor mission, the logistical support required for attaining and maintaining the maximum operational capability of the squadron under wartime conditions, recommended tactics and techniques for the employment of the aircraft in the air defense system when operating against typical bomber raids employing countermeasures and evasion; and (8) The determination of the capability of the lead collision course fighters to carry out broadcast control from the ground up." (DCS/O Project Reports, 1 December 1953, p 24, (in HRF 908).

5. Hq ADC, DCS/O Project Reports, 1 August 1954, p 9, in Vol II.

6. For the details on the results of these tests see: Final Report, Project APG/ADA/76-A, Phase I (Two Volumes), 31 Dec 1954; and Final Report, Project APG/ADA/76-A, Phase II, 6 May 1954.

7. See Vol III, document 48.

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Upon completing its review of the final reports of the tests, ADC organized the many deficiencies uncovered into four basic problems.[8] These were:

The low availability of combat ready aircraft.

The lack of maintenance facilities. This problem has a direct bearing on problem number one and includes: Maintenance shelters; shortages and delays in the delivery of ground handling equipment; shortage of test equipment and spares.

Lack of facilities for fire control system training. This lack affects the quality training of aircrews and development of tactics and techniques. Some of these deficiencies...are: Tow aircraft; tow targets, radar reflective; simulators; proximity scorers; scope recorders and camera mounts; a lack of realization in some quarters that there is a necessity for actual firing of the armament with which this problem is equipped.

Unrealistic manning.

These, then, were the major problems which ADC had to overcome before it could expect substantial improvement in the caliber of its weapons force. As mentioned above, these were not new problems, as the vast amount of correspondence between ADC and higher headquarters on the matters would attest. The confirmation of the problems by an outside agency whose business it was to uncover such deficiencies, however, would, ADC trusted, go a long way toward speeding up corrective actions.[9]

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8. Ibid.

9. For further details on Lock-on see Vol III, document 47 and documents 49 through 53. See also History of WADF, Jan-June 1954, Chapter 4.

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III

One of the two major causes for the very low combat capability of the F-94C squadron tested under Lock-on at Otis AFB was "inadequate aircrew-GCI proficiency."[10] Upon completion of the F-86D portion of the test at George AFB the same conclusion was reached. In that instance it was reported that "the proficiency of the average air-ground control team is below that required to effectively employ the F-86D as a combat weapon."[11] The reasons for these findings were many and diverse, but generally they boiled down to the need for more realistic training of directors in lead collision operations course and for the development of better tactics and techniques for the employment of the new interceptors. ADC could have predicted this conclusion, of course. In fact, the awareness of the problem was one of the major reasons for the initiation of the intensive individual and system training program throughout the Command on 1 December 1953.

IV

During the month and one-half the F-86Ds were grounded, the F-86D fighter pilots entered into an intensive ground training program. Subjects studied were F-86D engineering, instrument

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10. Final Report, APG/ADA/76-A, Part I, 31 Dec 1953, p 1. Deficiencies in the F-94C aircraft and fire control system was listed as the other major cause for the inability of the F-94C squadron to perform its mission.

11. Final Report, APG/ADA/76-A, Phase II, 6 May 1954, p 6.

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flight fundamentals and procedures, and flying safety measures.[12] During this time, also, the pilots journeyed to local radar stations for familiarization with the director's end of the GCI operation. Since the F-86D flight simulators were beginning to arrive in the squadrons, these equipments were put to good use. The only flying they got in was in the T-33s and administrative aircraft. The effect of this time out of the saddle on pilot proficiency was summarized as follows by the WADF historian:[13]

> ...pilots lost hard-won proficiency in the F-86D. They lost the feel of the aircraft, facility in radar scope interpretation, and the fine edge of coordination with their ground controllers; the crews which took to the air in February were less nearly able to perform their mission than they had been two months before. The accident hazard had 'drastically increased,' wrote the commander of the 25th Division, and 'operational efficiency is at a new all time low.'

The directors in the stations which relied on squadrons equipped with F-86Ds for the performance of active air defense missions and system training had to fall back almost exclusively on their target simulators -- the 15-J-1Cs -- for training during the period the Ds were grounded. Unfortunately, there was an

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12. See History of 31st Squadron, appended to History of 4702d Defense Wing History for Jan-June 1954.

13. History of WADF, Jan-June 1954, pp 234-235. The flying safety problem appeared to be getting worse instead of better during the period. Consequently, in April, General Chidlaw notified his commanders that he intended to standardize operational procedures down the line. Strict adherence to the standards, he believed, would go a long way toward reducing accidents. See Vol III, document 63.

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acute problem in supporting these devices during the period and many times they were out of operation.[14]

When the F-86Ds again took to the air, training got back underway in earnest. As mentioned earlier, in an effort to make up for the lost time, the training period was extended another month. Upon the conclusion of that period, the Air Defense Force commanders were asked whether or not the risk of subordinating the alert requirement to the training requirement had been well taken. Without exception, these officers replied that it had. Specifically, their comments were as follows:

> WADF: The reduction of alert commitments during the winter months aided considerably in accomplishing the conversion of U.E. aircraft. This action permitted a maximum number of aircraft to be utilized for training both air and ground crews and resulted in an overall increase of approximately ten percent in the combat readiness of fighter interceptor squadrons.[15]
>
> CADF: A greater capability of training within our interceptor squadrons was realized to a certain extent because of reduced alert commitments....In spite of T/O compliance grounding our aircraft for a considerable period of time, additional aircraft were made available for training purposes only. Due to the many difficulties encountered in operating this new equipment and coupled with the extreme shortages of ground handling and test equipment that we now and then suffer from, it is unlikely that the accelerated alert requirement could have been met anyway. Your assistance concerning the procurement of additional T-33s, GCA units, simulators, MTDs, parts and test equipment had a more far reaching effect than the

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14. The History of the 31st Air Div, Jan-June 1954, pp 191-194 contains a good account of the problems encountered with the 15-J-1Cs during the period.

15. Msg, WADF to ADC, ca. 20 Apr 1954, (in HRF 310).

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> reduction of the alert commitment. Because of the extremes in operating conditions as mentioned above, it is virtually impossible to report an accurate net gain from the reduced alert commitment. However, there is no doubt that this factor contributed to the present improved state of our operational readiness.[16]
>
> EADF: Before Balloon Pump [the name EADF gave to its training program] the command-wide training problem was truly staggering with heavy alert commitments to be met, new aircraft, inexperienced aircrews and unqualified maintenance personnel. By reducing our air defense commitments and allowing a concentrated effort on training, problems which would normally have taken many months to overcome were greatly reduced in a relatively short period.[17]

On 1 April, the fighter alert requirements were increased and soon thereafter the squadrons began to be called on to support project PULL OUT, the F-86D modification program. These actions reduced the number of aircraft available for training. However, through the media of sector training exercises and the facilities at Yuma, and assisted by the relaxation of the restrictions on practice intercept operations,[18] aircrew-director proficiency

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16. Msg, CADF to ADC, ca. 20 Jun 1954, (in HRF 310).

17. See History of EADF, Jan-June 1954, Vol II, document 170, p 7.

18. Developmental activities at the Weapons Center and increased familiarity with all aspects of maintenance and operations of lead collision course fire control systems, it was reported, enabled ADC to reduce significantly the number of restrictions on training with the systems. By allowing less restricted training, crews would be able to exercise systems nearer their designed capability. The effect would be: (1) more rapid advancement toward true combat readiness of individuals; (2) positive increase in aircrew confidence in systems; and (3) proportionate increase in combat capability of the command. (Hq ADC, Statement of Effectiveness, Feb 1954, p 15, in HRF 900). See Vol III, document 29 for an account of the restrictions on practice intercept missions at the close of the period.

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showed steady improvement from April through the end of June.[19]

Training began at the Yuma Weapons Training Center on 1 February, as scheduled. By the end of June, some eight F-94C and F-86D fighter squadrons had attended the center and about 131 controllers had taken the controller proficiency course. In early June, ADC submitted a requirement for an additional weapons center. If each squadron were to get the one month per year rocketry firing training deemed necessary, at least one additional training base was needed. The new center was to be located at Buckingham Field, Fort Meyers, Florida. While this installation was undergoing construction, Moody AFB, Georgia would be used as an interim weapons training base. Operations were scheduled to begin at Moody in early 1955.[20]

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V

The experiences during the F-94C and F-86D phases of Lock-on, the findings of the APGC and the Yuma Weapons Training Center test crews, and the day to day experiences of the directors and aircrews were resulting in a gradual massing of indispensable data on the various problems involved in close control, radio jamming, loss of communications, and 90° beam attack on high

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19. See Vol III, documents 55 and 61 for detailed information on the criteria for aircraft and aircrew combat readiness. See documents 59 and 60 for similar data on controllers and directors. See document 58 for the directive on aircrew/controller/director cross-training requirements.

20. For the full story of weapons training at Yuma during the period see Book II.

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speed and high altitude aircraft. In May, an APGC project, designated WOLFPACK, got underway at George AFB, California for exploring procedures for multiple interception against multiple bombers.[21] In the 25th Air Division, the "single vector scramble" technique was under study in an attempt to afford the interceptors greater surprise and at the same time render their communications systems less susceptible to enemy jamming.[22] Very soon, the Command hoped, the results of these tests could be published in a tactics and techniques manual and the ground-controlled intercept operation made standard throughout the system.[23]

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21. See Vol III, document 68. See also, History of WADF, Jan-June 1954, Chapter 4.

22. See History of WADF, Jan-June 1954, Chapter 4. See also, History of 25th Air Div, Jan-June 1954, p 32.

23. Hq ADC Manual 55-2, "Tactics and Techniques Doctrines for Interceptor Squadrons in Air Defense," was published in May 1953. The manual, while informative in many ways, was a most unsatisfactory guide to the employment of the new interceptors. In fact, at the time of its issue, very little was known of the capability of the new aircraft. Hq ADC had been working on a new manual practically from the date of release of the old. A copy of 55-2 is included in Vol III, as document 67.

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CHAPTER V

SYSTEM PLANS

I

On 1 July 1953, Headquarters ADC forwarded to higher headquarters a blueprint of air defense needs from mid-1954 through June 1960. Labeled the Air Defense Requirements study for 1954-1960 (short title: ADR 54-60), it was the fruit of many years of concentrated study and experimentation by General Chidlaw, his staff, and the Command as a whole. The purpose for its publication was "to define the established air defense requirements several years in advance," and ADC recommended that it be used by the Headquarters USAF staff for guidance in preparing future budgets and programs. ADC also recommended that it be sent to the Joint Chiefs of Staff for policy consideration.

Certain portions of the study contained Top Secret data, thus it was necessary to issue the whole under this classification. The majority of the data included in it, however, was Secret, and the following account was drawn from the pages bearing the Secret classification.

II

The future air defense structure would be a composite one -- i.e., one which made primary use of both high explosive and

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atomic armament. It would be comprised of two major segments, the Air Surveillance and Weapons Control System and the Weapons System.

Air surveillance and weapons control would be performed in two separate but contiguous geographical areas: The Air Defense Warning Zone and the Air Defense Combat Zone. Both zones would: (1) detect aircraft, both piloted and unmanned, (2) identify air traffic, and (3) direct combat forces in air battle.

The Air Defense Combat Zone was defined as that "area encompassed by a line representing the maximum limit of contiguous radar cover around the United States and certain parts of Canada and Mexico." The radar forces already in being or programmed -- the permanent radar stations, semi-mobile stations, gap-filler radars, airborne early warning and control aircraft, picket vessels, Texas Towers, and the Lincoln Transition System -- were the forces which would go to make up the Combat Zone defenses. Additionally, the radars owned by the other Air Force commands, the Army and the Navy would be integrated into the system, where practicable, and three CW radio fences, to be termed the American Lines, would be thrown up in the western area not covered by the radars. The purpose of these latter devices would be to "provide information on movement of hostile aircraft for the conduct of combat and trailer operations," this data to be collected at the surveillance radar terminal stations.

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Total forces assigned the Combat Zone would be as follows:

Direction Centers	40
Combat Centers (Estimated)	9
Headquarters Display Equipment	4
Prime Radar Stations	212
Automatic Gap Filler Radar	423
CW Radios	159
Picket Vessels	4
Texas Towers	5
AEW&C	126

The Air Defense Warning Zone would be established to the north of the Combat Zone, with overwater flanges extending to Hawaii and the Azores, and would be comprised of two lines of unmanned detection stations and manned data collecting and transmitting stations. One line would extend from Newfoundland across Canada, roughly in the vicinity of the 55th parallel, and up the West coast of Canada to Alaska. This line, along with picket vessel and AEW&C overwater flanges, would become operational in mid-1956 and provide at least two hours warning of attack by the TU-4 type of bombers. By mid-1958 an additional early warning line, termed the Northern Canada Distant Early Warning (DEW) line, would be built across the far north, from Greenland around the northern coast of Alaska. By that time, it was assumed, the Soviets would have developed a far better bomber than the TU-4 and the DEW line would guarantee sufficient warning of its approach. When this far distant warning line became operational, the function of the Mid-Canada segment would be to provide low altitude radar coverage for the northern perimeter of the Combat Zone.[1]

1. For a more detailed account of the early warning requirement see Appendix VI.

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III

Both the Air Defense Warning Zone and the Air Defense Combat Zone would have an identification function. An ADIZ was to be established completely around the perimeter of the combat zone, and all aircraft penetrating this zone were to be identified. Both multiple and single corridors were to be established "to facilitate identification and minimize inconvenience to air carriers." When an alert was sounded and the terms of SCAT (security control of air traffic) invoked, the area inside the perimeter ADIZ would, in effect, become a domestic ADIZ in which all air traffic would be controlled. In the vital areas where antiaircraft defenses were emplaced, Inner Defense Areas would be operative. Aircraft entering these areas, and not properly cleared, would be considered hostile and shot down.

Detailed information on how identification was to be accomplished in the Warning Zone was given in the study, as well as how briefings of pilots desiring to penetrate the warning or combat zones would be conducted and what actions would be followed in the event something arose to prevent the pilot from keeping his assigned appointment with the surveillance and identification stations.

IV

The weapons system for the 1954-1960 time period would be a composite one, comprised of manned interceptors, unmanned interceptors, and short range weapons. The advantages to not placing

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all its eggs in one basket on this matter, in spite of the fact that concentration on a single type weapon might result in some savings, was explained as follows by ADC: "Analysis of any one weapon system will reveal weaknesses which could be exploited; however, it is extremely difficult to find any one specific weakness which is common to a composite weapon defense."

The weapons were further categorized by the basic function they would perform -- long range, medium range, and short range. How these weapons would be deployed, and the rationale for this deployment was explained as follows:

> Combinations of these weapons have been deployed for area defense to achieve defense in depth. However, in some cases short range weapons have been deployed to provide close-in defense. The advantage of an area defense is that a larger proportion of the total number of weapons can be brought to bear against a concentrated attack. In addition, this affords longer combat times which will permit more time for bombers which may be killed in the first attack to drop out before a second wave of defense fighters are committed. This allows 'decision' time which tends to eliminate overcommitment of weapons against 'dead' bombers which may not have been completely demolished. Further, with weapons deployed in depth, a 'bonus' protection is given to all targets as a whole since it is not necessary to decide precisely which target complex to defend. To prevent the enemy from using short range, high-speed, air-to-surface missiles, long range defense weapons deployed in area defenses are essential to destroy the carrier before missile launch. Also, the problems of weapons collision, weapons attacking each other, mutual radar seeker interference, etc., in a highly concentrated mass air battle can be greatly relieved by spreading the battle over a greater area and increasing the battle time.

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The area weapons would consist of long range interceptors,[2] medium range interceptors and long range missiles. Close-in defense would be performed by short range missiles. Long range interceptors would have no specific areas to defend, but would be stationed on the perimeter of the combat zone and scrambled as necessary in the defense of targets within that zone. Medium range weapons -- consisting of medium range interceptors and long range missile squadrons -- would be deployed in the defense of specific geographic area targets, such as the Northeast or the Northwest. The short range weapons would consist of antiaircraft guns and short range missiles deployed to protect more concentrated and specific areas, "such as the target complex of the Washington-Baltimore or Philadelphia-Trenton-New York area."

The total forces would consist of twenty-nine long range interceptor squadrons, eighty-four medium range interceptor and

---

2. While such a requirement had not yet been submitted to higher headquarters by the time the Requirements study was completed -- since details were still under study -- ADC had the need for a very long range interceptor, possessing a range of 4000 nautical miles or more. The uses to which this aircraft would be put were depicted as follows: "This interceptor would be used for sporadic patrols of the early warning lines as frequently as the international situation might dictate. During patrols these interceptors would be expected to provide unequivocal identification of enemy raids, spoofing raids, or reconnaissance activity. When interception and identification was accomplished, enemy activity could be reported, and the enemy engaged and/or trailed. In the event NEAC and AAC should possess similar interceptors, it is anticipated that some would be used for this purpose."

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fifty-three long range missile squadrons (Bomarc),[3] and 100 battalions of short range missiles (NIKE).[4]

Navy fighter squadrons and the forces of the other major Air Force Commands, because of their deployment, were to be assigned to the protection of the southern area of the United States. During the 1954-1960 time period, the augmentation force fighters were to be fitted with the 'Bird Dog' or similar high explosive air-to-air rocket. The advent of this increased armament would make it unnecessary, ADC felt, to station any ADC-assigned interceptor squadrons in this southern area.

The Air National Guard and Air Reserve fighter squadrons and personnel would be employed as circumstances permitted.

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V

Sometime in the 1954-1960 time period atomic armament would be introduced into the air defense system. The long range interceptors, it was planned, would employ atomic armament as their primary weapon. The medium range weapons would have an atomic

---

3. Bomarc, under development by the Boeing Aircraft Co., had the following characteristics: 3 feet in diameter; 41 feet long; liquid rocket, and ram jet engines; weight about 12,000 lbs, at launching; ceiling 80,000 feet; speed 1500 knots; and range 125 NM in early models and 250 NM later. It was capable of attacking targets through ranges of 250 nautical miles from launching point. It would be deployed by flights of 25 each. All 25 of the missiles could be launched simultaneously and launching could take place within 2 minutes after the alert sounded. It required only 15 minutes to intercept at maximum range (250 NM) and it had an all-altitude kill capability with an atomic warhead. (Hq ADC, Briefing, 15 May 1954, p 128).

4. See Appendix VII for an account of the status of weapons research and development during the period.

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capability, but, as ADC stated, it would "only be provided dependent upon the availability and feasibility of using such armament," since these weapons would be employed under close control and vectored to a direct intercept from scramble status. The short range missiles would have "a limited atomic capability."

From the partial use of atomic armament it was natural for ADC to move on to the consideration of a defense system that used atomic armament predominently. The conclusions reached by ADC on the matter are best told in the words and form employed in the study:

> An atomic air defense system is feasible and is restricted solely by production capability and the approval and allocation actions required of agencies above Hq ADC level.
>
> The atomic air defense system results in savings in weapons force levels...because of the increased kill probability of the individual weapons....
>
> The surveillance and weapons control system would be unaffected by such a system except that the requirement for traffic handling capacity would be somewhat reduced.
>
> There will be no expenditure of fissionable material for training purposes.
>
> Large miss distances can be tolerated due to lethal radius of the burst. Enemy bombers can not successfully utilize evasive action to escape destruction. Although not measurable at this time, it is believed that enemy electronic countermeasures will impose less degradation on unguided atomic rockets than on guided high explosive types.
>
> Psychologically, although there is no supporting data to date, the reaction of enemy crews subjected to an aerial atomic attack may be such as to render the enemy strike impotent or so disorganized as to make the destruction thereof a much simpler task. Additionally, a high rate of defection may be expected.

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> The atomic armament can be designed in a manner which will permit employment at low altitude without serious ground effects.
>
> The cost of an atomic air defense system is considerably less than that of a composite air defense system even <u>without</u> subtracting the value of the non-deteriorating fissile material which, if unexpended, is recoverable at essentially full value....
>
> Determination of the quantity of atomic armament available to the Air Defense Command is urgently needed to permit proper detailed planning.
>
> The ultimate goal of the Air Defense Command is conversion to an optimum Atomic Defense System and should be attained at the earliest possible date.

Thus was the goal of the air defenses over the next six years set down in the Requirements study. Major General Frederic H. Smith, Jr., Vice Commander of ADC, summed up ADC's concept of tomorrow's air defense needs and how the Command was moving to meet them as follows in a letter to the Commander of the Air University just before the Requirements study was completed and released:

> The basic premise upon which our planning has been based is that the United States in the event of future war will be attacked with masses of atomic-thermonuclear weapons. The deployment of our forces, both now and in the future, has been designed to meet such an attack, and the weapons which we have requested have been selected in order to give this command the highest possible kill capability. We have submitted requirements for long range, high performance interceptors as an adjunct to the F-102 type aircraft, to enable us to carry on the air battle far from the target areas, and to subject the hostile forces to prolonged and decisive attrition.

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Another vital addition to the continental air defense system will be the erection of a distant early warning line designed to provide this country warning of an air attack some hours before hostile bombers arrive over the target area. These bombers will be met by extremely fast interceptors armed with rockets and missiles, some with atomic warheads, followed by unmanned supersonic interceptors homing to the target by their own radar, and finally by short range missiles. All of this complex network, moreover, will be knit together by high speed computing machines capable of carrying scores of tracks and controlling an equal number of interceptions by the automatic transmission of intercept data to our fighter aircraft. As may be seen by the comprehensiveness planned for this system...this headquarters is attempting to build an integrated, efficient and highly potent air defense system.5

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5. See Vol III, document 69.

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PART THREE

APPENDICES

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I

THE ACTIVE RADAR NET

Stations and Equipment

The active radar aircraft control and warning net at the end of June 1954 was comprised of eighty-nine radar stations.[1] Seventy-five were Permanent Radar Program stations. Eight were those constructed on Canadian soil but manned and operated by ADC under the terms of the Radar Extension Program. The other six were interim stations designed to plug gaps in the radar network until the stations programmed for construction under the Semi-Mobile Radar Program[2] were completed and placed in operation. No change took place during the first half of 1954, then, in the number of radar stations actually operational.

Each of the P-system and ADC-manned Radar Extension Program (REP) stations was operating with its programmed primary search radar at the end of June. Twenty-six of the seventy-five P-system stations were equipped with the CPS-6B/FPS-10 radar; the remaining forty-nine were equipped with FPS-3s. All eight of the REP stations

---

1. See Part Four, Table II, for a listing of the operational radar stations at the end of June 1954, with the types of primary equipment assigned each station. There were actually 124 AC&W squadrons activated at the end of the period. Those not assigned to duty stations were either in record status or were training alongside one of the squadrons operating a P-site preparatory to their assignment to a Semi-Mobile Radar Site. (Hq ADC, Command Summary, RCS: CST-U4, 30 Jun 1954, p 4, in AGF).

2. See Appendix II. This program, previous to this period, was designated the Mobile Radar Program.

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had FPS-3s. Only four of the stations remained without height-finders.[3] Twenty-eight of the stations, the majority of which were programmed to receive FPS-6 height equipment,[4] were still operating with interim height finders. At the close of the period, FPS-6s were on hand at many of these sites and being readied for operation.[5] It looked as if most of the radar stations would be in operation with their programmed gear by the end of the year.

All of the active radar stations were still operating without backup, or emergency, equipment at the end of the period. The absence of this equipment was still the most critical problem, material-wise, in the radar net. If a primary search radar broke down, the station went off the air. There was still no definite

---

3. These were: P-73 at Bellefontaine, Ohio; P-72 at Olathe NAS, Kansas; P-11 at Yaak, Montana; and P-76 at Mt. Laguna, California.

4. Programming at the end of June 1954 called for the equipping of twenty-three of the P-program stations with FPS-6 height-finders. Twenty-three were to have FPS-4s and three FPS-5s. The CPS-6B/FPS-10 radars, of course, had built in height-finders. See Part Four, Table II for a listing of height-finders programmed, by station.

5. The situation at the 751st AC&W Squadron at Mt. Laguna, California, for example, was as follows: All components of the FPS-6 height-finder had been delivered to the SBAMA depot by March except the pedestal and the sail. The installation of the tower was finished except for the radome and the installing of the electrical components. The pedestal and the sail were delivered late in June, and by the end of the month installation of this equipment was almost complete. The new height-finder would become operational in July, it was figured. (27th Air Division History, Jan-Jun 1954, pp 108-109).

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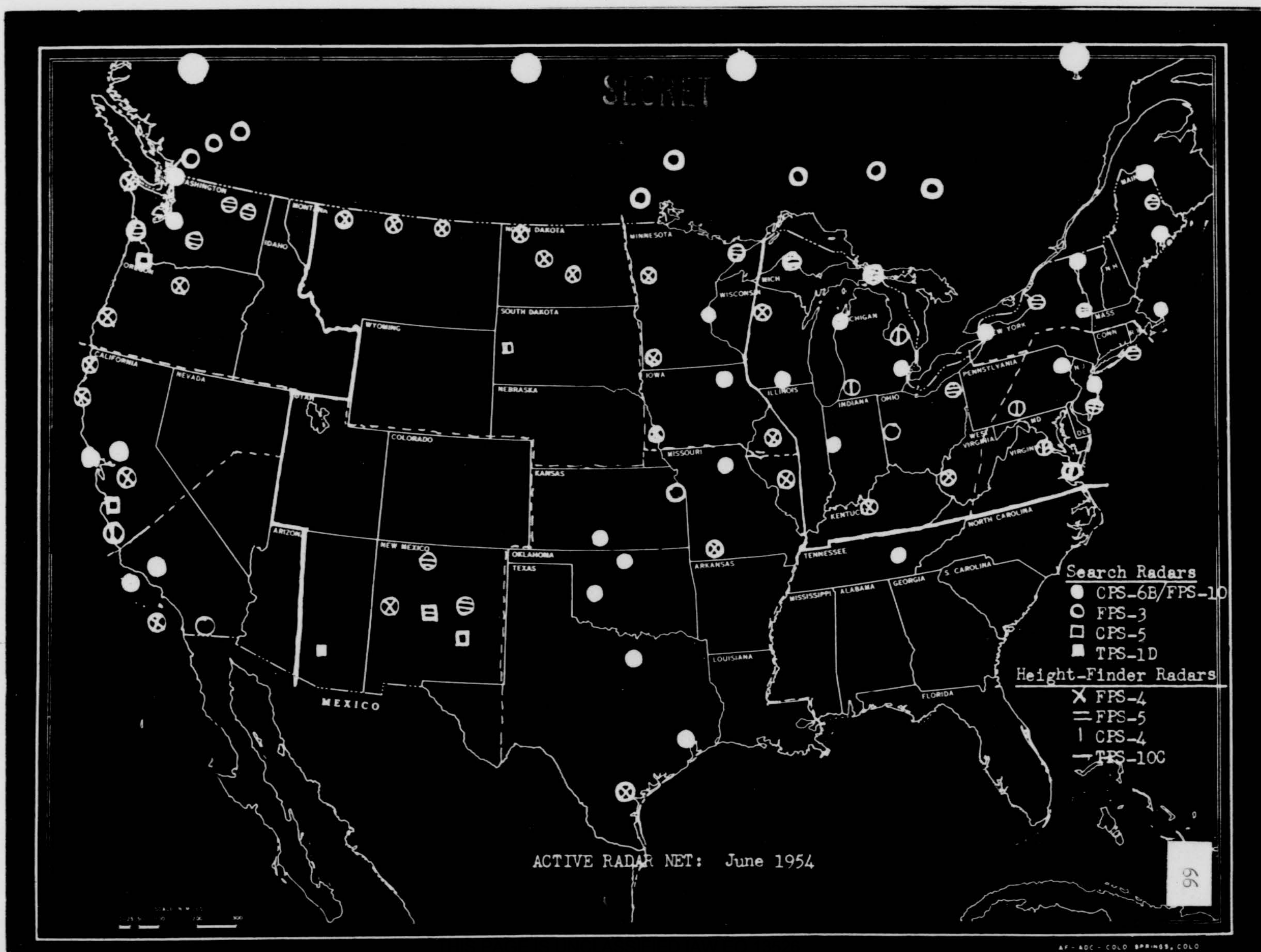

ACTIVE RADAR NET: June 1954

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information on when this problem would be resolved.[6]

The only serious equipment failures experienced in the radar net in the first half of 1954 were with the FPS-4 height-finders. Between October 1953 and April 1954, the FPS-4s were out of operation or had to be placed on reduced operations about seventeen percent of the time.[7] A report on the causes for the breakdowns of these equipments was sent to the Rome Air Force Depot in the hope that that agency could eliminate their weak features.[8]

The project underway to increase the range of the CPS-6B/FPS-10 radars was disrupted during the period as a result of the shortage of magnetron tubes (QK-254). By June, the long range modification kits (OA/347) had been installed in eighteen of the twenty-six CPS-6B stations. The remaining eight stations were scheduled to receive their kits by September 1954.[9] At the close of the period, it was planned to complete installation of the kits

---

6. In early 1954, Hq ADC submitted a revised listing of its P-system primary and backup radar equipment requirements to higher headquarters. See Ltr, ADC to USAF, "ADC Radar Equipment Requirements, Permanent Program (Revised)," 26 Jan 1954, (Doc 1). This listing was approved by higher headquarters with minor exceptions in February 1954. (Hq ADC, Diary, 19 Feb 1954). For information on the priority of assignment of this programmed equipment, see Ltr, ADC to Rome AFD, "Installation Priorities for AN/FPS-6, AN/FPS-8, and AN/FPS-4 Radar Equipment in the "P" Program," 26 Jan 1954, (Doc 2).

7. Ltr, ADC to Rome AFD, "AN/FPS-4 Equipment Failure," 1 Apr 1954, (Doc 3).

8. Ibid.

9. 1st Ind, ADC to AMC, 7 Jun 1954, to Ltr, AMC to ADC, "QK-254 Magnetron Tubes," 19 May 1954, (Doc 4).

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according to schedule, but, pending receipt of additional magnetron tubes, to continue to restrict their operation at all but four sites.[10] The Raytheon Manufacturing Company, maker of the tubes, believed that it would be able to increase output of them during the latter half of 1954.[11]

Radar Evaluation

Three Radar Evaluation (Electronic Countermeasures) Flights -- the 4713th at Griffiss AFB, New York, the 4617th at Hill AFB in Utah, and the 4754th at Hamilton AFB, California -- were activated during the period.[12] This was in line with the recommendation submitted by ADC and approved by USAF in early 1954[13] that the radar calibration squadrons be replaced with organizations which could provide electronic-countermeasure and systems training to the radar stations as well as assist in the evaluation of radar performance.[14]

The mission directive of the new organizations was issued on

---

10. These sites were P-10, P-21, P-38, and P-46. See Msg, ADC to Air Defense Forces, 24 Mar 1954, (Doc 5).

11. Ltr, AMC to Gentile AFD, "Magnetron Tubes for OA-347 Search Kit," 30 Apr 1954, (Doc 6). See Hq ADC, Statement of Effectiveness publications from February through July 1954, for a full account of the magnetron tube problem.

12. Hq ADC General Orders #2, 25 Jan 1954, (Doc 7).

13. Hq ADC, Staff Notes, 24 Feb 1954, p 5, (in HRF 925).

14. For background information on this subject see: ADCHR #6, Part I, pp 87-89.

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13 March.[15] By the end of May, there were a total of twenty-seven B-29s on hand in the squadrons.[16] In June, ADC sought to increase the aircraft allocation to each of these units to twelve so that enough would be available to conduct systems training, which included AC&W, fighter interceptor, and antiaircraft missions.[17] The histories of these organizations contain excellent accounts of their activities and status during the period.

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Manpower and Training

Inadequacies in the manpower tables of the radar squadrons and the generally low skill proficiency of AC&W personnel -- particularly among controllers, scope operators, and maintenance technicians -- remained the major manpower problems in the active radar net during the first half of 1954.

The problem of adequate tables of organization for the squadrons was a part of the larger problem of obtaining sufficient personnel to efficiently operate the active radar net after the stations programmed for construction under the first two phases of the Semi-Mobile Radar Program came into being. Early in 1953, it will be recalled, ADC forwarded to higher headquarters its future radar

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15. ADC Regulation 24-8, "Organization and Mission of Radar Evaluation (ECM) Flights," 13 Mar 1954, (Doc 8).

16. Hq ADC, Command Data Book, 1 Jun 1954, p 8.5. Further information on the manning and equipment status of the new organizations during the period is contained in their histories.

17. Hq ADC, Staff Notes, 4 Jun 1954, p 2, (in HRF 925).

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squadron requirements.[18] In this so-called "Functions Study," manpower needs were translated in terms of the duties each of the P-program stations and the first and second phase Semi-Mobile Program stations would perform. USAF approved this plan in principle shortly thereafter, but, by the end of 1953, had not approved the overall manning totals requested by ADC.[19]

In March 1954, ADC and USAF representatives convened at Headquarters ADC to discuss the matter at length. The purpose of the conference was to develop manning criteria and to determine the manpower requirements of the AC&W squadrons required to operate those sites which would become operational by 1 October 1954.[20] From the conference came a draft of a new table of organization (1-2101) for the radar squadrons. By the end of June 1954, further action on the matter was suspended pending approval from higher headquarters of the new table.[21]

18. ADCHR #5, pp 20-27.

19. Hq ADC, DCS/O Projects Report, 1 Aug 1954, p 2.

20. Ltr, USAF to ADC, "Implementation of AC&W "Functional Concept," 22 Apr 1954, (Doc 9).

21. Hq ADC, DCS/O Projects Report, 1 August 1954, pp 2-3. At the close of June, ADC was exploring the possibility of establishing a so-called "Minimum table of organization" for the radar squadrons. Each squadron would be manned over this minimum allotment according to its particular workload on a table of distribution basis. For further information on this subject, see: Msg, ADC to Major Subordinate Units, 19 Feb 1954, (Doc 10). Ltr, 29th Air Division to AC&W squadron commanders, "Proposed Authorizations," 9 Jun 1954, (Doc 11).

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Late in 1953 a large number of aircraft radar observers were cross-trained to the controller field.[22] From that point through the end of June 1954, controller assignment was up to authorization. The problem during the period was that the majority of the controllers were unskilled in their duties. Of the 1137 controllers authorized the command in May 1954, 988 were assigned. According to ADC's estimates, however, only about half of these officers were fully qualified in their career field (AFSC 1635). ADC attributed this poor showing to poor selection on higher headquarters' part of persons sent to controllers school at Tyndall Air Force Base, and to a general dissatisfaction among the controllers with their career fields.[23] In a detailed study of the problem in May, Headquarters ADC's Deputate for Operations set down what it believed had to be done to improve the situation at USAF level. Generally, a more attractive career field had to be established, a better selection system put into effect, and a more effective program for controller

---

22. For an excellent account of this cross-training activity and the criteria observed, see History of Eastern Air Defense Force, July-December 1953, pp 84-87. As told in this study: "The withdrawal of radar observers from fighter squadrons coupled with a small number of overseas returnees turned the trick. The manning level in the aircraft controller field shot up from 55% to 95% during the last six months of 1953, and the shortage was a major problem no longer." See this volume, also (pp 87-91) for an account of the consideration being given by ADC to using airmen controllers under certain conditions.

23. Hq ADC, IRS, "ADC Qualitative Controller Requirements," 26 May 1954, (Doc 13).

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training, particularly one which dealt with 90 degree beam lead collision course interception, placed into operation.[24]

Radar operator and radar maintenance manning problems remained much the same as during the last half of 1953. Manpower authorizations for these specialties were inadequate; and the skill level of those persons actually assigned was, generally speaking, still too low.[25] As was noted earlier, steps to correct the authorization problem were underway at the close of the period. To raise the skill proficiency, both ADC and the Air Training Command continued full speed ahead with their efforts to improve their respective training programs.[26]

---

24. Ibid.

25. The situation, at the end of June, was reported as follows in one Hq ADC publication: "Effective manning is presently showing a favorable increase. However, continued overseas levy action and anticipated high number of separations through FY 55 is expected to deter or retard this present increase. The ability of Hq USAF to replace these losses with equally skilled personnel is not apparent at this time." (Hq ADC, Statement of Effectiveness, July 1953, p 15).

26. For information on the training activities underway to increase the skill proficiency of AC&W personnel, see the following: Ltr, 798th AC&W Squadron to ADC, "Deficiencies in TTAF Course," 24 Mar 1954, (Doc 13); Ltr, ADC to AMC, "Air Defense Command Operator Technician and Technical Instructor Requirements for Fiscal Year 1955," 16 Apr 1954, (Doc 14); Ltr, 33d Air Division to CADF, "Manning - Radar Repairmen," 25 May 1954, (Doc 15); Ltr, 33d Air Division, to CADF, "Evaluation of Training at ADC Training Facilities," 29 Jun 1954, (Doc 16).

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T H I S P A G E I S U N C L A S S I F I E D

II

SEMI-MOBILE RADAR PROGRAM

Early in 1954 there were 106 AC&W sites programmed for construction under the provisions of the Semi-Mobile Radar Program -- forty-four under the first phase of the program (to be completed by June 1955), thirty-three under the second phase (to be completed by June 1955), and twenty-nine under the third phase (to be completed by December 1956). At the end of June 1954, the overall number of these stations had been reduced to ninety-nine. The total number of first and third phase stations programmed remained the same -- forty-four and twenty-nine respectively -- but the second phase stations had been reduced in number to twenty-five. The programmed completion dates for the three phases of the program remained about the same at the end of the period as they were in December 1953.[1]

At a meeting held at Headquarters, ADC in early February 1954, it was decided that six Semi-Mobile stations could be deleted from that program in favor of the employment of automatic gap filler radars.[2] In keeping with the policy set by Headquarters, USAF in late 1953, for

1. See Part Four, Table I.

2. The stations deleted were: M-104, Wierton, Ontario; M-107, Sultan, Ontario; M-108, Mattawa, Ontario; SM-146, Okanogan, Washington; SM-152, Nakusp, B.C.; and SM-154, Birken, B.C. For the reasons for these deletions see: Hq ADC, IRS, "Revision of First and Second Phase Supplemental Radar Programs," 11 Feb 1954, (Doc 1).

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each of the first phase stations deleted as a result of this decision a second phase station was reprogrammed for completion under the first phase of the program.[3] That meant that the first phase of the program remained at forty-four, but the second phase was reduced from thirty-three to twenty-seven. At a later date, two more of the programmed first phase sites were eliminated and the two second phase stations redesignated first phase sites.[4] This action reduced the programmed second phase of the Semi-Mobile Radar program to twenty-five. The map on the next page shows the planned deployment of these stations.[5]

By the end of June 1954, thirty-nine site surveys had been completed for the first phase of the program. Twenty-seven construction directives had been issued and thirteen construction contracts

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3. For an account of this policy, see ADCHR #6, Part I, p 47. See also: Ltr, ADC to EADF, "USAF Policy on Mobile Radar Programs," 12 Dec 1953, (Doc 2); and Ltr, Col O. T. Halley, Hq ADC to Col E. F. Carey, Jr., ADC Liaison Office with Lincoln Laboratory, 20 Apr 1954, (Doc 3). As explained in this latter correspondence, "Since funds had been allocated for the 44 first phase radars USAF desired that when a first phase site was deleted a second phase site be redesignated as a first phase site."

4. The two additional stations eliminated were M-96 at Luke AFB, Arizona, and M-111 at Hallock, Minnesota. See Ltr, ADC to AMA's ADF's, RAFD, and AMC, "ADC Radar Equipment Requirements, First and Second Phase Semi-Mobile Radar Program (Revised)," 9 Apr 1954, (Doc 4). A listing of the radar equipment requirements for the first and second phases of the Semi-Mobile Radar Program is appended to this document.

5. For a listing of the planned deployment of the Semi-Mobile Radar stations see Part Four, Table III.

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awarded.[6] Site surveys had been completed on all twenty-five of the second phase sites, and seven construction directives issued. No construction contracts for the second phase of the program had yet been awarded.[7]

In April, the Planning Guide for the third phase of the Semi-Mobile Program was received from higher headquarters.[8] The directive for siting the third phase stations was sent to the field in that month, also.[9] By the end of the period, eight surveys had been completed on this phase of the program, four of which were approved by Headquarters, ADC.[10]

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6. Ltr, ADC, "Bi-Weekly AC&W Status Report," 2 Jul 1954, (Doc 5). The three Canadian sites programmed for construction under the first phase of the program were being "held in abeyance pending finalization between Canadian and U.S. government representatives." Other pertinent details on the status of certain other first phase stations are given in this document.

7. Ibid.

8. Ltr, USAF to ADC, "Planning Guide for the Third Phase Augmentation Radar Program," 5 Apr 1954, (Doc 6).

9. Ltr, ADC to Defense Forces, "Siting Directive for 3d Phase Semi-Mobile Radar Program," 19 Apr 1954, (Doc 7).

10. As in fn 6, above. For information on the status of ADC's requirements for equipping the Semi-Mobile Radar stations, see: Ltr, ADC to AMA's, ADF's, RAFD and AMC, "ADC Radar Equipment Requirements, First and Second Phase Semi-Mobile Radar Program (Revised)," 9 Apr 1954, (Doc 4); and Ltr, ADC to USAF, "Arctic Equipment Requirements for ADC Radar Program," 21 Apr 1954, (Doc 8). See also: Hq ADC Program, Sect III, pp 4-8, 1 Jul 1954.

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III

AIRBORNE EARLY WARNING AND CONTROL

Delays in delivery of the RC-121C aircraft, the inadequacy of maintenance and other facilities at Otis AFB, and further organizational study necessitated revision of the airborne early warning and control program in early 1954.

In late 1953, plans called for the first of the seven squadrons programmed for the AEW&C program to be activated at McClellan AFB, California. The squadron was to remain at McClellan only for the period necessary for it to receive its ten allotted RC-121C Constellation aircraft and to become conversant in their usage. Then it was to transfer, as a complete unit, to Otis AFB in Massachusetts. A second ~~AC&W~~ AEW&C squadron was then to be activated at Otis early in 1954. In the last half of 1954, an additional squadron was to be activated at that base. At that time, too, a Group headquarters was to be created to supervise and administer the three squadrons. In 1955, three squadrons and a Group headquarters were to be activated at McClellan AFB to perform ~~AC&W~~ AEW&C operations off the West Coast.[1] The seventh ~~AC&W~~ AEW&C squadron was to be activated at Seymour-Johnson AFB,

1. See Part I, Appendix III, "Programmed Build-up of Forces," p 118, ADCHR #6.

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Goldsboro, North Carolina in early 1956.[2]

As was told in the last volume of the history, the 4701st AEW&C Squadron was activated at McClellan AFB on 1 October 1953, in accordance with the above planning.[3] By the end of the year, two RC-121Cs, minus their radar gear and thirty-four pilots were assigned to the squadron.[4] The mission of the unit at that time, to hold until fully equipped aircraft were assigned, was training.[5]

Early in 1954, ADC saw that, because of the lack of adequate facilities at Otis, the first build-up of ~~AC&W~~ AEW&C forces would have to take place at McClellan AFB.[6] Plans for an early transfer of the 4701st to Otis were therefore dropped and action taken to transfer the 4712th AC&W Squadron, scheduled for activation at Otis in May, to McClellan. A reappraisal at this time, too, was made of the type of organization required to administer and supervise the operations of these two squadrons once they were equipped.

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2. Ibid. For a statement of justification for locating an additional AC&W squadron at Seymour-Johnson airfield, see: Msg, ADC to USAF, 9 Jan 1954, (Doc 1).

3. See Part I, ADCHR #6, pp 50-51.

4. History of 4701st Airborne Early Warning and Control Squadron, 1 January-30 June 1954, p 5.

5. Hq ADC, Diary, 21 Aug 1953.

6. See ltr, ADC to ARDC, "ADC Proposal for RC-121D Aircraft," 17 Jun 1954, (Doc 2).

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As was mentioned, it was planned in 1953 to establish two Group headquarters at Otis and McClellan to train and operate the AC&W squadrons to be stationed at those bases. In March 1954, ADC changed its thinking on this score and recommended to higher headquarters that the Group organization concept be scrapped in favor of Air Division (AEW&C) headquarters. ADC explained its reason for posing this change as follows:[7]

> In attempting to determine the level of the headquarters required in the organization it was readily apparent that an individual of General Officer caliber was required to command the effort. The multitudinous operational problems to be faced in a new and unknown type operation, the development and testing of training methods and tactics and techniques, the complexity of the equipment involved, and the fact that each aircraft is in fact a mobile direction center all dictated that a division level was most appropriate.

ADC asked for two such organizations, one to be established as soon as possible at McClellan, the other to be activated at Otis as soon as it became possible to establish ~~AC&W~~ AEW&C squadrons at that base.

In its initial reply to this request, USAF authorized the activation of an Air Division (AEW&C) at McClellan. However, higher headquarters did not go along with the recommendation that two such Air Divisions should become a permanent feature of the AEW&C program. Admittedly, USAF stated, the Group headquarters, as conceived in 1953, would not be of the size and nature to oversee the operations of three squadrons. But this could be corrected by the establishment, eventually,

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7. Ltr, ADC to USAF, "Airborne Early Warning and Control Organization," 26 Mar 1954, (Doc 3).

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of two Wing headquarters.[8] In a later paper, USAF explained its reasons for permitting the activation of an Air Division (AEW&C) at McClellan as follows:[9]

> . . . the intent of this Headquarters in approving your request for an Air Division (AEW&C) Hqs . . . was to authorize an organization to perform the planning, supervision and coordination required for this program during the formative stage before the Wing Headquarters (previously Group Hqs) came into being.

As finally agreed upon by ADC and USAF, one Air Division (AEW&C) was to be activated as soon as possible, and to remain in operation until sometime in 1955 when all six AEW&C squadrons were in operation and a Wing headquarters in being at Otis. At that time, it would be inactivated and its duties taken over at McClellan by a Wing headquarters. This was a logical move, for the Air Division (AEW&C) would have the job of establishing an AEW&C force on both coasts; the Wing headquarters, once this force was in being, would be responsible for maintaining only their assigned portions of it.

On 21 May 1954, ADC submitted its revised schedule for buildup of its AEW&C force to higher headquarters for approval. This final proposal, bearing USAF's concurrence, is appended.[10]

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8. Msg, USAF to ADC, 16 Apr 1954.

9. 1st Ind, USAF to ADC, 25 Jun 1954, to ltr, ADC to USAF, "AEW&C Program," 21 May 1954, (Doc 4).

10. Ltr, ADC to USAF, "AEW&C Program," 21 May 1954, with 3 Incls and 3 Inds, (Doc 4). See also, ltr, ADC to USAF, "Airborne Early Warning and Control Program (AEW&Con)," 24 Jun 1954, (Doc 5).

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If all went as planned, ADC, by June 1955, would have seven squadrons of AEW&C aircraft in operation under the supervision of Wing headquarters at Otis and McClellan Air Force Bases.[11] The schedule for reaching this force is depicted on the chart on the next page.

On 1 March, a second squadron of AEW&C, the 4712th, was activated at Otis AFB.[12] As is explained in the unit's history for the period, this was a paper activation, only.[13] Persons assigned the organization were placed with the 4701st Squadron pending official transfer of the unit to McClellan in line with the revised program. The 8th Air Division (AEW&Con) was activated at McClellan on 1 May, and assigned to WADF.[14] At this time, the 4701st Squadron was assigned to the new organization, with stations at McClellan. The 4712th Squadron was officially transferred to the 8th Air Division on 25 May.[15]

The mission of the 8th Air Division, as established by Headquarters, ADC in June, was as follows:[16]

> . . . to provide airborne early warning and control in the air defense combat zone. This includes: station patrol to extend the contiguous land based surveillance and control

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11. See Part Four, Table I.

12. EADF General Orders #11, 25 Feb 1954, (Doc 1 in EADF History for Jan-Jun 1954).

13. See: History of 4712th AEW&C Squadron, Jan-Jun 1954, pp 1-2.

14. ADC General Orders #12, 30 Apr 1954, (Doc 6).

15. Ltr, EADF to 4707th Defense Wing, "Movement Orders, 4712th AEW&C Squadron," 8 May 1954, (Tab 4 in History of 4712th AEW&C Sqdn, Jan-Jun 1954).

16. Ltr, ADC to WADF, "AEW&Con Program," 16 Jun 1954, (Doc 7).

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AEW&C PROGRAM: July 1954-Jan 1956*
as of June 1954

RC-121 C&E Delivery Schedule

AEW&C Sqdn	1954 Jul	Aug	Sep	Oct	Nov	Dec	1955 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1956 Jan
McCLELLAN																			
4701	10	10	10	10	10	10	10	10	(redesignated as 960 Sqdn and transferred to Otis)										
4712th (963)	1	5	7	9	11	13	16	18	10	10	10	10	10	10	10	10	10	10	10
964									10Z	10	10	10	10	10	10	10	10	10	10
965														Z			4	7	9
													X					A	
OTIS																			
960									10	10	10	10	10	10	10	10	10	10	10
961						Z				2	4	6	8	10	10	10	10	10	10
962													Z	2	6	10	10	10	10
						X													
SEYMOUR-JOHNSON																			
966																	Z		
TOTAL ACFT:	11	15	17	19	21	23	26	28	30	32	34	36	38	42	46	50	54	57	59

*Source: Revised AEW&C Program appended to Doc 4, this case study.
Y 4712th AEW&C redesignated 963d Sqdn Mar 1955.
Z Date unit to be activated.
A Date 8th Air Div to be inactivated.

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> capability; emergency replacement duty for inactive land based and/or picket ship surveillance and control stations and augmentation for over saturated land based surveillance and control stations.

The official mission directive for the organization was published in late July.[17]

By the end of June 1954, four equipped RC-121Cs were assigned the 8th Air Division.[18] Twelve crews were on hand, none of which was qualified.[19] Major emphasis, then, in the AEW&C squadrons, at the close of the period, continued to be placed on training and coming to understand the capabilities of the RC-121s.[20] At the higher headquarters, every effort was being made to better equip the RC-121s for their mission.[21]

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17. WADF Regulation 23-4, 23 Jul 1954, (Doc 3 in History of 8th Air Division (AEW&Con), January-June 1954).

18. History of 8th Air Division (AEW&Con), January-June 1954, p 5.

19. Ibid.

20. See Histories of the 8th Air Division, and 4701st and 4712th AEW&C Squadrons for Jan-Jun 1954 for fuller information on this subject. See also: History of WADF, Jan-Jun 1954, pp 336-366 for an excellent accounting of the subject.

21. See, for example, ltr, ADC to USAF, "Requirements for Navigational and Ground Stabilization Equipment for AEW&C Aircraft," 21 Apr 1954, (Doc 8); and Hq ADC, R&R, "Informal Report of Staff Visit," 6 Apr 1954, with 1 Incl, (Doc 9).

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IV

LOW ALTITUDE GAP FILLER PROGRAM

Headquarters, USAF approved ADC's requirement for low altitude gap filler radars on 11 January 1954.[1] At this time, the first phase of the program comprising 125 of the approved 323 radars included in this program, were placed in the Fiscal Year 1954-55 budget.[2]

The planning guide for the low altitude radar program was received from higher headquarters in early April. What the program was, why it was required, and how it was to be implemented was stated as follows in that document:[3]

> The low altitude gap filler program will consist of approximately 323 unattended low altitude gap filler radars. These radars are to be used to fill the low altitude gaps existing between the heavy radars in the present Air Defense System and result from the fact that electronic coverage must follow the "line of sight" rule.
>
> This program will fill these gaps and is expected to provide radar coverage down to 500 ft altitude on the perimeter of the combat zone, on the outer perimeter of the double perimeter areas, and sufficient coverage within the double perimeter areas whereby a target at 500 ft altitude, traveling at 250 MPH, would not be out of surveillance for a period greater than four minutes.

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1. See ltr, USAF to ADC, "Air Defense Program Requirements," 11 Jan 1954, (Doc 70 in ADCHR #6, Part I).

2. Ibid. See previous volumes of the history for additional background information on this program.

3. Ltr, USAF to ADC, "Planning Guide for the Low Altitude Gap Filler Radar Program," 5 Apr 1954, with 1 Incl (Doc 1).

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> This degree of coverage for all practical purposes permits constant tracking of any hostile within these areas. At critical points outside the double perimeter areas, gap filler radars will be employed where additional coverage is required to enable maximum utilization of the AA capability.

It was estimated the the first phase of the program would be completed and the radars operational by mid-1956. These radars were to be deployed generally across the North Central United States and Canada. The second phase of the program consisted of eighty-five radars, these to be deployed around the perimeter of the United States. The third phase consisted of 113 radars, to be placed within the double perimeter areas to increase the low altitude tracking capability.[4]

ADC issued the Siting Directive for the low altitude gap filler program on 26 May 1954.[5] The numbering system devised for identifying the gap filler stations was as follows: First appeared the designation of the radar station into which the gap filler station was tied, followed by a letter of the alphabet. For example, say station P-2 had three gap fillers tied into it, the gap-fillers would be identified as P-2-a, P-2-b, and P-2-c. Also, the name of the closest town in the vicinity would be used in the identification.[6] The priorities for siting within each Air

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4. Ibid.

5. Ltr, ADC to Air Defense Forces, "Siting Directive for the Low-Altitude, Unattended Gap-Filler Radar Program," 26 May 1954, (Doc 2).

6. Ibid.

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Defense Force area, the criteria for siting, and the deadlines by which each of the several phases necessary to place the radars in operation had to be completed were set down in this document.[7] The first problem encountered in the drive to meet the mid-1956 operational date for completion of the first phase of this program was a shortage of qualified siting personnel.[8] Resolution of this matter was underway at the close of the period.

The radar equipment to be used in the low altitude gap filler program was the AN/FPS-14, described by USAF as "a modified CAA type radar with integrated standby facility."[9] How the system was to operate with this equipment was depicted as follows:[10]

> The proposed method of operating and monitoring these unattended low level gap fillers will be to have a series of these sites tied into selected Permanent or Augmentation radar stations through normally available telephone lines. The radar data will be transmitted over telephone circuits through the use of the slowed-down video (SDV) technique. In view of the fact that this equipment will be capable of dual channel operation, as well as being unattended, routine maintenance problems will be simplified since one (1) channel can be serviced while the other is in full operation. Also of interest is the possibility that remote switchover can be accomplished from the master stations. In view of these technical characteristics, maintenance personnel will be assigned to the master station from which a two-man team (for electrical safety) will visit each site a minimum of once each day.

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7. Ibid.

8. 1st Ind, ADC to USAF, 28 May 1954, to ltr, USAF to ADC, "AC&W Program," 19 Apr 1954, (Doc 3).

9. As in fn 3, above.

10. Ibid.

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ADC informed higher headquarters that it hoped the FPS-14 and its ancillary equipment would be delivered in a package.[11] Since these radars were programmed to operate unattended all the components had to be installed before any operational capability at all could be achieved. This, of course, was in contrast to manned radar stations where some degree of operational capability could be attained as soon as the minimum equipment was in place. The "package" for the low altitude stations, as sought by ADC, consisted of the following: radar; tower; standby power equipment, SDV (slowed-down video); building; and Vidicon Combiner, if available.[12] How to program assignment of these several equipments and facilities so that they would be received, installed, and constructed at about the same time was under study in Headquarters, ADC at the close of the period.

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11. As in fn 8, above.

12. Hq ADC, Staff Notes, 5 Apr 1954, p 3.

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V

FIGHTER INTERCEPTOR FORCE

Unit and Aircraft Changes

One squadron was added to ADC's fighter interceptor force during the first half of 1954, bringing the total number of squadrons assigned to fifty-five. Two trained and equipped F-86D squadrons -- the 440th at Geiger AFB, Washington and the 496th at Hamilton AFB, California -- were lost to overseas assignments during the period[1] and three squadrons -- the 539th, 444th, and the 460th -- were activated. The new squadrons were stationed at Stewart AFB, New York, Charleston AFB, South Carolina, and McGhee-Tyson Municipal Airport, Tennessee respectively.[2] Activation of the 444th at Charleston AFB, a SAC installation, increased the number of bases occupied by the interceptor force from forty to forty-one.

The conversion to jet all-weather aircraft was almost completed by mid-1954. At the end of December 1953, it will be recalled, twenty-eight of the fifty-four interceptor squadrons assigned were equipped with F-86Ds.[3] Eight were flying F-94Cs

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1. See Part One, Chronology.
2. *Ibid*.
3. See ADCHR #6, Part I, pp 57-61.

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and three F-89Cs. Twelve squadrons still were operating jet non all-weather aircraft -- two the F-94As and Bs and ten the F-86As, Es, and Fs, and F-84Gs. Three squadrons had not yet received aircraft. By the end of June 1954, all fifty-five of the squadrons assigned were equipped with aircraft. Thirty-six were flying F-86Ds, ten F-94Cs, and three F-89Cs. Only three squadrons continued to operate with jet non all-weather aircraft. Each of these were equipped with F-86Fs. The remaining three squadrons -- the 438th at Kinross AFB, Michigan, the 497th at Portland Municipal Airport in Oregon, and the 18th at Minneapolis-St Paul Municipal Airport, Minnesota -- were in the process of converting to the new F-89Ds.

The first F-89D was delivered to ADC and to the 18th Fighter Interceptor Squadron on 7 January 1954.[4] In the same month, the 438th Squadron began to convert to the new aircraft.[5] By the end of the period, both of these squadrons possessed their authorized complement of twenty-five aircraft. Deliveries to the 497th Squadron did not begin until March, but by June this unit, too, was at full aircraft strength.[6]

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4. History of 31st Air Division, Jan-Jun 1954, p 201. An excellent account of the difficulties encountered by the 18th in the changeover from F-86Fs to the new F-89Ds is included in this study.

5. History of 30th Air Division, Jan-Jun 1954, p 21.

6. History of 4704th Air Defense Wing, Jan-Jun 1954. See also 25th Air Division History for the same period. Considerable data on the preparations made to receive the F-89Ds in the 497th Squadron and the experiences of that unit with the new aircraft after they were assigned may be found in these studies.

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The map on the next page shows the deployment of the fighter interceptor force with the type of aircraft each squadron was flying at the end of June 1954. Statistical tables giving the total number of aircraft assigned, by type and by unit, are included in Book I.[7]

Comparison of these figures with Headquarters ADC 1953 program documents shows that assignment of F-86Ds to ADC during the first half of 1954 was considerably less than planned in 1953. Engine deficiencies, which required rework of the fuel control system, were partially the cause of the delays in delivery of new F-86Ds from production. The strike at North American and the inclement weather which prevented flight testing of newly built F-86s in late 1953 also contributed to delivery delays.[8] By early 1954, these problems had been resolved and Headquarters USAF felt that there would be no further serious slippages in production and delivery. However, soon after, higher headquarters found it necessary to alter its F-86D allocation schedule to the extent that some sixty of these aircraft previously programmed for assignment to ADC were sent overseas.[9] This action, plus the extensive F-86D modification

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7. See Part Four, Table V, which provides a complete breakdown of the June 1954 interceptor force. See also, Table VI, which gives total aircraft and crews assigned as of June 1954, by type aircraft.

8. Hq USAF, Summary Control Statement, 26 Feb 1954, p 17.

9. Msg, ADC to USAF, 17 Jun 1954, (Doc 1).

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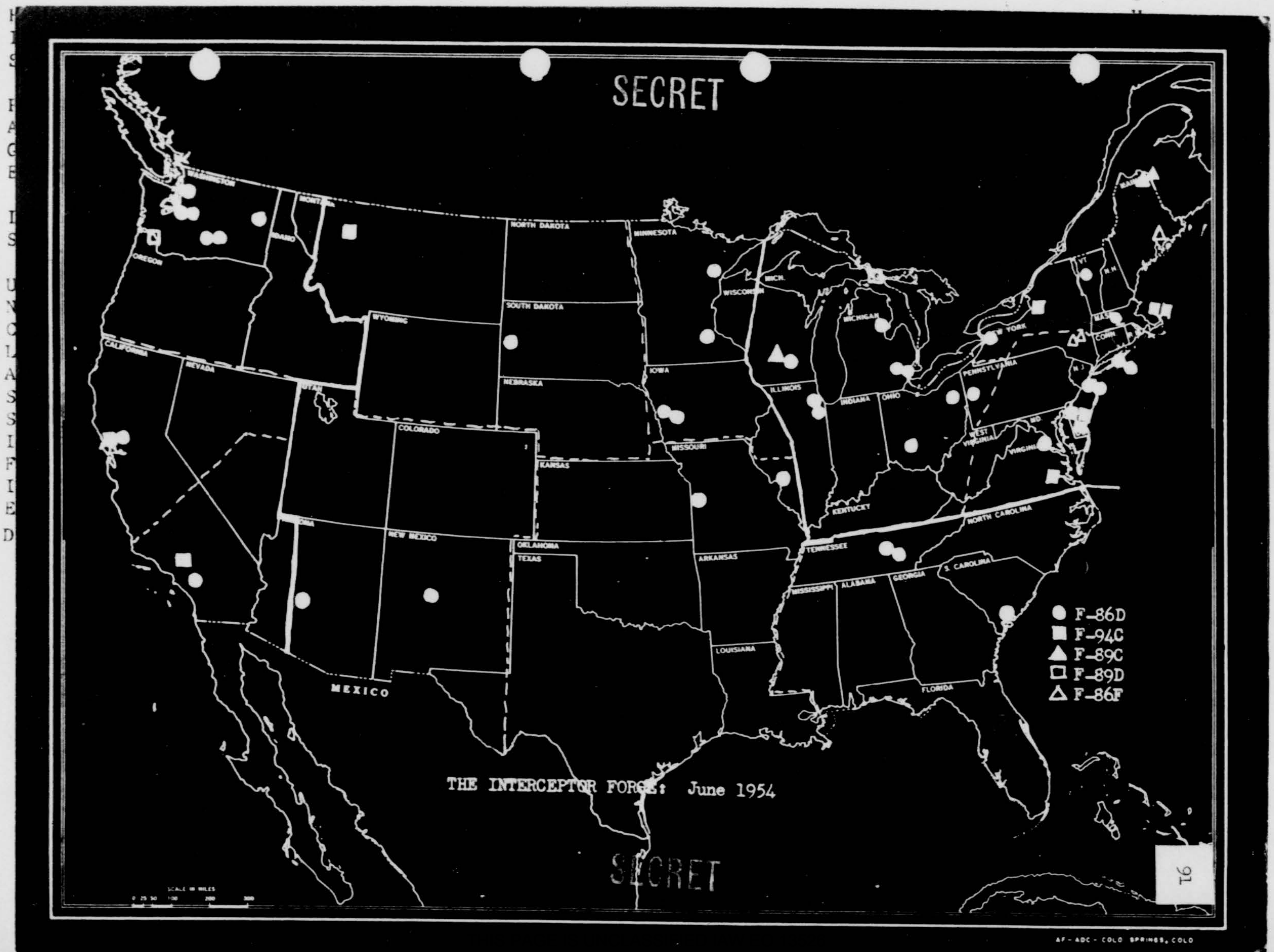

THE INTERCEPTOR FORCE: June 1954

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program which was begun during the period -- a subject discussed later in this study -- threatened to lower ADC's F-86D inventory in the near future below the safety mark.

Operational Status of the Interceptors

Both the in-commission and the combat readiness ratings of the interceptors remained severely low during the first half of 1954.

In late 1953, all the F-86Ds in the command were grounded except for use in an air defense emergency.[10] This action was taken because of the steadily increasing rate of accidents with the aircraft. Primary reason for the accidents was about equally divided between material failure and pilot error. The most common material failures were fuel, oil, and hydraulic leaks, improper electrical installations, and surface anti-icing line leaks. Most of the pilot errors were attributable to the complex nature of the aircraft. On 16 December, AMC issued a technical order (IF-86D-221) requiring rework of the fuel control system plus replacement of certain fuel line fittings leading to the afterburner section. This work was done by teams of General Electric and North American Aviation personnel (working with USAF maintenance personnel) who visited the F-86D bases. Ungrounding of the F-86Ds began about 5 January. By the following month, most of the aircraft were in

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10. See ADCHR #6, Part I, p 66.

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flying condition again, and by 4 March they were all back in the air.[11] They remained ungrounded through June.

The F-94Cs had to be grounded twice during the period. In January, the landing gear on three of the aircraft failed. A technical order, requiring each aircraft to be inspected against the possibility of such a defect, was issued. By the end of January, these inspections, which took about three hours per aircraft, were completed and all the F-94Cs back in operation.[12] On 5 May, they were again grounded, this time because of engine difficulties. It had been found that the Accessory Gear Drive Bearing in several engines in one squadron had been installed in reverse. They were back in flight in a day or two, however, and remained in that status for the rest of the period.[13]

When there were no general grounding orders in effect, maintenance problems provided the major reason for aircraft being out-of-commission. In May 1954, forty-three percent of the aircraft on hand in the squadrons were out-of-commission for maintenance reasons.[14]

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11. Msg, ADC to USAF, 22 Jun 1954, (Doc 2).

12. Hq USAF, Summary Control Statement, 26 Feb 1954, p 4.

13. Hq ADC, Diary, 7 May 1954.

14. See Part Four, Table VII, for a breakdown, by type aircraft, of the out-of-commission rate of the interceptors in May 1954.

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Shortages of ground handling equipment (power units, hydraulic test stations, aircraft aft dollies, etc.)[15] and skilled mechanics and electronic technicians continued to be the major reasons for this poor maintenance showing.[16] Higher headquarters and Air Training Command seemed to be doing their best to meet the skilled personnel requirement, but the demand which was USAF-wide, still far exceeded the supply. Consequently, ADC's only hope for relief continued to lay in on-the-job training in the squadrons.[17] Here, too, a grave problem existed, however; there was a serious shortage of qualified supervisors. Early in 1954, ADC sought USAF's permission to waive the restriction on retraining skilled

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15. See the Hq ADC, Statement of Effectiveness publications for February through July 1954 for a monthly accounting of the ground handling equipment shortage problem and the success attained in the constant effort to overcome it.

16. These were the same major causes for the low maintenance record during the last half of 1953. In an effort to alleviate the problem, ADC established the COSAMO project in late 1953, it will be recalled. This was the pooling of maintenance equipment and personnel at certain selected bases and the routing of aircraft from all the squadrons through those bases for repair. The project was abandoned in early 1954. For the details on this project and the reasons for its demise, see the histories of the Air Defense Forces and the Air Divisions for the period.

17. The following account of the effort to overcome the shortage of skilled personnel problem appeared in one squadron history: "The chief source of skill level raising has been the squadron itself and through the several Air Force Schools that maintenance people have attended. . . .Our Tech Reps [one each from No. American, General Electric, Hughes, and Philco] continue to prove themselves invaluable to the organization. They carry the load in the training of our maintenance personnel. Through conducting classes and advising our people in trouble shooting, they have greatly increased the squadron maintenance level." (History of 4702d Defense Wing, Jan-Jun 1954, Appendix on 31st FIS, p 3.)

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conventional mechanics into the jet maintenance field.[18] This request was granted. By August of 1954, some 670 men with the "seven-level" conventional aircraft mechanic background were to be assigned to ADC units. Once these men had mastered their new assignments, ADC believed, jet maintenance on-the-job training, and actual maintenance on the line, would show a vast improvement.[19]

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Interceptor Modification

The biggest event in the program for modification of the interceptors during the period was the initiation of Pull Out. Under the terms of this project, all of the F-86Ds in ADC and elsewhere in the Air Force, were to be returned to the North American Aviation plant at Fresno or the Sacramento Air Material Area in California for dissassembly and overhaul. The purpose and plan of

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18. ADC to USAF, "Shortage of Seven-Level Jet Aircraft Maintenance Personnel," 27 Feb 1954, (Doc 3).

19. Hq ADC, Statement of Effectiveness, June 1954, p 13. For further detailed information on the activities underway to improve maintenance capability, see the following documents: Ltr, ADC to 4750th Training Wing (Air Defense), "Current Technique Dissemination Program," 20 Jul 1954, (Doc 4); Ltr, ADC to USAF, "Technical Training Requirements, F-86D," 4 Jan 1954, (Doc 5); Ltr, ADC to Major Subordinate Units, "Identification and Utilization of F-86D Maintenance Personnel," 2 Jul 1953, (Doc 6); Ltr, ATRC to ADC, "F-86D Maintenance Special Training," 14 Dec 1953, (Doc 7); Ltr, ADC to ATRC, "F-86D Maintenance Special Training," 4 Jan 1954, (Doc 8); Ltr, ADC to AMC, "E-System Fire Control E-4, E-5, E-6) - Plan of Maintenance," 5 Jan 1954, (Doc 9).

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execution of the project was summed up as follows in one publication:[20]

> The purpose is to incorporate late engineering changes on service F-86D airplanes. These changes resulting from flight test, design development, and service experience will improve operational performance, promote flight safety, and make maintenance easier.
>
> Almost all present service F-86Ds will make the journey to Fresno or Sacramento sooner or later. Individual parts from these airplanes will be reworked at various locations. The rear fuselage section will be taken to the North American Aviation plant in Los Angeles. E-4 fire control system components will be sent to Hughes Aircraft Co; autopilot components to Lear Inc; engines to USAF depot.

Overall monitorship of the project was assigned to AMC's Sacramento facility. Each major Air Force command flying F-86Ds and the other AMC support organizations were to furnish assistance as necessary. In a letter to the field in February, ADC explained to its assigned organizations what role ADC would be expected to play in the successful implementation of the project.[21]

Pull Out got underway in March[22] and was in full swing by

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20. NAA Operations and Services News, Vol 10, No. 23, 25 Jun 1954, (Doc 10).

21. Ltr, ADC to Major Subordinate Units, "ADC Implementation of Project: 'Pull-Out,'" 5 Feb 1954, (Doc 11). A complete rundown of the modifications to be accomplished by Pull-Out is provided in this document.

22. Hq USAF, Summary Control Statement, 25 Mar 1954, p 17. The following description of Pull-Out appeared in this document: "This Project - just beginning and scheduled to be completed by August 1955 - includes the modification of airframe, fire control system, auto pilot and engines, and installation of drag chutes. Aircraft will be reworked in varying degrees with those more recently out of production requiring less work. Withdrawals of aircraft from units for delivery to modification centers will be made so as to retain in each squadron an acceptable operational capability - approximately but not less than 18 per squadron."

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the end of June. ADC's problem was to meet its commitments to the project with as little disruption of training and active air defense operations as possible. In scheduling the deliveries of the aircraft to the modification centers ADC sought to attain the following: Keep at least eighteen F-86Ds on hand in each squadron throughout the project; avoid the transfer of F-86Ds between units; in the course of the deliveries, eliminate the mixed assignment of dissimilar models of the F-86D within individual squadrons which, in the past, had hampered maintenance; and, last, avoid interference as much as possible with programmed conversion and equipping schedules throughout the interceptor force.[23] Generally, ADC succeeded in these goals through June. Due to slippage in F-86D production, however, and the reallocation by higher headquarters of new production F-86Ds originally scheduled for assignment to ADC to overseas squadrons, ADC was worried that soon aircraft assignment in the squadrons would fall below eighteen. Just before the close of the period, ADC sought from USAF an increased assignment of new production F-86Ds in the months following. Otherwise, ADC pointed out, assuming that it continued to support the Pull-Out project as originally planned, the inter-

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23. Ltr, ADC to USAF, "Factors Affecting the Successful Operation of Project 'Pull-Out'," 7 Apr 1954, (Doc 12).

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ceptor force would be reduced to skeleton proportions.[24]

Preparations for a modification program similar to Pull-Out for the F-94Cs were on the verge of implementation at the close of the period. The Plan for this project was set down in April at a meeting at AMC Headquarters between representatives from AMC, ADC, Lockheed, Hughes Aircraft, APGC and the ATRC.[25]

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24. Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 1-30 June 1954," 19 Jul 1954, (Doc 13). This document gives a good account of the status of the Pull Out project at the end of June. See also: Msg, ADC to USAF, 17 Jun 1954, (Doc 1). For additional detailed information on the establishment and progress of Pull Out during the first half of 1954, see the following documents: Ltr, ATRC to ADC, "Project 'F-86 Pull Out' - Technical Training," 8 Jan 1954, (Doc 14); Memo of Understanding, "Project Pull Out," 12 Jan 1954, (Doc 15); Hq ADC IRS, "Project Officers for F-86 Pullout," 25 Jan 1954, (Doc 16); Hq ADC IRS, "Ferry Routes for Project 'PULL OUT'," 25 Jan 1954, (Doc 17); Ltr, ADC to USAF,"Progress Report on F-86D Project Pull Out," 28 Jan 1954, (Doc 18); Hq ADC, "Conference Guide Notes," 9 Feb 1954, (Doc 19); Msg, ADC to USAF, 26 Feb 1954, (Doc 20); Ltr, ADC to Major Subordinate Unites, "ADC Aircraft Scheduling and Assignment Plan for Project 'PULL OUT'," 26 Feb 1954, (Doc 21); Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 13-26 February 1954," 9 Mar 1954, (Doc 22); Ltr, ATRC to ADC, "Project F-86 Pull Out - F-86D Maintenance Special Training," 12 Mar 1954, (Doc 23); Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 27 February to 15 March 1954," 24 Mar 1954, (Doc 24); Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 16-31 March 1954," 8 Apr 1954, (Doc 25); Ltr, ADC to AMC, "F-86D Aircraft Project 'Pull-Out'," 14 Apr 1954, (Doc 26); Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 1-15 April 1954," 21 Apr 1954, (Doc 27); Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 16-30 April 1954," 6 May 1954, (Doc 28); Ltr, ADC to USAF, "Progress Report on F-86D Project Pull Out, 1-31 May 1954," 11 Jun 1954, (Doc 29); Ltr, ADC to Major Subordinate Units, "ADC Aircraft Scheduling and Assignment Plan for Project 'Pull Out'," 15 Jun 1954, (Doc 30).

25. Ltr, ADC to AMC, "F-94C Deficiencies and Recommended Modifications," 23 Apr 1954, (Doc 31).

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As it stood at the close of the period, the plan was to accomplish the F-94C modification in two phases, as follows:[26]

> Phase I covers the modernization of about 150 F-94C aircraft to include cockpit enlargements and IRAN, and approximately 200 T.O.'s and Engineering Change Proposals. . . . Phase II, also to include IRAN and approximately 200 T.O.'s and /Engineering Change Proposals/ is proposed to be accomplished at Sacramento AMA and will involve the remainder of the F-94C aircraft. It is estimated that Phase II will begin about 1 September. There is no estimated completion for this program at the present time. All kits and parts to accomplish Phase I and Phase II of this program are available, except those to accomplish modernization of the J-48-5A engine to -7A configuration. Pratt and Whitney representatives indicated that they will require approximately nine months lead time to furnish the kits and parts for Sacramento to accomplish the engine modification.

Pilots

Late in 1953, it will be recalled, ADC asked higher headquarters to reduce the authorized aircrew to aircraft ratio in the F-86D squadrons from 2.0 to 1.5. As a result of the cessation of hostilities in Korea, a large number of pilots trained in the employment of day jet fighters were released for assignment to other duties. The only action open to USAF for placing these pilots was to assign them as overages to all the major Air Force commands. ADC's point of view was that it did not have enough flying hours to train the vast increase in pilot strength which would result if USAF went ahead with its plans to make equitable distribution

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26. Hq USAF, Summary Control Statement, 25 June 1954, p 6.

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of the overages among the major commands.[27] Reduce the F-86D authorization to 1.5, ADC stated, and we can handle our share of the overages. If you keep us at 2.0, however, and then assign these additional pilots, our training program will suffer severe damage, and our timetable for establishing an adequate air defense force will be seriously disrupted.[28]

USAF turned this request down in October 1953, but General Smith, ADC's Vice Commander, appealed the case to General O'Donnell, USAF's personnel chief.[29] Finally, in March 1954, higher headquarters complied, and the authorized aircrew to aircraft ratio of the F-86D squadrons was temporarily reduced to 1.5.[30] F-94C and F-89 squadron authorization remained at 2.0 per aircraft. At the close of the period, the interceptor squadrons were manned up to authorization in all cases. Considerable overmanning existed,

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27. The question of why ADC had not used up its allotted number of flying hours during FY 1954 came up during the period. In the following correspondence, ADC explained why this had been so (aircraft groundings, modification requirements, etc.) and informed higher headquarters that once it was over the hurdle of conversion, it would need all the flying hours programmed, plus even more, if it were going to bring assigned aircrews to the peak of proficiency: Ltr, USAF to ADC, "OPF 54-1 Flying Hour Program vs Operational Readiness," 28 Jan 1954, (Doc 32); Msg, ADC to USAF, 5 May 1954, (Doc 33); Msg, ADC to USAF, 22 Jun 1954, (Doc 2); and Msg, ADC to USAF, 12 Jul 1954, with 3 Hq ADC IRS's, (Doc 34).

28. See ADCHR #6, Part I, pp 67-70.

29. Ibid.

30. Ltr, USAF to ADC, "Reorganization of the 2d and Certain Other Fighter-Interceptor Squadrons," 3 Feb 1954, (Doc 35).

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but it was within manageable bounds.[31]

Generally, the pilot situation in the squadrons remained much the same during the period as it was during 1953; i.e., large numbers of pilots were on TDY for training, and active air defense requirements were met by overworking those pilots who were qualified in the new aircraft. The situation was rapidly improving, however. About fifty percent of the aircrews were combat ready at the end of June 1954.[32] This was an improvement of about eleven percent over the situation in January, which meant that as conversion activity decreased aircrew proficiency would increase.[33] Other actions were underway at the end of the period which promised to improve the pilot situation, also, such as the stabilization of pilot assignment and the increased ability of the Air Training Command to meet all weather crew training needs.[34]

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31. See Part Four, Table VI, for data on crew assignment.

32. Part Four, Table V contains information, by squadron, on the number of aircrews assigned which were combat ready. For a definition of the term "combat ready," see ADC Historical Study #6, which appears as Book III to this volume.

33. See Hq ADC, Command Data Book, Jun 1954, p 4.7, for a monthly accounting, from January through June 1954, of aircrews authorized, required, on-hand, and combat-ready.

34. In early 1954, USAF established the following policy with regard to the assignment and initial training of interceptor pilots for ADC: (1) No pilot to be assigned ADC unless he was a qualified interceptor pilot; (2) ATRC pilot graduates would have completed a full 38 hour F-86D and 45 F-89/94 course instruction; and (3) beginning around October 1954 all initial interceptor pilot training in support of ADC cockpit manning requirements would be conducted by ATRC. (Hq ADC, Diary, 26 Feb 1954).

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Interceptor Force Programming

The programmed 1957 interceptor force goal remained sixty-nine squadrons on fifty-five bases. The majority of these, thirty-eight to be exact, were to be located generally along the East Coast and in the vicinity of the Great Lakes region in the Eastern Air Defense Force region. Seventeen were to be scattered through the mid-section of the nation in the Central Air Defense Force area of defense. The remaining fourteen were to be deployed along the West Coast, under Western Air Defense Force.[35]

Each of the sixty-nine squadrons was to be equipped with twenty-five jet all weather aircraft. Thirty-five would operate F-86Ds, twenty-two F-102s, seven F-94Cs, and six F-89Ds. The planned deployment of this force is shown on the map on the next page.

The first F-102s were scheduled to arrive in ADC between June and December of 1956. The most recent information available on this Convair-built, delta-wing, single-place, jet all weather interceptor was that it had a maximum climb of 40,000 feet per minute, a combat ceiling of 56,000 feet, and a maximum speed of 1100 knots. Its radius of action was about 500 nautical

35. For a listing of the bases to be occupied by this force, and of the type of aircraft to be assigned to each base, see Part Four, Table VIII. For the timetable set by ADC as of the end of June 1954 for reaching this force goal, see Table I.

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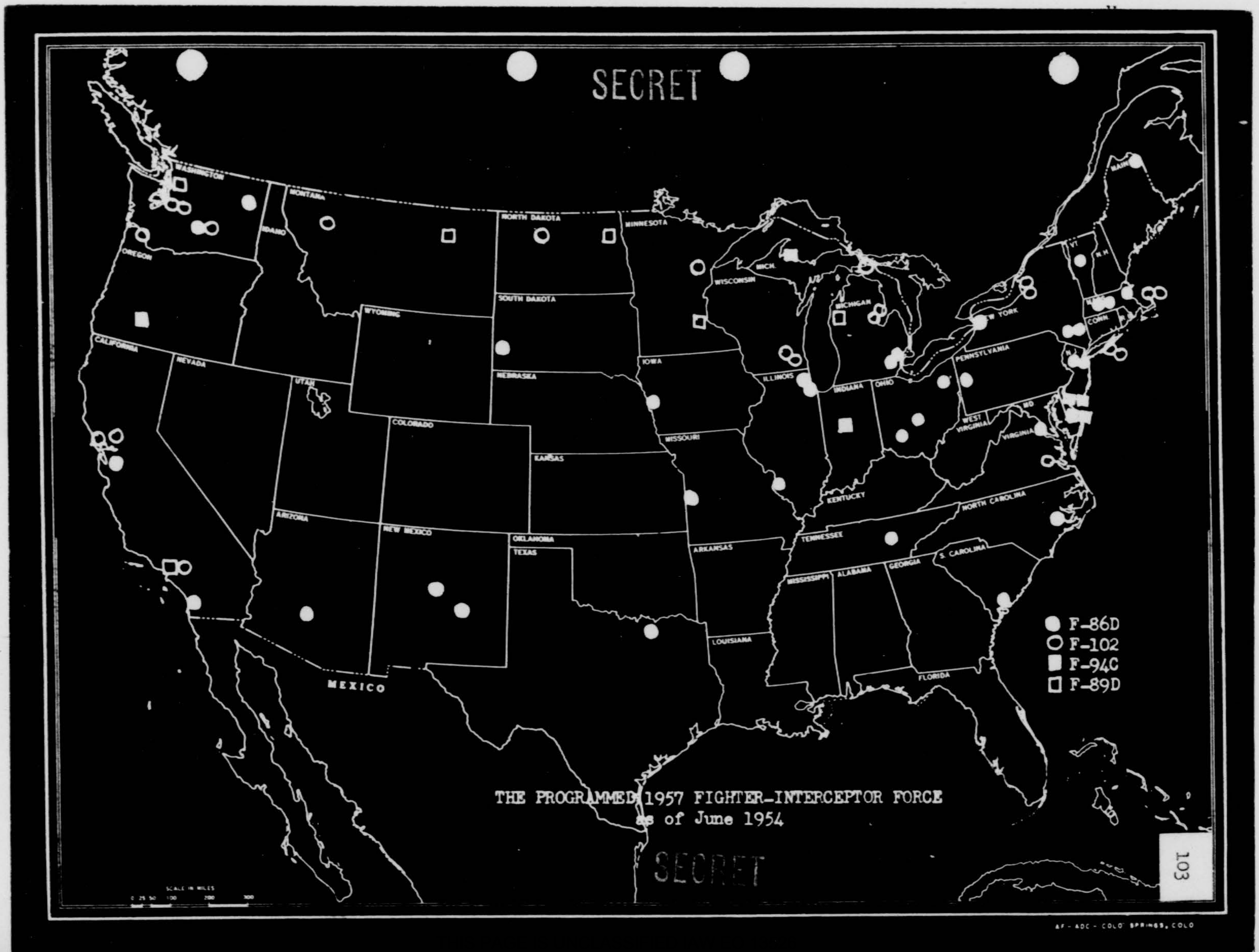

THE PROGRAMMED 1957 FIGHTER-INTERCEPTOR FORCE
as of June 1954

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miles.[36] ADC planned to employ the F-102, during the 1956-1960 time period, as a medium range weapon.[37]

By the end of 1953, the YF-102, the prototype model of the F-102 scheduled to be assigned ADC by 1956, had completed six successful flights at the Air Force Flight Test Center before sustaining major damage.[38] With regard to the results achieved on these tests, the following was reported:[39]

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36. Hq ADC, Briefing, 15 May 1954, p 116.

37. See Appendix VIII. The following account of the F-102, its characteristics and the plans for its development and assignment, appeared in the Hq USAF, Summary Control Statement for 28 July 1954, p 34: "Two models of this aircraft are currently programmed. The F-102A, which will incorporate the J-57 engine and the E-9 Fire Control System (The E-9 Fire Control System is being programmed for this aircraft because of the delay in MX 1179, the integrated electronic control system) and the F-102B, which will incorporate, at an early date, the MX 1179 and J-67 engine. The 102A is scheduled for first flight during October 1953. Limited production is programmed to begin in April 1954. The maximum speed of the F-102A with the E-9 Fire Control System will be Mach 1.4 at 35,000 feet and of the F-102B Mach 2.0 at 34,000 feet. A feasibility study has been initiated with the contractor for the installation of two inch T-214 rockets in lieu of 2.75 folding aircraft rockets in the F-102A." For additional data on the characteristics of and the status of operational planning for the use of the F-102 in the air defense system, see: Ltr, USAF to ADC, "Operational Concept of the F-102A," 3 Dec 1953, with 1 Incl and 1st Ind, ADC to USAF, 25 Mar 1954, (Doc 36); Ltr, ADC to SAAMA, "F-102 Support Needs," 28 Apr 1954, (Doc 37); and Ltr, USAF to ADC, "Recommended Changes and Comments on the F-102A Operational Plan," 1 Jul 1954, (Doc 38).

38. Hq USAF, Summary Control Statement, 23 Dec 1953, pp 24-25. The damage occurred due to a loss of power during the critical period of takeoff when the airspeed was low and the angle of attack high.

39. Ibid.

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> . . . the handling qualities of the airplane, especially the stability and control at low speeds during takeoff and landing, were considered good. The visibility at takeoff and landing altitudes was reported to be satisfactory. The top speed demonstrated was Mach 0.93 attained in a climb with afterburner to 35,000 ft., at which time power was reduced to conduct flutter investigations. The high-speed, high-altitude capabilities were to be demonstrated on the test flight.
>
> Minor mechanical malfunctions prevented the airplane from completing the flutter investigations and demonstrating its high performance capabilities earlier in the program. These malfunctions pertained mostly to the landing gear retraction mechanism, fuel pressure system and instrumentation.

A second YF-102 was completed at Convair in San Diego and placed in operation by the end of December 1953. On its eighth flight, this aircraft attained a speed of Mach 1.06.[40] No major problems were encountered in any of its flights. On 30 January 1954, USAF indicated its confidence in the new aircraft by releasing Fiscal Year 1954 funds for procurement of thirty-seven of them.[41]

At this same time, USAF approved funds for the purchase of twenty TF-102s. ADC wanted these training aircraft delivered before the tactical models were assigned, and, in February, prepared a study of the matter. In this work, ADC pointed out the many problems that had been encountered during the period of conversion to the F-86D. It was felt that many of these problems

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40. Hq ADC, Staff Notes, 11 Feb 1954, p 4.

41. Ibid., 11 Feb 1954, p 4.

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might not arise in the process of conversion to the F-102s if an adequate number of TF-102s were procured in advance of delivery of the tactical models. ADC's recommendation was that each fighter interceptor squadron scheduled to convert to F-102s receive sixteen TF-102s two months before the tactical models arrived. When the tactical models arrived, twelve of the TF-102s would be transferred to a squadron scheduled to convert two months later; the remaining four TF-102s would be kept for training.[42] Whether or not USAF would be able to meet ADC's needs on this matter remained to be seen.

On 12 June 1954, a tentative table of Organization for F-102A squadrons had been prepared and forwarded to higher headquarters. The table would be revised as more data on the new aircraft and its support needs became available.[43]

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42. Ibid., 24 Feb 1953, pp 3-4. For additional data on the planned use of the TF-102s, see: Hq ADC, IRS, "Operational Plan for the TF-102A," 26 May 1954, (Doc 39).

43. Hq ADC, DCS/O. Project Reports, 1 Aug 1954, p 58.

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VI

EARLY WARNING

In order to give the Strategic Air Command time to launch a counter-offensive, bring the defense forces to full alert, and initiate the many other military and civil emergency defense measures presently planned before the enemy reached his bomb release line, ADC had to be certain of receiving from two to six hours of early warning of impending attack. ADC's immediate need for early warning would be satisfied by the construction of the Mid-Canada Early Warning System. The plan underway to meet the estimated 1960 Soviet jet bomber capability was the construction of a Northern Canada Distant Early Warning System (DEW Line). Upon the completion of these systems, and their overwater extensions, ADC would have, far in advance of the Combat Zone and between the United States and its potential enemy, an Air Defense Warning Zone stretching from Hawaii to the Arctic Circle to the Azores.[1]

The mid-Canada early warning segment[2] had been favored by

1. Hq ADC, Air Defense Requirement, 1954-1960, p 33-42. See also, Hq USAF, "General Operational Requirement for a Distant Early Warning System," 26 Jan 1954, (Doc 1).

2. Previous Air Defense Command Historical Reports refer to this as the McGill Line.

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ADC in early 1953 when it recommended installation at the earliest possible date of a warning zone approximately two hours in advance of the radar coverage of the United States' continental air defense system. Only momentarily it had questioned the advisibility of creating a more distant early warning zone three to six hours in advance of the continental air defense radar net.[3]

The mid-Canada line was to be based on the use of CW doppler radio equipment developed by McGill University and RCA of Canada. This equipment, emitting radio beams, would be capable of detecting aircraft, from sea level to 60,000 feet or higher with a reliability of 95% or better, if they sought to penetrate the radio fence that was envisaged. Any aerial object seeking to cross the proposed line of unmanned CW radio stations would automatically be reported to manned collecting installations, from which necessary action would emanate.

Air Defense planners of both Canada and the United States contemplated the location of such a radio fence generally along the 55th parallel in central Canada, on the fringe of Canadian populated areas. It was hoped that this East-West line would connect the radar stations of British Columbia with those of Labrador, while an extension north along the Alcan Highway would connect the Alaskan radar net with this mid-Canada line. In addition, airborne early

3. Msg, ADC to USAF, 7 Feb 1953, (Doc 62, ADCHR #6).

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warning lateral extensions were also recommended in order to project the line from Alaska to Hawaii and from Labrador to the Azores.

As envisaged by ADC in late 1953, the program for the mid-Canada early warning line was to be as follows:

> ...this system will consist of approximately 314 radar stations. 304 of these...will be unmanned automatic early warning reporting stations.... While these stations will be unmanned, space is being provided in the operations buildings for three personnel to remain overnight when required. The remaining 10 stations...will be supply, servicing and data collecting points in addition to being early warning reporting stations. It is estimated that it will be economically feasible to construct access roads to approximately 50 of the stations and funds have been requested in the program. The remaining stations...must be serviced by helicopter. Planned personnel strength is 6 officers and 25 airmen.[4]

Given a green light and the approval of a $50 million appropriation by the Air Council, ADC was requested to compile additional information on the capability of equipment, Canadian-American joint defense agreements, and operational concepts and locations, with a view toward commencement of the early warning net.[5] It had been expected that the 55th parallel line would be operating in a limited capacity by 1957, and at full capability by 1959.[6] However, revised estimates placed the operational date of equipment to be used in

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4. Ltr, ADC to USAF, "FY-1955 Public Works Program (Call for Estimates)," 14 Nov 1953, (Document 7, ADCHR #6).

5. Hq ADC, DCS/O Project Reports, Dec 1953, p 12.

6. Hq ADC, Briefing, 15 May 1954, p 20.

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this warning line as June 1956.[7]

By February 1954 a joint RCAF-USAF engineering group, including two ADC representatives, had been formed to develop estimates on specifications, costs, equipment and manpower.[8] The Air Defense Commands of both the United States and Canada recognized that time was the most important factor in creating the mid-Canada early warning segment.

Initially, data obtained from this CW radio fence had been visualized only as providing early warning to combat zone air defense units. But long range plans conceived during the period sought to implement its detection capabilities. Since additional data was required to identify aircraft that tried to penetrate the net, ADC researchers sought to add equipment that would determine whether aircraft were inward or outward bound, as well as indicate their number, height, and speed.[9] Furthermore, the long range plans would extend contiguous radar coverage northward from the Continental United States to the mid-Canada segment, thus making that East-West line the northern periphery of the combat zone.[10]

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7. Hq ADC, Air Defense Requirements, 1954-1960, p 41.

8. Hq ADC, Statement of Effectiveness, Feb 54, p 17; ibid., Mar 54, p 17.

9. TWX, ADC to USAF, 10 Jun 1954, (Doc 2).

10. TWX, ADC to USAF, 12 Feb 1954, (Doc 3).

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Requirements were altered to include approximately 218 CW radio detectors, small non-rotating radios, located to form a double line of stations spaced laterally about 30 miles apart and 2 miles apart in depth; 218 microwave communication sets and some 20 low powered H-type homing beacons with VHF/UHF transmitters and receivers were also deemed necessary for proper functioning of the line.[11] In addition, it was felt necessary to install a rotating radar at each CW radio detection station designated as collection points for each 400-500 mile section of the line. This would permit traffic control and insure a higher degree of reliability in identification, which could be performed either by procedural or electronic means, by requiring friendly aircraft to fly over the mid-Canada early warning line at the designated identification corridors.[12]

Air defense planners, unsatisfied with an early warning net that permitted very limited warning of the future Russian attack capability with jet bombers having speeds up to 550 knots, were already at work to extend the early warning net. The safety of the United States, they felt, necessitated the construction of a Distant Early Warning (DEW) line in Northern Canada, likewise composed of a double line of ground based warning stations sited approximately 30 miles apart and two miles in depth. This program,

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11. Hq ADC, Air Defense Requirements, 1954-1960, p 34.
12. Ibid, p 49-50. Also same as fn 2 above.

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designed to fill in the existing aircraft detection voids between the Alaskan net and the radar stations near Thule, Greenland, would absorb the overwater extensions of the mid-Canada early warning line. The western flank of this DEW line would continue to extend from Alaska to Hawaii in the North Pacific, but its Eastern flank was now shifted from Greenland to the Azores in the North Atlantic. The most logical method of accomplishing this overwater line was through employment of AEW aircraft and naval picket vessels.[13]

A USAF proposal that the DEW line extend from Kodiak-Fairbanks-Aklavik-Coppermine-Thule-Keflavik, Iceland, approximately 3600 nautical miles, with the North Atlantic overwater extension going from Iceland to Great Britain,[14] did not receive the support of air defense planners. The Thule-Keflavik-United Kingdom extension was rejected.[15]

It was expected that the installation and operation of the Northern Canada Distant Early Warning line and its sea-wings would provide a maximum warning time, from the Arctic Circle to

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13. Hq ADC, Air Defense Requirements, 1954-1960, Section I, Annex A, Appendix 1.

14. Hq USAF, "General Operational Requirement for a Distant Early Warning System," 26 Jan 1954, (Doc 1).

15. Hq ADC, Air Defense Requirements, 1954-1960, Section I, Annex A, Appendix 1.

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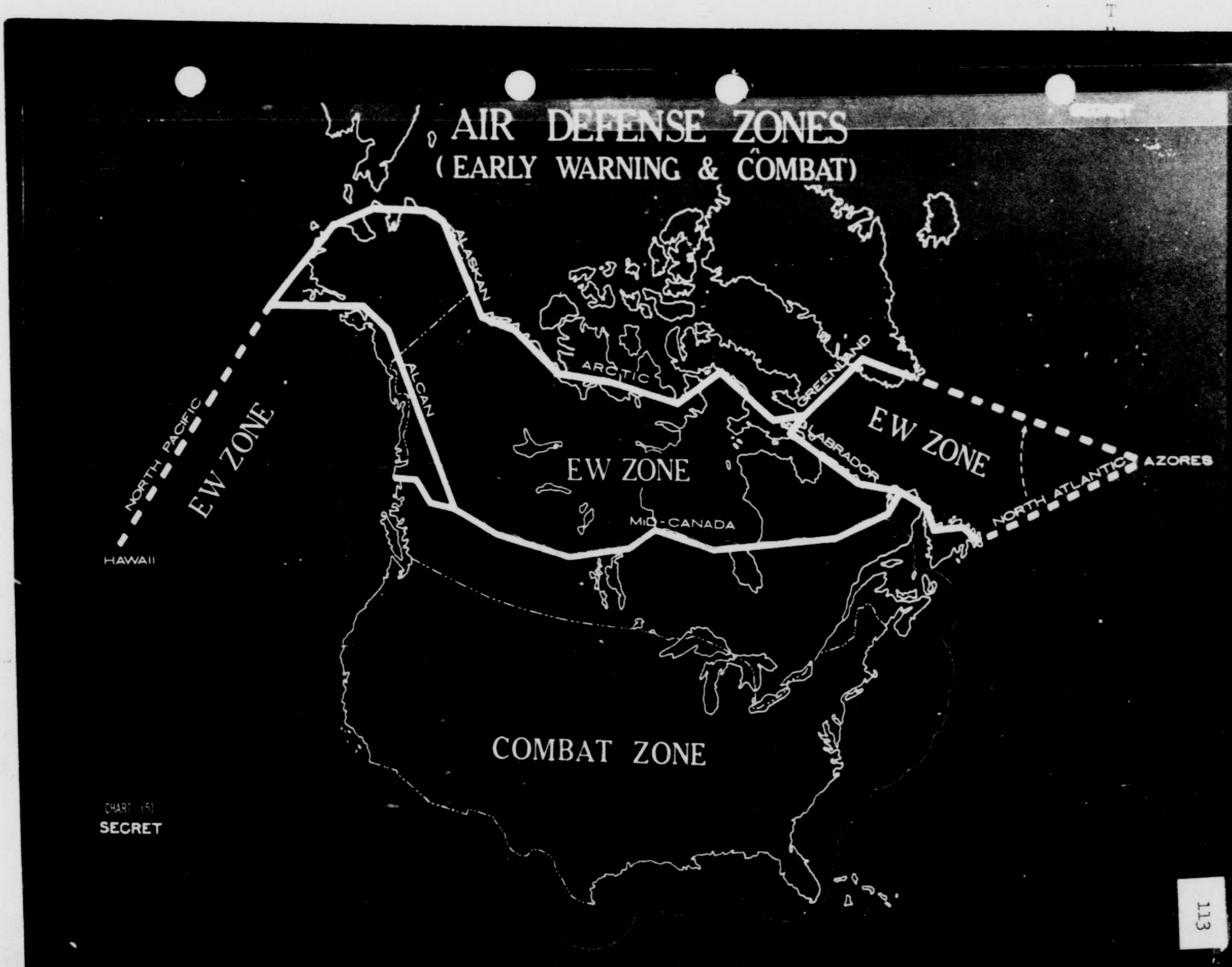

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the northern border of the United States, of six hours for TU-4 aircraft and two hours for jet bombers and missiles.[16] The operation of the DEW line would modify the functions of the mid-Canada early warning line. The latter would no longer be the first line of warning, but would be the advance line of the northward extending combat zone periphery.

Though the operational date of CW radio detectors for the Northern Canada Distant Early Warning line was given as 30 June 1958, the programming of sites, installation of equipment, acquisition of trained personnel, evolvement of procedures, and integration into the air defense net for North American, all of which had yet to be determined by negotiation with Canada, promised to occupy much research time and development in the future.

The problem of the DEW line was further complicated by serious weaknesses inherent in extending early warning lines without providing means of identification. Unless the Northern Canada electronic fence was backed by force, the enemy was capable of spoofing raids,[17] thus confusing our ability to discriminate between pre "D" day annoyance raids and the initial real raid of war. Spoof raids might be employed with such frequency as

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16. Hq ADC, Briefing, 15 May 1954, p 20.

17. "Spoofing" is the simulation of air raids in order to arouse the enemy's defense, confuse and exhaust him to the point where he is unable to recognize or effectively oppose the paralyzing raid of real war. Spoofing tactics were employed by both sides with varying degrees of success during World War II.

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to nullify any real benefits to be derived from a DEW net. It might further provoke the United States to declaring war on Russia as the only competent way of solving the spoofing problem.

There were only two possible solutions to the spoofing problem open to air defense planners at the close of the period. First, the DEW line might be capable of defense by long range interceptors operating in conjunction with early warning radars incorporated into the net. However, there were too many apparent disadvantages connected with use of conventional interceptors and missiles in this augmentation of the DEW line. A second proposed solution was to abandon the concept of ground based early warning backed up, where possible, by fighter interceptors.[18]

By the end of the period, USAF and ADC were largely commited to the creation of both Canadian early warning lines using CW radio detectors and/or conventional radars "located as to form barriers that cannot be avoided or crossed surreptitiously without providing information that may be used for alerting the air defense."[19] Circumnavigation of the overwater extensions did not appear feasible within the forseeable future.

While programming went forward to provide the Airborne Early Warning aircraft and naval picket ships that would be

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18. Hq USAF, "General Operational Requirement for A Distant Early Warning System," 26 Jan 1954, (Doc 1).

19. Hq ADC, Air Defense Requirements, 1954-1960, p 33.

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needed to man the overwater extensions of the Northern Canada Distant Early Warning line, serious consideration was given to use of buoy mounted CW doppler radio fence.[20] It was proposed that the overseas detection lines from Alaska to Hawaii, and from Greenland to the Azores, be composed of a series of anchored buoys, each of which would be separated some 30-50 miles from the others. Each buoy would contain within it, doppler radio equipment similar to that developed by McGill University and programmed for use in both mid- and Northern Canadian early warning lines. Using necessary auxiliary power equipment, the buoys would be designed to operate in unattended fashion for 3-6 months. With an estimated 99% reliability per thousand miles of line, the fence would be capable of detecting aircraft from sea level to 60,000 feet or higher, indicating direction, height, and number of aircraft involved in the penetration.

It was estimated that the cost of a complete buoy station, excluding the cost of installation and possible cost of developing a suitable power supply, would be less than $250,000. The cost of a thousand miles of CW Doppler Fence was expected to be about $7,500,000. Survey results further indicated that installation costs for the buoy line would approximate $3,000,000, and that the annual costs of operating this line would be about $5,000,000.

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20. The discussion on the CW Doppler Fence comes from: Ltr, ADC to USAF, "(Secret) CW Doppler System for Overwater Early Warning," 23 Mar 1954, (Doc 4); Hq ADC, IRS, Operations Analysis, "Status Report on Buoy Mounted Radar Doppler Fence," 13 Apr 1954, (Doc 5).

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The apparent need for further survey of oceanographic, topographic, and climatic conditions existed in areas where the buoy CW Doppler Fence would be employed. In addition to the problems of designing and anchoring a buoy in 2000 fathoms of water, those of developing a diesel engine with sufficient reliability to power the CW radar, of spacing and stabilizing the communication equipment, of refueling and maintaining electronic equipment through visiting buoy tenders, were all being given serious study as the period drew to a close.

While the Defense Research Board in Canada conducted tests and studied new design features of doppler radio equipment, members of the Lincoln Laboratory offered to construct a model buoy system; the Woods Hole Oceanographic Institute indicated a willingness to assist in obtaining test data on the model; the Operations Analysis Stand-by Unit at Iowa State College was requested to prepare a detailed buoy design and study its dynamic stability; and the Scripps Institute of Oceanography and the Navy Electronics Laboratory also indicated their special interest in this project.

Preliminary investigation and analysis seemed to indicate to the Operations Analysis personnel of ADC the feasibility of using the CW Doppler principle for overwater early warning. So enthusiastic were these personnel that there seemed little doubt to them as to the advantages in cost, manning and effectiveness of the doppler technique in this respect also. In fact, they

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claimed that the principle "would be extremely favorable in all aspects when compared with AEW and picket ship lines."

Since the object of the buoy-mounted doppler fence was intended to eliminate, rather than implement, the requirement for picket vessels and AEW aircraft, air defense planners felt that its antisubmarine aspects must be developed. The stability of the envisaged buoy would possibly make it ideal as a sonar listening platform capable of detecting any penetrating ships or submarines. Here were capabilities that needed exploring and research development.

Neither USAF nor ADC had approved use of the doppler fence for overwater early warning by the end of June 1954. In fact, serious study yet remained to be done to determine how the system, if really feasible, would be integrated into the air defense system. Only further analysis would help determine if such an early warning line "would provide a higher reliability at a greatly reduced cost than any other methods now under consideration."

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VII

LINCOLN TRANSITION SYSTEM

On 6 May 1953, it will be recalled, the Air Research and Development Command announced that the Lincoln Laboratory Transition Air Defense System was to be supported while the Willow Run ADIS program was to be phased out.[1] Implementation of the decision involved innumerable conferences between the specialists at Lincoln Laboratory, ARDC, ADC, AMC, USAF representatives, Bell Telephone and Western Electric Company technicians, and other interested air defense components throughout the remainder of that year and during the first half of 1954. The task envisaged was a tremendous one in scope and importance for the future in order "to make the defensive system an integrated entity and capable of being a strong deterrent to war."[2] Integration of the Lincoln Transition System into the Air Defense Command would necessitate considerable deviation from previously planned concepts and procedures.

Given the need of producing a high-speed, semiautomatic data processing and weapon control system throughout the Air Defense Command, the Lincoln Laboratory was urged to make every effort to

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1. See ADCHR #5, pp 11-12.

2. ADC, Transition System Program, 18 Jan 1954, p 3, (Doc 1).

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implement such an objective. The accomplishment of the air defense mission itself made this demand imperative in order to conduct successfully the air battle of the future.[3] The effectiveness of the defense, it was hoped, would be increased with the additional ability to handle raid and weapon capacity, the accuracy of results, and the saving of time in making air defense decisions.[4]

The semiautomatic system would, in essence, take the radar data from radar sites and convert this information into a form that could be transmitted via telephone lines to a computer central in a Direction Center. The computer central would also receive data from such various sources as: the ground observer corps, civilian and military flight operations, weather information agencies, passive detection stations, and cross-telling information from adjoining sub-sectors. Electronic computers would sort and develop this data to show current air situations. Guided by combat operations personnel, the computer would produce orders to be used by air defense weapons and furnish additional information to auxiliary agencies. All this data would then be transmitted automatically to the using agencies, such as fighter-interceptor squadrons, adjacent Direction Centers, CAA and AAA facilities.[5]

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3. Ibid., p 1-2

4. Ltr, USAF to ADC, "Semiautomatic Air Defense System," 13 Apr 1954, with 1 Incl, Operational Concept for a Semi-Automatic Air Defense System, (Doc 2).

5. Ibid.

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The operation of the Lincoln Transition System would directly depend upon reliable and continuous communication between the computer central and the various radar and weapon units assigned to it. Extensive use of landline wire and radio microwave facilities, probably leased from United States and Canadian commercial communications companies, would be required to effect this end. Some alternate routing of information would be necessary in the event these communication links were interrupted.[6]

At a 17 May 1954 conference regarding Direction Center internal communications it was agreed to incorporate direct telephone lines, automatic dial exchange and manual switchboard operations. Additional features, such as selective ringing on long line circuits, dial operated intercom system, multi-appearance and transfer switches, were to be incorporated into the system. A comparable system, commensurate with requirements, would be installed in the sector's combat operations center.[7]

The "heart" of the transition system was the high speed digital computer. Lincoln Laboratory representatives proposed several types of computers and methods of using them. Of these, ADC, on 5 December 1953, accepted use of a duplex computer, the AN/FSQ-7, operating in one location, as being most suitable from an operational and economical

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6. Hq ADC, Air Defense Requirements, 1954-1960, Section I, Annex C, Appendix 4, p 82; Ltr, Lt Col O. T. Halley to V. B. Bagnall, Western Electric Company, 12 May 1954, (Doc 3).

7. ADES Bulletin #3, August 1954, p 8, (Doc 4).

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standpoint.[8] The two computers, operating side by side, one operational and one standby with a common set of input, output and display facilities, would give the Direction Center the capacity of:[9]

1. Processing data on 400 tracks by utilizing its own radars.

2. Displaying information on an additional 400 tracks processed at adjacent direction centers.

3. Providing guidance instructions to 200 weapons (excluding short range missiles) for half of its tracking capacity.

4. Furnishing acquisition and engagement instructions to all short range missile units.

All future ADC personnel requirements, cost estimates, site locations and production programming for a ground electronic system would be based upon the acceptance of the duplex AN/FSQ-7 computer.

The geographical area served by a duplex computer (or Direction Center) would be a subsector, whose area would be limited by the number of heavy and small gap filler radars that could be accepted by the computer.[10] This number, on a sliding scale, was given as:

Heavy Radars	3	4	5	6	7
Small Automatic Radars	22	17	12	7	2

8. ADC, Transition System Program, 18 Jan 1954, p 5-6, (Doc 1).

9. Hq ADC, Briefing, 15 May 1954, p 110; see also ltr, A. G. Hill, M.I.T., to General B. Chidlaw, 9 Sep 1953, (Doc 5), and TWX, ADC to USAF, 5 Dec 1953, (Doc 6).

10. Ltr, ADC to USAF, "Concept of Operation of Semi-Automatic Direction Center," 26 April 1954, (Doc 7).

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ADC also estimated that the inclusion of two AN/FPS-6 Height Finder Radars at each prime radar site would furnish the required number of tracks that the capacity of the Lincoln Transition System demanded.[11]

It was expected that a single Direction Center, using the Lincoln Transition System, would be capable of covering an area four to five times as large as that presently covered by a GCI Station manned by an AC&W squadron. However, the number of both sectors and subsectors would be conditioned by the critical target areas involved, the number of radars and other data sources in the area, and the amount of air traffic that occurred overhead.[12] Sufficient technical or operational data was not yet available, however, to determine the exact limitations of the system.

In view of the improved capabilities of the Direction Center, it was desired that the subsector commander be made responsible for the operational, logistical and administrative control of all air defense units in his area, in order to attain the maximum effectiveness of a semi-centralized system.[13] However, there was a danger that the processing and summarization of data from

11. This could also be achieved by using four FPS-6 Radars with two manually operated Range Height Indicators. TWX, ADC to USAF, 2 Mar 1954, (Doc 8).

12. USAF, Concept for Operation of Semiautomatic Air Defense System, 13 Apr 1954, (Doc 2).

13. ADC, Transition System Program, 18 Jan 1954, p 9-10, (Doc 1).

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adjacent subsectors by one Direction Center, in addition to its own workload, might reduce its combat capacity "to an unacceptable figure." While the highly essential needs of the Air Defense Control Center must be met in order to permit economical and effective use of all air defense weapons, air defense planners felt that it would be erroneous to reduce the flexibility and capacity of the Direction Centers.[14]

The overall operational supervision of from three to six Direction Centers would be exercised by the Air Defense Control Center of the Air Division. It, too, would have a semiautomatic summary display AN/FSQ-7 combining information from the Direction Centers, presenting this data of the air situation to the air division commander for his battle supervision, threat and weapons evaluation.[15] Each Air Defense Force Combat Operations Center and the United States and Canadian Air Defense Combat Operations Centers would also have similar equipment to consolidate the air situation at any given moment.[16]

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14. Ltr, ADC to USAF, "Air Defense Transition System (Air Defense Combat Center)," 18 Jun 1954, (Doc 9).

15. Hq ADC, Briefing, 15 May 1954, p 110. By the close of the period ADC questioned the advisibility of using only one simplex computer in an Air Defense Control Center (Air Division Combat Center as it was called) since it was not deemed feasible to superimpose this ADCC on one of the direction centers. Possible changes in the ADCC computer were under serious consideration. Ltr, ADC to USAF, 18 Jun 1954, (Doc 9).

16. Hq ADC, Briefing, 15 May 1954, p 110.

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The International Business Machine Corporation and Lincoln Laboratory estimated that delivery of the first AN/FSQ-7 computers would start in November 1955 and be completed by 1 May 1956.[17] It had been originally expected that the cost of a single computer would be 6.3 million dollars, but ADC's acceptance of a duplex computer raised this estimate to 11.8 millions; new figures were set at 7.11 million for two Direction Centers and their power plants. Upon request, ADC submitted its revised estimates of funds needed for the seven duplex computers and support facilities[18] it hoped to have in operation by 1956.[19]

	FY-1954	FY-1955
Original Figure	48.925 million	90.955 million
Revised Figure	49.38 "	133.007 "

From the beginning, ADC planners sought to achieve a "package approach" toward funding the Lincoln Transition System. They insisted that USAF agree to complete budgetary support of the program in order to be realistic. They claimed that radar data, for example, could not be processed by the Direction Center unless the new communications equipment was installed and operating. Furthermore, it would be ridiculous for the electronic computer to be ready for installa-

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17. ADC, Transition System Program, p 24, (Doc 1).

18. These included such items as slowed down video and communication links.

19. ADES Bulletin #2, January 1954, p 7, (Doc 10).

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tion without the proper building to handle it.[20]

Meanwhile, testing and training programs were under consideration. The Cape Cod test program of the Transition System by Lincoln Laboratory was supported by air defense planners who desired that emphasis be placed on realism in testing air surveillance and weapons control. The processing of live aircraft through the system would test its capacity to function properly within the air defense system.[21]

It was felt that a firm training program must be established well in advance of the introduction of the Transition System. This would probably assure the required number of adequately trained personnel for manning and servicing the equipment as it became available for operational use.

The Air Defense Engineering Service and Western Electric Company, the latter having been selected to assist in the installation and integration of the Lincoln Transition System, were requested to schedule tentative programs for training personnel. It was felt that on the job training would be the most advantageous

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20. Ltr, ADC to USAF, "ADC Transition System Program," 27 Jan 1954, (Doc 11). For additional information on funding see: Ltr, ARDC to USAF, "Funding for Air Defense Centralized System--Transition Phase," 6 May 1953, (Doc 12); Ltr, ADC to USAF, "Lincoln Laboratory Technical Memorandum No. 20," 17 Sep 1953, (Doc 13); Ltr, USAF to ADC, "Transition Air Defense System," 27 Nov 1953, (Doc 14); Ltr, ADC to USAF, "Proposed ADES Work Statement," 29 Apr 1954, (Doc 15).

21. Hq ADC, Diary, 4 May 1954.

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method of instructing operational personnel.[22] Since stability of operating personnel was deemed necessary to proper functioning of the Transition System, serious consideration was being given to a recommendation to utilize the "civilianization" concept in both operational and maintenance functions.[23]

With phasing in of the Air Defense Transition System to begin in 1957, it became necessary to re-evaluate the approved 1955 Air Defense Command goal of 16 air division sectors. While air defense planners still required 16 air divisions to operate manually the programmed air defense system until the Transition System went into operation,[24] it was hoped that by 1960 this number would have been gradually reduced to nine.[25]

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22. ADC to Distribution, "Recommendations of the Air Defense Advisory Committee," 7 Jun 1954, with 1 Incl, (Doc 16).

23. Ibid.

24. ADC Staff Notes, 18 Mar 1954, p 5. The increased radar coverage that was being put in operation, its resultant surveillance information, increased number of air defense weapons awaiting assignment, inability of existing 11 air divisions to control accurately the large number of radars and weapons, and expected magnitude of air battles, all made the creation of the five additional Air Divisions vital if the United States did not intend to impair the effectiveness of air defense in the interim period before the Lincoln Transition System went into effect. TWX, ADC to USAF, 11 Jun 1954, (Doc 17). USAF proposed that the five additional divisions might utilize Tactical Control Center equipment in lieu of fixed control center equipment. TWX, USAF to ADC, 17 Mar 1954, (in HRF 107.1). There could be little doubt that augmentation of the 1955 Interim Program would involve many administrative problems.

25. Hq ADC, Air Defense Requirements, 1954-1960, p 43.

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Study of the geographical boundary criteria for the Transition System eventually resulted in the proposal that the United States be divided into 42 subsectors (including the South Central portion of Canada), with two of these subsectors in the Colorado-Utah-Wyoming triangle (numbers 41 and 42) being manually operated.[26] The proposed subsectors -- shown on the map in the order of installation -- were to be included in nine sectors, with the sector commander responsible for the target complex, probable approach routes, and effective use of weapons to insure possible successful conduct in any air battle within his area.[27]

Having determined the priorities for installing the AN/FSQ-7's in the designated 40 subsectors,[28] air defense planners were hard at work with the task of site selection. Since the first seven priorities were within areas that would comprise the 26th, the 85th (still to be activated) and 32nd Air Divisions, Eastern Air Defense Force Head-

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26. See attached map of Transition System Boundaries, April 1954. Subsector numbers preceded by "C" indicate proposed Canadian controlled subsectors. This assumes that Canada will have a comparable system and plan its installation generally in this fashion. Hq ADC, IRS, Lt Col O.T. Halley to ADHAA, "Revised Boundaries for Transition System," 17 Apr 1954, (Doc 18); Ltr, ADC to USAF, "Selection of Transition System Direction Center Locations," 30 Apr 1954, (Doc 19); Ltr, ADC to EADF, "Readjustment of Transition System Boundaries," 13 Mar 1954, (Doc 20).

27. ADC Staff Notes, 18 Mar 1954, p 5.

28. The 41st and 42nd subsectors were to be manually operated.

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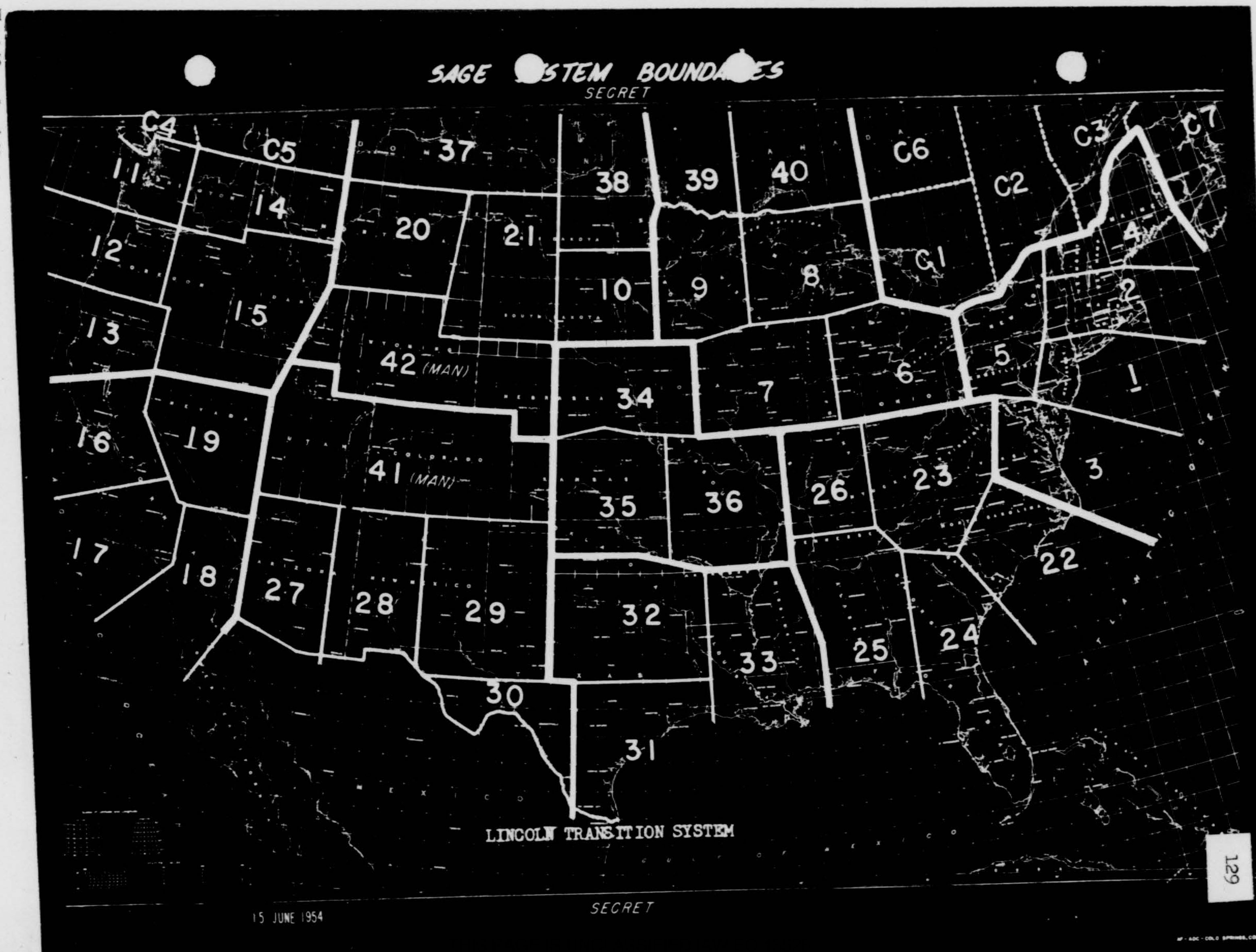

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quarters was required to conduct site surveys in conjunction with representatives from ADES.[29] Headquarters Western Air Defense Force was assigned the task of site selection for subsectors 11 through 19 inclusive.[30]

The criteria for site selection was to emphasize both operational and economic considerations. Because the Lincoln Transition System would depend upon a flexible and reliable communications network, this became the most important factor in site selection.[31] To this factor were added other criteria: distance from major target area, availability of desired real estate, possible use of existing ADC facilities, airfield availability span of control and integration of combat centers and direction centers into the plans of bases selected.[32]

As the period drew to a close, air defense planners felt that the Lincoln Transition System possessed "sufficient flexibility and capacity," and that current planning would prevent serious problems in its introduction into the Air Defense Command.[33] However, an

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29. TWX, ADC to EADF, 3 Feb 1954, (Doc 21).

30. TWX, ADC to WADF, 15 Jun 1954, (Doc 22).

31. ADC, Transition System Program, p 21, (Doc 1).

32. Ibid.; ADES Bulletin #3, August 1954, p 6-7, (Doc 4). See also, Ltr, ADC to USAF, "Concept of Operation of Semi-Automatic Direction Center," 26 Apr 1954, (Doc 2).

33. Ltr, Air Defense Advisory Committee to ADC, 28 May 1954, (Doc 16).

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awareness of the Transition System's limitations was already apparent. For example, provision would have to be made for processing long distance early warning intelligence; it was conceivable that this might possibly be done by the manual introduction of all such information at the responsible levels of the Air Defense Command.[34] In addition, the Lincoln Transition System would be subject to the same types of electronic countermeasures as the present system, namely, through jamming of its data sources and communications.[35]

While many problems and possible slippages in production were yet to be encountered before the Lincoln Transition System would be installed and operational, air defense planners were optimistic that they were on the right track. The advent of nuclear weapons, coupled with improved and additional means of delivery by the enemy, had necessitated new air defense concepts for a totally different electronic ground environment to help counter these advances. The Lincoln Transition System promised to assist in achieving this desired end.

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34. Ibid.

35. USAF, Concept of Operation for Semiautomatic Air Defense System, 13 Apr 1954, (Doc 2).

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VIII

WEAPONS SYSTEM RESEARCH AND DEVELOPMENT

As is explained in detail in the 1960 Air Defense Requirements study, ADC's future weapon system requirement was for a "composite" force consisting of manned interceptors, unmanned interceptors (missiles), and short range weapons.[1] ADC believed that "Analysis of any one weapon system will reveal weaknesses which could be exploited [but that] it is extremely difficult to find any one specific weakness which is common to a composite weapon system."

Research and development on certain of the interceptors and missiles required for this future system and on more efficient warheads for both these weapons was already underway during the period. Research and development on certain other weapons required had not yet been initiated. In short, then, ADC had set down the principle and the requirement for weapons assignment and deployment for the future defenses by mid-1954: whether or not the requirement would be met in time lay with Headquarters USAF and the research and development agencies.

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1. Hq ADC, Air Defense Requirements, 1954-1960, pp 51-61. Another term used in describing the future weapons requirement was the "family of weapons concept." See ADCHR #5, Chapter 7, "Weapons Programming," for information on the early development on this concept.

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Manned Interceptors

ADC's requirement for manned interceptors was twenty-nine long range interceptor squadrons on seventeen bases, and eight-four medium range interceptor squadrons on forty bases.[2] Additionally, very long range interceptors were needed, but a formal requirement for this type had not yet been submitted pending further study of the problem.[3]

Very Long Range Interceptors. With the proposed extension of the CW doppler early warning lines across northern Canada, and its overwater extensions, back up long-endurance interceptors were considered to be the primary requirement. Capable of a 4000 NM range, such aircraft would be used for patrolling EW lines, identifying aircraft, detecting enemy spoofing raids, carrying out other reconnaissance activity, and engaging the enemy or trailing him for surveillance purposes.[4]

Long Range Interceptors. This type of interceptor would be one which had the range required to strike the enemy the moment he reached the Air Defense Combat Zone.[5] Deployed in such a fashion that they could be used at the outer perimeter of this zone, such

2. Hq ADC, Air Defense Requirements, 1954-1960, p 60.

3. Ibid., p 51.

4. Ibid.

5. The Air Defense Combat Zone was to be extended northward from the continental United States to the mid-Canada early warning segment. See Annex X. See also, ltr, ADC to USAF, "Planned Use of Long Range Interceptor," 20 Oct 1953, (Doc 1).

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interceptors, it was expected, would be twin-engined and dual presentation, have a combat radius of about 1000 NM, a combat ceiling of 60,000 feet, supersonic speed at 50,000 feet, and be capable of carrying both atomic rockets and other secondary high explosive armament.[6] It was desired that these long range interceptors be capable of combat with repeated passes at all altitudes and in any weather from ground surface to combat ceiling. Equipped with a search radar to enable detection of a target at ranges of 100 NM,[7] they had to have a fire control system capable of minute target discrimination, lock-on ranges of 30 NM, at least a 25% speed advantage over any bomber capability, be equally effective at low altitudes, and be invulnerable to enemy ECM.[8] It was estimated that approximately 20% of the ADC interceptor force in the future would be composed of such long range interceptors.[9] This interceptor, some felt, would give ADC:[10]

> the capability of making interceptions on long-range, high speed, high altitude aggressor aircraft at the maximum distance from directing ground radar stations and prior to penetration of the sector of responsibility, and the further capability of trailing enemy formations as long as may be required prior to penetration of the double perimeter and/or target complexes.

Medium Range Interceptors. As an enemy penetrated the Combat Zone he would be met by medium range manned interceptors. ADC felt

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6. Hq ADC, Briefing, 15 May 1954, p 118, 126; 2nd Ind, ADC to CADF, 20 Mar 1954, to Ltr, 29th Air Div to CADF, "Qualitative Operational Requirements," 12 Feb 1954, (Doc 2).

7. Hq ADC, Staff Notes, 3 May 1954, p 4-5.

8. Hq ADC, Air Defense Requirements, 1954-1960, p 52.

9. Ltr, ADC to Dunlap & Associates, Inc., 19 Jun 1954, (Doc 3).

10. Ltr, 29th Air Div to CADF, 12 Feb 1954, (Doc 2).

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that a "greatly increased" threat by Russian aircraft in the period from 1959 on, made it mandatory to reconsider the requirements demanded in medium range interceptors, as present programmed requirements would no longer suffice.[11]

By the 1960-1963 period, ADC hoped to have available for tactical operation medium range interceptors that included these military characteristics: single-place, completely integrated electronic system as typified by the MX 1179,[12] a fire control system with a lock-on range of 50 NM, a speed of mach 3.0, a climb rate of mach 2.0, combat altitude of 70,000 feet, minimum armament of 3 atomic missiles, and a combat radius of 400 NM at an overall speed of mach 2.5.[13]

Meanwhile, ADC felt that a definite need existed for a companion medium range interceptor to the F-102, the latter being expected to be the major manned air defense interceptor in the 1957-1960 time period.[14] While study and review of the F-89X, F-100B, and

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11. TWX, ADC to USAF, 15 Jan 1954, (Doc 4).

12. The MX 1179 system will presumably have the ability of automatically flying the interceptor from its base to the intercept point, firing the armament, breaking off the attack, and returning to base, with pilot monitoring only. Hq ADC, Briefing, 15 May 1954, p 66; Incl, WADF Staff Memorandum, 11 Feb 1954, to Ltr, Maj Gen W. E. Todd to Maj Gen F. Smith, 17 Feb 1954, "Report of Visit to Aircraft Companies," (Doc 5).

13. TWX, ADC to USAF, 15 Jan 1954, (Doc 4).

14. The F-102 has been described as: a 60 degree delta configuration, with turbo-jet engine, a combat weight of 21,000 pounds, a maximum rate of 40,000 feet climb per minute, a combat ceiling of 56,000 feet, maximum speed of 1100 knots, a combat radius of about 500 NM, and armament that consists of rockets and guided missiles. Hq ADC, Briefing, 15 May 1954, p 116.

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F-104 continued,[15] and the F-103 was informally scheduled to fly in 1957 as a research vehicle,[16] ARDC, USAF and ADC all gave serious consideration to the F-101 interceptor as the possible companion to the F-102. Not only did the F-101 promise greater endurance, but its potential performance, cost and availability were appealing. Time was considered of the essence in the procurement of this weapon for its operational use in the 1957-1960 time period.[17] What ADC desired was "insurance" that if the F-102 should be temporarily grounded for structural or other reasons, that serious consequences to the Air Defense System would be mitigated by use of a companion medium range interceptor.[18]

Although the F-101 was not scheduled to fly until September 1954, ADC apparently felt it could not afford the luxury to "try before we buy."[19] As the period closed, it was recommended that

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15. 1st Incl, ARDC to USAF, 22 Jun 1954, to Ltr, Brig Gen F. B. Wood to Maj Gen F. Smith, "USAF Interceptor Program," 22 Jun 54, (Doc 6).

16. Republic Aviation's F-103 has been described as having these characteristics: delta configuration, a 55 degree sweep with tail surfaces, combination turbo jet and ram jet engine, combat weight of 32,250 pounds, a maximum rate of climb of 60,000 feet per minute, a ceiling of well over 60,000 feet, maximum speed of 1724 knots, and a combat radius of approximately 400 NM. Hq ADC, Briefing, 15 May 1954, p 120. Hq ADC, Staff Notes, 6 Mar 1954, p 2, and 3 May 1954, p 6.

17. TWX, ADC to USAF, 15 Jan 1954, (Doc 4); Ltr, ADC to USAF, "Requirement for Medium Range Interceptor," 10 Jul 1954, (Doc 7).

18. Ibid., (Doc 7).

19. 1st Incl, ARDC to USAF, 22 Jun 1954, (Doc 6).

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USAF assign Priority 1-A to the accelerated development and procurement of the F-101, which would become approximately 50% of the total air defense medium range interceptor force in the 1957-1960 period. This interceptor would be a single-place all weather aircraft, equipped with a J-57 jet engine, an MG-3 fire control system firing rockets only, have a combat ceiling of 53,600 feet, maximum speed of 1.51 mach at 35,000 feet and 1.17 mach at the 50,000 feet altitude, and a combat radius of about 400 NM.[20] However, ADC desired that future developments of the F-101 incorporate: "J-75 or J-67 engines; two-place cockpit; fire control system and weapons load equivalent to that of the F-102B; and complete all-weather operational capability."[21]

MISSILES

Behind the very long range, long range and medium range fighter-interceptors, the enemy would be met by long range missiles that would be capable of attacking air targets from a range of 30-500 nautical miles. Air Defense planners hoped that such long range missiles, which they often referred to as pilotless aircraft, would be capable of minute target discrimination, be equally effective at any altitude from surface to 80,000 feet, and highly

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20. Ibid.

21. ADC had indicated its willingness to waive the requirements for airframe anti-icing in order to obtain the F-101 at the earliest possible date.

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invulnerable to ECM.[22] Designed as a tactical weapon only, they were being devised to provide massive defensive destructive power against any mass raid.[23]

The F-99 (BOMARC)[24] was programmed for tactical operation in 1957.[25] A conference on 17 February 1954 determined that the operational suitability testing would be done at an ADC guided missiles training base in 1956.[26] ADC had tentatively, at least, decided to deploy BOMARC missiles in flights of 25 each to defend specific geographical target complexes in the Air Defense Combat Zone.[27]

ADC believed that an "insurance" pilotless interceptor[28] was also required as a companion to the BOMARC. Designed for use at

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22. Hq ADC, Air Defense Requirements, 1954-1960, p 55.

23. Hq ADC, Briefing, 15 May 1954, p 128.

24. This weapon has been described as: 41 feet long, 3 feet in diameter, 12,000 pounds at launching, uses liquid rocket and ram jet engines, a performance capability up to a ceiling of 80,000 feet at a speed of 1500 knots, and a 125 NM range in the early models (250 NM later). Ibid., p 122.

25. 1st Ind, USAF to ADC, 6 October 1953, to Ltr, ADC to USAF, "Availability of F-99 (Bomarc) in the Air Defense System," 14 Sep 1953, (Doc 8).

26. Hq ADC, Staff Notes, 6 Mar 1954, p 2.

27. Hq ADC, Briefing, 15 May 1954, p 128.

28. PILOTLESS INTERCEPTOR: "An aircraft which is equipped to function without a human pilot aboard." Air Force Letter 136-3, 1952; The New Military and Naval Dictionary, 1951; Encyclopedia Britannica, 1952 edition. Compare this with GUIDED MISSILE: "A weapon which travels through space and carries within itself a means for controlling its path of flight. This includes bombs, rockets, and in the broad sense of the definition, even conventional aircraft. However, a guided missile must be one which can be launched in one direction, then changed in flight to hit another target." Baughman's Aviation Dictionary and Reference Guide, 3rd Ed., 1951.

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medium ranges up to 500 nautical miles, it was desired that such an unmanned interceptor be further capable of augmenting short range ground-to-air guided missiles, providing mutual support to other pilotless interceptor squadrons as far as 100 miles apart, and be able to intercept enemy aircraft up to the bomb release line.[29] It was estimated that the L-253, surface-to-air pilotless interceptor being developed by Lockheed Aircraft Company, might be capable of providing the air defense requirements in this area. An outgrowth of the X-7 weapon, the L-253 was presumably being designed for speed in excess of mach 2.0, a capability up to 60,000 feet, high rate of fire from each launch site, command mid-course guidance, and a CW pulse doppler seeker system for terminal guidance.[30]

However, as the period drew to a close, ARDC put a strong damper on the L-253 proposal due to cuts in the guided missile budget, and the fact that ADC had not been able to prove the operational effectiveness of the L-253 missile over weapon systems currently being developed. ARDC implied that the Air Defense Command had been lured by the "most attractive feature" of the L-253, namely, an early operational date. Therefore, ARDC proposed adoption of the Lockheed ramjet test vehicle, known as the L-275,

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29. Ltr, ADC to USAF, "Requirements for a Development and Testing Program for the Lockheed Pilotless Aircraft, L-253," 19 Feb 1954, (Doc 9).

30. Ibid.; Hq ADC, Staff Notes, 3 May 1954, p 6.

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as an interim project of value in the flight testing of guided missiles development program.[31] Both USAF and ADC approved this proposal.[32]

Some consideration had also been given to the possible use of the MATADOR,[33] but air defense research seemed to have discounted its possible use:[34]

> In view of known enemy capabilities in CM and their present jet bomber status, MATADOR appears too limited a weapon for air defense use. It is too slow, too easily jammed systems-wise, 18 months to two years availability puts it out of proper time period, and it postulates effectiveness only against targets which do not maneuver either in azimuth or elevation.

Meanwhile, confusion regarding delegation of responsibility over short range surface-to-air guided missiles continued to reign during the period. While there was an apparent future requirement for short range surface-to-air missiles, deployed to protect specific areas, capable of proceeding to intercepts at speed of at least mach 2.0, functioning at altitudes from surface to 80,000 feet, and operating at distances of 0-50 NM with minute target discrimination,[35]

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31. Ltr, ARDC to ADC, "Lockheed Missile Proposal," 8 Jun 1954, (Doc 10).

32. 1st Ind, USAF to ADC, 1 Apr 1954, and 2nd Ind, ADC to USAF, 10 Jul 1954, to Ibid., (Doc 10). See also, Hq USAF, Summary Control Statement, 26 Feb 1954, p 20.

33. Glenn L. Martin's B-61 MATADOR was USAF's first pilotless bomber.

34. 1st Ind, ADC to WADC, 22 May 1954, to Ltr, WADC to ADC, "Investigation of an Air Defense MATADOR," 21 Apr 1954, (Doc 11).

35. Hq ADC, Air Defense Requirements, 1954-1960, p 57.

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the problem of assigning responsibility to either Headquarters, Army Antiaircraft Command or Headquarters, ADC awaited solution by the Joint Chiefs of Staff.[36] The TALOS being developed for ADC, and the improved NIKE[37] used by antiaircraft units, were basically the same type of short range guided missile, designed for deployment and employment "in basically the same manner."[38]

ADC was not able to program any deployment for TALOS until JCS announced a "firm decision." As late as fall, 1954, JCS had not completely delimited the areas of responsibility. While the Antiaircraft Command was encouraged to develop surface-to-air missiles with ranges up to approximately 50 NM, the Air Force was permitted to develop such surface-to-air missiles as it felt necessary to the fulfillment of its assigned mission, even if these were designed to augment or replace such antiaircraft weapons. Meanwhile, ADC might proceed to develop TALOS as a vehicle for use in training BOMARC units.[39]

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36. Ltr, ADC to USAF, "Technical Information on Talos," 28 May 1954, (Doc 12).

37. It was estimated that NIKE was effective from medium altitudes through 60,000 feet and out to 25 miles in range. By the end of 1954, 14 NIKE battalions would be operational and on site in nine critical areas. Hq ADC, Briefing, 15 May 1954, p 72.

38. TWX, ADC to USAF, 21 December 1953, (Doc 13).

39. TWX, USAF to ADC, 18 Jun 1954, (Doc 14).

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The training of pilotless interceptor or guided missile units promised to be a difficult one. The problem that had to be met was a serious one and was best summed up in a preliminary plan offered by ADC:[40]

> Manned interceptors can be maintained, flown and returned to the base for as long as the need may exist. The pilotless interceptor...can be maintained indefinitely but there is no requirement for it to fly except for tactical employment. Because it is a weapon of high destruction capability and is deployed in areas of high tactical importance with their accompanying high population centers, public sentiment would not allow the pilotless interceptor to be launched at will without there being a target to destroy. Experience has taught that organizational efficiency is obtained by the functional personnel observing the active results of their works; this would dictate that the pilotless interceptor personnel be provided with weapons to launch and to fly...it is imperative that a Base and a safe Firing Range be provided for the Air Defense Command Pilotless Interceptor Unit Training Program.

Although guided missiles were relatively new and untried weapons as yet in the history of air defense, the future seemed to indicate increased accent upon their development, effectiveness and deployment. Air defense planners were conscious of two major advantages that missiles seemed to enjoy over the more conventional air defense weapons: greater effectiveness for a given cost against a single mass enemy attack, and capability against the high performance threats offered by supersonic offensive missiles.[41]

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40. 1st Incl to 1st Ind, ADC to USAF, 14 Jul 1954, to Ltr, USAF to ADC, "Siting of the Air Defense Guided Missile Operational Suitability Test," 4 Jun 1954, (Doc 15); Ltr, ADC to USAF, 25 May 1954, "Requirement for Pilotless Interceptor Unit Training," (Doc 16

41. Hq ADC, Briefing, 15 May 1954, p 114.

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Interceptor Armament

In an effort to provide fighter-interceptors with an effectiveness at least comparable to missiles, ADC continued development of future air-to-air rockets designed to attain an increased kill potential. It was estimated that in 1954 ADC fighter-interceptors, equipped with 2.75" folding fin air rockets, could provide a .15 to .45 kill probability against one TU-4 aircraft. By 1956, it was hoped that ADC interceptors, armed with GAR-1 (Falcon) guided air-to-air rockets,[42] would produce a kill probability of .5 against a Russian TU-4 bomber; by 1958, the F-102 interceptor, employing both folding fin air rockets and Falcons, would probably have a .60 to .65 kill probability against enemy jet bombers of the B-47 type.[43] There was also an awareness that future weapons systems would have to give full consideration to the effects of more powerful rockets and guns on interceptor engine performance.[44]

While Hughes Aircraft Company redesigned the GAR-1A to improve its capabilities between the 50,000-60,000 feet level,[45] ADC approved the requirement to provide future F-89H, F-102, F-101 all

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42. See TWX, ADC to USAF, 27 Jan 1954, (Doc 17), for list of proposed bases to be occupied by Falcon carrying aircraft.

43. Hq ADC, Briefing, 15 May 1954, p 68.

44. Hq USAF, Summary Control Statement, 23 Dec 1953, p 23.

45. Hq ADC, Diary, 9 Mar 1954.

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weather fighter-interceptor squadrons with the ratio of one GAR-1B rocket to two GAR-1As.[46] The GAR-1B rocket would employ an infrared seeker head instead of the standard electronic seeker head of its predecessor. The infrared seeker was estimated to be effective at all altitudes where adverse weather was not present, not susceptible to ECM, not affected by ground clutter, and less likely to become confused with multiple targets. However, it was undesirable as primary armament for air defense being strictly a fair weather, day or night, weapons system and suffered additional disadvantages of being ineffective against jet type aircraft in a head-on attack.[47]

Experimentation continued also on the "Bird Dog Project" to develop a large, high explosive rocket for use as auxiliary armament on augmentation air defense aircraft.[48] Further research occurred with the 1.5" NAKA and a 2.0" rocket, both designed to reduce the size of the 2.75" fin air rocket in the hope that a "higher kill per weight can be achieved."[49]

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46. TWX, ADC to USAF, 2 Aug 1954, (Doc 18).

47. Ibid. Consideration was already being given to the programming and equipment required to support GAR-1 Equipped squadrons. Ltr, USAF to ADC, "Programming of Personnel and Equipment Required to Support GAR-1 Equipped Squadrons," 16 Mar 1954, and 1st Ind, ADC to USAF, 1 Apr 1954, (Doc 19). USAF sanction was withdrawn from development of the AEROWOLF, infrared guided air-to-air rocket, though the Aerojet Company continued the project. Hq ADC, Staff Notes, 3 May 1954, p 2.

48. Hq ADC, Staff Notes, 3 May 1954, p 2.

49. Hq ADC, Briefing, 15 May 1954, p 68.

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Atomic Weapons

The cost of the composite defense system discussed above would obviously be tremendous. Those responsible for the air defense of the United States had come to the conclusion that the cost of an atomic air defense system would be considerably less in total cost, while providing the same high rate of attrition upon an attacker.[50] Results of weapon studies seemed to have been convincing that the cost per kill against an enemy attack was greatly in favor of atomic war-heads in air defense weapons, which were considered both practical and possible.[51] ADC seemed so convinced on these points that it was willing to state its future objective: "The ultimate goal of the Air Defense Command is conversion to an optimum Atomic Defense System and should be attained at the earliest possible date."[52] The probability seemed to exist that "nuclear warheads may be the only way to assure successful air defense."[53]

The JCS indicated that there would be no shortage in the production of fissionable material by 1957, and that an abundance of such

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50. ADC interest in and request for development of atomic weapons for use in air defense from 1951-1953 is best related in: TOP SECRET, Nuclear Weapons in the Air Defense System (Project HEAVENBOUND), Special Historical Study, Air Defense Command, September 1953.

51. Ltr, ADC to USAF, "Atomic Weapons in Air Defense," 8 Jan 1954, (Doc 20). See also, SECRET AFSWC, "Feasibility of Nuclear Weapons for Air Defense," Technical Report 53-9, 8 Jun 1953, (in HEAVENBOUND study).

52. Hq ADC, Air Defense Requirements, 1954-1960, p 100.

53. Hq ADC, Briefing, 15 May 1954, p 138. Also, (Doc 20).

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materials would exist by 1959-1961. ADC immediately commenced "serious planning" for broad usage of atomic weapons starting in 1957-1958, with the long-range aim of achieving atomic capability with all types of weapons employed in air defense.[54]

As conceived by ADC, atomic weapons would be used to accomplish three main purposes in air defense: to attain a high kill against attacking formations and destroy their armament before it could exact its toll, to achieve a similar effect upon any enemy "carrier based" aircraft, and to force the dispersal of the enemy attack. This latter purpose would presumably give ADC more opportunity to determine and assess the raid's objectives before assigning weapons to specific targets.[55] An apparent by-product to be considered was the probable psychological demoralization of enemy air crews subject to atomic defense attack.[56]

It appeared to Air Force atomic energy experts that atomic warheads for air defense use might be limited to 12-18 inches in diameter, and be of lesser Kiloton yields than those required for strategic and tactical employment.[57] On 2 April 1954 the JCS

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54. Ltr, ADC to USAF, 8 Jan 1954, (Doc 20).

55. Hq ADC, Briefing, 15 May 1954, p 138.

56. Hq ADC, Air Defense Requirements, 1954-1960, p 100.

57. Hq ADC, Staff Notes, 5 Apr 1954, p 5-6. It was estimated that short range missiles should have a yield of 1-5 kt, medium range pilotless interceptors a yield of 5-15 kt, and interceptor armament a yield in the area of .05-5 Kt. Ltr, ADC to USAF, 8 Jan 1954, (Doc 20)

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approved development of an unguided, high velocity air-to-air rocket employing an atomic warhead, to be delivered by Air Force or Navy fighter-interceptors. The JCS had done this on the recommendation that such a rocket was the "most feasible approach to atomic energy in air defense."[58] It was estimated that the lethal radius of the rocket, or other air defense weapons that might employ atomic warheads in the future, would permit large miss distances since enemy bombers could not use evasive tactics to escape destruction.[59] Such a rocket would probably not be fully developed and tested until July 1956.

As the period drew to a close, air defense projects were being initiated to study and develop: a nuclear warhead for short-range surface-to-air guided missiles and medium range pilotless interceptors, possible air-to-air bombing with nuclear weapons,[60] and a cockpit hood to protect the fighter-interceptor pilot from light and thermal effects involved in atomic weapons.[61] In addition, ADC required that atomic armament be designed for employment

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58. Hq ADC, Staff Notes, 5 Apr 1954, p 5-6; Ltr, ADC to USAF, "Air-to-Air Rocket," 22 Apr 1954, (Doc 21).

59. Hq ADC, Air Defense Requirements, 1954-1960, p 100.

60. Hq ADC, DCS/O Project Reports, 1 Aug 1954, p 23-24.

61. 1st Ind, ADC to ARDC, 18 Jan 1954, to Ltr, ARDC to ADC, "Thermal Radiation Protective Device for Aircraft," 29 Dec 1953, (Doc 22).

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at low altitudes without serious effects to the ground environment, that means be devised to identify nuclear weapon carriers, that research be given to the possibility of detonating nuclear weapons carried in enemy aircraft, that research continue on the development of nuclear powered fighter-interceptors, and that air defense nuclear armament be designed to insure "insofar as possible, the complete destruction of an enemy on a one-shot basis."[62]

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62. Hq ADC, Air Defense Requirements, 1954-1960, p 99.

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IX

ELECTRONIC WARFARE

Preparations for electronic warfare -- defined by ADC as "that type of warfare aimed at achieving offensive or defensive military advantage from both friendly and enemy use of communications-electronics techniques"[1] -- remained a major activity within ADC during the first half of 1954. Key projects underway to improve ADC's electronic warfare capability were: continued concentrated training in electronic counter-measures;[2] the formulation of methods of maintaining controller-aircrew contact in the event normal air-ground communications were effectively jammed by enemy action; the development of passive detection equipment to be used both to extend the detection capability of the radars and for detection and tracking in the event the radars were successfully jammed; and the development of ground-based equipment designed to jam the enemy's navigational and bombing electronic gear.

Air-Ground Communications Jamming

Anti-jamming techniques for minimizing the vulnerability of the UHF ground-to-air communications system -- sometimes considered

1. See ADC Regulation 101-2, "Electronic Warfare Policy," 11 May 1954, (Doc 1).

2. Details on this aspect of ADC's electronic warfare program may be found in the lower echelon histories for the period.

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to be the "weakest link, ECM-wise" in the air defense structure[3] -- continued to be the subject of much study during the period.

Late in 1953, ADC had recommended the installation of high-powered amplifiers (1 KW, 12 pre-tuned channels) and directional antennas at each AC&W installation.[4] The amplifiers were to be designed to implement the multiple transmission system. This system would enable the ground controller to transmit on 12 channels simultaneously, in the blind, with interceptor pilots able to switch from one channel to another in an attempt to locate one on which he might receive his instructions.[5] With USAF approval of these desired requirements, production models were commenced during the period.[6]

As early as 13 October 1953, the Air Defense Command approved of a plan to utilize high-powered commercial broadcast stations for close control of fighter-interceptor aircraft in case the UHF ground-to-air

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3. (History of WADF, 1952B, p 124, document 42).

4. Hq ADC, DCS/O Project Reports, Dec 1953, p 44.

5. 27th Air Div. History, 1953B, p 63. ADC felt that one means of strengthening the ground/air interceptor control frequencies against enemy jamming was to change frequently tactical call words and frequencies in the future. Each change would insure security for a relatively short period of time while increasing the enemy's problem of analyzing our call words. Hq ADC, Staff Notes, 5 Apr 1954, p 1.

6. 168 directional antennas, AS/450, were delivered to the various depots. 200 of the 1 KW UHF amplifiers, the OA-105, were on contract, though production would not start until August 1954 if the test results proved satisfactory. Hq ADC, DCS/O Project Reports, 1 Feb 1954, p 39.

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control communications were jammed by the enemy.[7] The plan, named "BROFICON", would use commercial broadcast transmitters, modulated by ADC controllers over engineered circuits, to send messages to fighter-interceptor aircraft, which would pick up the transmission on their AN/ARN-6 radio compass receivers. Transmission from the interceptor aircraft was not deemed essential in this back-up system.[8]

It was expected that the general equipment requirements for "BROFICON" would include:[9]

1. A switching system at the data link transmitter site to switch information from UHF transmitters to a telephone line for relay to the commercial broadcast transmitter.

2. Terminal equipment at the broadcast station.

3. Transmission lines.

4. Aircraft receiving equipment would consist of a small, light-weight broadcast receiver or a modified UHF receiver to incorporate a broadcast receiving capability.[10]

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7. Hq ADC, DCS/O Project Reports, Dec 1953, p 14; Ltr, ADC to USAF, "Use of Commercial Broadcast stations for Close Control of Fighter-Interceptor Aircraft," 26 Jan 1954, (Doc 2).

8. See (Doc 2).

9. Hq ADC, Air Defense Requirements, 1954-1960, p 82.

10. Consideration had been given to phasing out the AN/ARN-6 compass receiver for receiving directional finding fixes and using TACAN, a 1000 megacycle short range navigational system. Since the airborne unit of TACAN, the AN/ARN-21, was incapable of receiving commercial station frequencies, modifications were needed in the receivers. Hq ADC, DCS/O Project Reports, 1 Oct 1953.

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While "BROFICON" would enjoy the dual advantages of being economical in its use of existing equipment, and being extremely difficult to jam because of the high power of commercial transmitters (50 KW in most cases), its possible disadvantages were apparent enough.[11] There was a possibility, for instance, that it might interfere with CONELRAD, and that the enemy might use "BROFICON" commercial broadcasting stations for navigational purposes.[12]

Air defense electronic warfare had long demanded the control of electromagnetic radiations within the United States in case of enemy attack. The Department of Defense and the Federal Communications Commission had devised plans (CONELRAD) to control electronic facilities which might emit signals or call signs capable of being picked up by enemy radio compasses and utilized for navigational purposes.[13] Military tactics dictated minimizing the use of electromagnetic radiations to the enemy; however, the civilian requirement insisted that commercial radio broadcasting was the most feasible and essential manner of informing and instructing the general public during an enemy attack. CONELRAD sought to combine both needs.[14]

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11. Ltr, ADC to USAF, 26 Jan 1954, (Doc 2).

12. Ibid.

13. This had been done in accordance with Executive Order 10312, 10 Dec 1951.

14. Hq ADC, Briefing, 15 May 1954, p 86; EADF, 1953B, Chapter V, p 244.

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The "synchronous-sequential system" that CONELRAD proposed was relatively simple. Three or more radio stations in a small area would use the same frequency to broadcast precisely the same message in a varied sequence. Every fifteen to forty-five seconds the source of emissions would change in a given area, thus rendering useless the enemy aircraft radio finding equipment.[15]

ADC proposed that only those commercial broadcast stations that were not tied in with the CONELRAD plan, or those stations that preferably would not require additional "back-up equipment," be selected for fighter-interceptor control purposes.[16] It was estimated that sufficient commercial stations existed to implement both CONELRAD and BROFICON. A proposed list of AC&W sites and nearby commercial broadcasting stations to serve them, was forwarded to USAF for approval. Proximity to vital target areas and high transmitting power were the criteria used in their selection.[17]

In order to minimize navigational aids to the enemy, ADC further proposed that BROFICON be used only in the following manner:[18]

1. It would be employed after normal UHF communications had been rendered useless by enemy jamming.

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15. Ibid.

16. 1st Ind, ADC to WADF, 20 October 1953, to Ltr, WADF to ADC, "Request for Change in BPC 55-1," 9 Oct 1953, (in HRF 461).

17. Ltr, ADC to USAF, 26 Jan 1954, (Doc 2).

18. Ibid.

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2. The commercial stations tied in with the plan would be on the air only during brief periods required for the actual transmission of instructions to fighter-interceptors.

3. It would be used after the enemy had penetrated outer air defenses and the air battle was in progress.

Passive Detection

ADC could not overlook the possibility that the enemy might devise a super-jammer or radar camouflage that would render current electronic detection through radar worthless.[19] Should he succeed in doing this, Passive Detection equipment would become extremely important in electronic warfare. Twenty-nine experimental Passive Detection sets were programmed by the Air Defense Command for location at peripheral radar sites.[20] These sets would have two objectives:

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19. WADF, 1953B, p 106-108, gives a good accounting of passive detection.

20. Hq ADC, Briefing, 15 May 1954, p 52; Ltr, USAF to ADC, "USAF Passive Detection Program," 22 Jun 1954, (Doc 3). ADC researchers had rejected interim lashup type PD equipment because of major shortcomings. 4th Ind, ADC to EADF, 5 Apr 1954, to Ltr, Hq 26th ADiv to EADF, "Increased Capabilities of Passive Detection," 7 Dec 1953, (Doc 4). To "Military Characteristics for Passive Detection Equipment," D/Requirements, USAF, No. ADW-52-C1, 28 Aug 1952, the Air Defense Command had added these requirements in designing acceptable PD equipment: (a) Ability to detect electro-magnetic emissions to line-of-sight ranges with a high degree of probability; (b) Ability to rapidly correlate signals with another station so that rapid, accurate DF fixes could be made; (c) Ability to monitor simultaneously wide portions of the frequency spectrum while retaining the ability to reduce the receiver coverage to discreet portions of the frequency band when intelligence or enemy activity so dictated. Ltr, ADC to USAF, "Requirement for a Passive Detection System," 28 Nov 1953, (Doc 5).

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first, to extend the air defense detection range of attempted enemy penetration, thus serving in an early warning capacity;[21] secondly, to accomplish this by the interception of electromagnetic emanations from the navigational and bombing radar of enemy aircraft. Through signal analysis and D/F fixes, it would be possible to obtain plots on the aircraft's position, to know what type of radar it employed, and to provide useful intelligence regarding its probable mission and capabilities.[22]

Ground Based Jammers

ADC was well aware of the "potential value of a workable ground based jamming system," that was carefully integrated into the over-all air defense picture.[23] The object of such a system was to reduce substantially the enemy's bombing accuracy without interfering with defensive electronic facilities. Otherwise, indiscriminate and uncoordinated jamming could well nullify all the electronic devices in the entire air defense system. In addition, such a system had to be economically feasible when compared with other air defense weapons in order to be acceptable to ADC

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21. This had been the essential use of Passive Detection equipment in the past. Its very location in peripheral areas emphasized this objective. Ltr, ADC to USAF, 28 Nov 1953, (Doc 5).

22. Hq ADC, Briefing, 15 May 1954, p 52: Hq ADC, Air Defense Requirements, 1954-1960, p 46.

23. See ltr, Maj Gen F. H. Smith, Jr., VC ADC, to Maj Gen D. T. Spivey, CG CADF, 8 Jun 1954, (HRF #56).

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requirements.[24]

The Signal Corps had developed the AN/TPQ-8, consisting of a 1 Kilowatt spot jammer, with receivers, antenna positioning equipment, and a jamming transmitter.[25] This ground-jammer was to become available to the Air Force in late 1954. ADC rejected its widespread use, however, due to the high cost and limited operational capability of its equipment.[26] It would be used momentarily, though, to "establish an operational concept for the employment of this type of equipment."[27] The same ADC criticism and evaluation applied to the AN/MLQ-7 jammer, available for operational testing after January 1956, to assist in the development of doctrine and techniques for jamming.[28]

Late in 1953, ADC drew up and forwarded to Headquarters USAF a concept for utilizing a large number of small, inexpensive "unattended, automatic sweep jammers distributed around a given target area." This concept, known as "Distributed Area Jamming,"

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24. Ltr, ADC to USAF, "Ground-Based Jamming Study," 18 Feb 1954, (Doc 6).

25. Ltr, ADC to WADF, "Status of ADC Ground-Based Jammer Program," 14 Apr 1954, (Doc 7).

26. Ibid.

27. Hq ADC, DCS/O Project Reports, Dec 1953, p 44.

28. 1st Ind, USAF to ADC, 1 May 1954, to ADC to USAF, "Ground Based Jamming Study," 18 Feb 1954, (Doc 6).

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seconded by the Rome Air Development Center, was sent to the Research and Development Command for testing and evaluation,[29] while the General Electric Company was assigned the problem of studying the ground-based jammer complex.[30] There seemed to be evidence that the Signal Corps, too, was swinging to the Distributed Area Jamming concept.[31] RADC contracted with Capehart-Farnsworth for four pre-production models of Distributed Area Jammers for testing purposes, possibly available in the latter part of 1954.[32] No definite ADC requirements could be made until this equipment had been demonstrated in operational tests.

However, on 16 March 1954, Air Research and Development Command and Rome Air Development Center personnel described their laboratory investigation of distributed area jamming. They concluded:[33]

> that a prohibitive amount of power was required to accomplish effective jamming with an omni-directional jamming antenna if noise modulation was used. Therefore, they investigated several pulse techniques and concluded that a pulse jammer, synchronized with the victim radars PRF, was the most effective modulation

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29. Ltr, ADC to WADF, 14 Apr 1954, (Doc 7).

30. Ibid.

31. Ibid.

32. 1st Ind, USAF to ADC, 1 May 1954, to ltr, ADC to USAF, "Ground Based Jamming Study," 18 Feb 1954, (Doc 6). Raytheon was given a contract for the development of carcinotron tubes for this equipment.

33. Ibid., Inclosure 1.

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> possible. Their opinion is that powers on the order of 100 watts will be sufficient to jam the main lobe of a nav-bomb radar to a degree sufficient to preclude radar navigation and bombing. Their studies also indicate that this type of jammer, in order to protect a large industrial area, must be spaced at intervals of about 20 miles square. In order to achieve broad-band radiation from a magnetron, they intend to utilize the pushing effect of an over-coupled magnetron combined with a triangular topped modulation pulse, to cause the frequency of the output to rapidly change during the duration of the pulse. Tests have shown that 50 mc band with is attainable at "S" band, and about 150 mc at "X" band with available tubes. This figure may be increased considerably if carcinotrons can be used for this application.

Air defense planners estimated that, on the basis of present knowledge, point defense of vital areas would be the most applicable use for this particular ground based jammer.

ADC at the close of June 1954, then, was seeking an area jamming capability. By denying the enemy all use of his navigational and bombing radar, air defense forces would be in a position to force any attacker to consider only good weather daylight raids.[34] With the possible attainment of this desired goal, air defense doctrine might be considerably altered. The difference between day and night operations in the air, which electronic devices had consistently attempted to eliminate, would again become apparent if ADC's "ideal" were attained. The enemy, however, could be expected to react immediately to the area jamming weapon that threatened to tip the offensive-defensive struggle in favor of the latter. The corrective action he might be forced to undertake remained in the realm of speculation.

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34. Hq ADC, Briefing, 15 May 1954, p 76.

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Electronic Warfare Exercise and Test Area

In May, USAF proposed the establishment of an "electronic warfare exercise and test area." This would be a controlled electronics battleground area wherein "defensive as well as offensive techniques and procedures could be developed and evaluated, and personnel trained." Absence of restrictions to operations in the area would alone determine the effectiveness of the exercise. It was believed that the "test area" mission might be assigned to the 35th Air Division and APGC without "unduly jeopardizing the primary Air Defense mission in that relatively non-critical area."[35]

Feeling that a valid need existed for evaluating the effectiveness of air defense equipment when exposed to unlimited ECM measures, ADC quickly indorsed USAF's proposed exercise. It expected that such a proving ground would:[36]

> provide a means to tactically evaluate ADC counter ECM equipment; i.e., ground-based jammers, tunable magnetrons, etc. The information obtained from an electronics warfare exercise would greatly assist this command in accurately computing "Bomber Kill Factors". Present studies in this field have made no attempt to degrade kill factors from the effects of ECM primarily because there were no means of evaluating its effectiveness under operational conditions.

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35. Ltr, USAF to ADC, "Electronics Warfare Exercise and Test Area," 18 Mar 1954, (Doc 8).

36. 1st Ind, ADC to USAF, 7 Apr 1954.

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It was recognized that the 35th Air Division would be distracted in some degree from its assigned responsibilities, but ADC planners did not believe that the ability of that air division to perform its basic air defense mission would be jeopardized.[37]

ADC warned that the urgent requirement for maintaining electronic equipment in critical target areas would prevent its reassignment to the non-critical 35th Air Division Sector. It proposed that additional electronic equipment be obtained in conjunction with APGC requirements, especially since the exercise was designed to evaluate air force equipment.[38]

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37. Ibid.

38. Ibid.

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PART FOUR

TABLES

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TABLE I

1954-1957 PROGRAMMED BUILD-UP OF FORCES

	Dec 1954	June 1955	Dec 1955	June 1956	Dec 1956	June 1957
Defense Force Headquarters	3	3	3	3	3	3
Air Divisions (Defense)	12	14	16	16	16	16
Defense Wings	6	6	4	4	4	4
Fighter Squadrons						
F-86A/F	2	-	-	-	-	-
F-86D	39	42	41	45	41	33
F-89C	-	-	-	-	2	-
F-89D	5	7	9	13	7	6
F-94C	10	10	9	9	8	7
F-102A/B	-	-	-	-	7	23
TOTALS	56	59	60	67	65	69
AC&W Squadrons						
Permanent	75	75	75	75	75	75
1st Phase	39	41	44	44	44	44
2nd Phase	3	19	25	25	25	25
3rd Phase	-	-	10	22	29	29
REP	8	8	8	8	8	8
Gap Fillers	-	-	62	125	175	225
Texas Towers	-	-	-	-	2	5
AEW&C Div	1	1	-	-	-	-
AEW&C Wing	1	1	2	2	2	2
AEW&C Squadrons	3	4	7	7	7	7
Radar Evaluation Units	3	3	3	3	3	3
GOC Squadrons	9	10	16	16	16	16
GOC Detachments	49	56	56	63	63	63

*Source: Extracted from Hq ADC, Program, 1 Jul 1954, Section I, pp 1-2.

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TABLE II

ACTIVE RADAR NET: June 1954*

EASTERN AIR DEFENSE FORCE

Air Div	Sqdn	Site Number	Location	Func-tion X	Oper Status Y	Search Radar in Operation	Height Finder in Operation	Height Finder Programmed
32d	Hq Sec	P-5	Syracuse, N. Y.	CC	F	--Headquarters, 32d Air Division--		
	762	P-10	N. Truro AFS, Mass.	DC	F	CPS-6B	CPS-6B	CPS-6B
	654	P-13	Brunswick NAS, Me.	DC	F	CPS-6B	CPS-6B	CPS-6B
	764	P-14	St. Albans AFS, Vt.	DC	F	CPS-6B	CPS-6B	CPS-6B
	763	P-21	Lockport AFS, N. Y.	DC	F	CPS-6B	CPS-6B	CPS-6B
	655	P-49	Watertown AFS, N. Y.	DC	L-3	FPS-3	FPS-5	FPS-4
	656	P-50	Saratoga Spgs, N. Y.	DC	F	FPS-3	FPS-5	FPS-6
	765	P-65	Charleston AFS, Me.	DC	F	FPS-3	FPS-5	FPS-6
	766	P-80	Caswell AFS, Me.	DC	F	FPS-10	FPS-10	FPS-10

*Sources: AC&W Operational Status Report, RCS: AF-220 (in Hq ADC DC&E Files); and Hq ADC, Command Data Book, June 1954.

X DC stands for Direction Center; CC for Control Center; and SS for Surveillance Station.

Y X stands for Inoperative; L for Limited Operational; S for Sustained Operational; F for Fully Operational; CL for Capable of Limited Operations; CS for Capable of Sustained Operations; and CF for Capable of Full Operations. For an explanation of the number used, and for a definition of the terminology, see last page of this Table.

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Air Div	Sqdn	Site Number	Location	Function	Oper Status	Search Radar in Operation	Height Finder in Operation	Height Finder Programmed
26th	Hq Sec	P-3	Roslyn, N. Y.	CC	F	--(Headquarters, 26th Air Division)--		
	646	P-9	Highlands AFS, N. J.	DC	F	CPS-6B	CPS-6B	CPS-6B
	648	P-30	Benton AFS, Pa.	DC	F	CPS-6B	CPS-6B	CPS-6B
	773	P-45	Montauk AFS, N. Y.	DC	F	FPS-3	FPS-5	FPS-6
	770	P-54	Palermo AFS, N. J.	DC	L-3	FPS-3	FPS-5	FPS-6
	647	P-55	Quantico Marine Base, Va.	DC	L-3	FPS-3	CPS-4	FPS-6
	771	P-56	Cape Charles AFS, Va.	DC	L-3	FPS-3	CPS-4	FPS-6
	772	P-63	Claysburg AFS, Pa.	DC	L-3	FPS-3	CPS-4	FPS-4
30th	Hq Sec	P-23	Willow Run AFS, Mich.	CC	F	--(Headquarters, 30th Air Division)--		
	665	P-16	Calumet AFS, Mich.	DC	F	FPS-3	FPS-5	FPS-6
	676	P-19	Antigo AFS, Wisc.	DC	F	FPS-3	FPS-4	FPS-4
	661	P-20	Selfridge, Mich.	DC	F	CPS-6B	CPS-6B	CPS-6B
	755	P-31	Williamsbay AFS, Wisc.	DC	F	CPS-6B	CPS-6B	CPS-6B
	752	P-34	Empire AFS, Mich.	DC	F	CPS-6B	CPS-6B	CPS-6B
	783	P-43	Guthrie AFS, W. Va.	DC	F	FPS-3	FPS-4	FPS-4
	782	P-53	Rockville AFS, Ind.	DC	F	FPS-10	FPS-10	
	754	P-61	Fort Austin, Mich.	DC	S-2	FPS-3	CPS-4	FPS-6
	662	P-62	Brookfield AFS, Ohio	DC	F	FPS-3	FPS-5	FPS-4
	753	P-66	Sault Ste Marie AFS, Mich.	DC	F	FPS-3	FPS-5	FPS-6
	781	P-67	Ft. Custer, Mich.	DC	L-3	FPS-3	CPS-4	FPS-4

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Air Div	Sqdn	Site Number	Location	Function	Oper Status	Search Radar in Operation	Height Finder in Operation	Height Finder Programmed
30th	664	P-73	Bellefontaine AFS, Ohio	DC	L-3	FPS-3	________	FPS-4
	784	P-82	Ft. Knox, Ky.	DC	F	FPS-3	FPS-4	FPS-4
	913	C-14	Pagwa River, Ont.	EW	L	FPS-3	TPS-10D	
	912	C-10	Ramore, Ont.	EW	L	FPS-3	TPS-502	TPS-502
	914	C-15	Armstrong, Ont.	EW	L	FPS-3	TPS-10D	
CENTRAL AIR DEFENSE FORCE								
29th	Hq Sec	P-83	Great Falls AFB, Mont.	CC	F	--Headquarters, 29th Air Division--		
	681	P-24	Cut Bank AFS, Mont.	DC	S-3	FPS-3	FPS-4	FPS-4
	778	P-25	Havre AFS, Mont.	DC	F	FPS-3	FPS-4	FPS-4
	779	P-26	Opheim AFS, Mont.	SS	F	FPS-3	FPS-4	FPS-4
	780	P-27	Fortuna AFS, N. D.	DC	F	FPS-3	FPS-4	FPS-4
	786	P-28	Minot AFS, N. D.	DC	F	FPS-3	FPS-4	FPS-4
	785	P-29	Finley AFS, N. D.	DC	F	FPS-3	FPS-4	FPS-4
	740		Ellsworth AFB, S. D.	DC	L-3	CPS-5D	CPS-4	MPS-14
31st	Hq Sec	P-36	Ft. Snelling, Minn.		F	--Headquarters, 31st Air Division--		
	739	P-17	Wadena AFS, Minn.	DC	S-3	FPS-3	FPS-4	FPS-6
	787	P-18	Chandler AFS, Minn.	DC	F	FPS-3	FPS-4	FPS-6
	674	P-35	Osceola AFS, Wisc.	DC	F	CPS-6B	CPS-6B	CPS-6B
	756	P-69	Finland AFS, Minn.	DC	S-3	FPS-3	FPS-5	FPS-6
	789	P-71	Omaha AFS, Neb.	DC	S-3	FPS-3	FPS-4	FPS-6

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Air Div	Sqdn	Site Number	Location	Function	Oper Status	Search Radar in Operation	Height Finder in Operation	Height Finder Programmed
31st	788	P-81	Waverly AFS, Iowa	DC	F	FPS-10	FPS-10	FPS-10
	791	P-85	Hanna City AFS, Ill.	DC	F	FPS-3	FPS-4	FPS-4
	915	C-16	Sioux Lookout, Ont.	EW	L	FPS-3	TPS-502	TPS-502
	916	C-17	Beausejour, Man.	EW	L	FPS-3	TPS-10D	TPS-10
33d	Hq Sec	P-86	Tinker AFB, Okla.	CC	F	--(Headquarters, 33d Air Division)--		
	793	P-47	Hutchinson NAS, Kans.	DC	S	FPS-10	FPS-10	FPS-10
	746	P-52	Tinker AFB, Okla.	DC	F	FPS-10	FPS-10	FPS-10
	790	P-64	Kirksville AFS, Mo.	DC	F	FPS-10	FPS-10	FPS-10
	797	P-68	Fordland AFS, Mo.	DC	F	FPS-3	FPS-4	FPS-4
	798	P-70	Bellevile AFS, Ill.	DC	F	FPS-3	CPS-4	FPS-4
	738	P-72	Olathe NAS, Kans.	DC	S-3	FPS-3	____	FPS-4
	741	P-75	Lackland AFB, Tex.	DC	S-3	FPS-3	FPS-4	FPS-4
	796	P-77	Bartlesville AFS, Okla.	DC	S-3	FPS-10	FPS-10	FPS-10
	745	P-78	Duncanville AFS, Tex.	DC	F	FPS-10	FPS-10	FPS-10
	747	P-79	Ellington AFB, Tex.	DC	F	FPS-10	FPS-10	FPS-10
34th	Hq Sec	P-41	Kirtland AFB, N. M.	CC	F	--(Headquarters, 34th Air Division)--		
	769	P-7	Continental Dv AFS, N. Mex.	DC	S	FPS-3	FPS-4	FPS-5
	767	P-8	Tierra Amarillo AFS, N. Mex.	DC	S	FPS-3	FPS-5	FPS-6
	768	P-51	Moriarity AFS, N. M.	DC	S	FPS-3	FPS-5	FPS-5
	686	M-90	Walker AFB, N. M.	DC	S	CPS-5D	____	MPS-14

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Air Div	Sqdn	Site Number	Location	Function	Oper Status	Search Radar in Operation	Height Finder in Operation	Height Finder Programmed
34th	684	M-92	Tuscon, Ariz.	DC	L	TPS-1D	________	MPS-14
	687		Kirtland AFB, N. M.	DC	S	CPS-5D	TPS-10C	MPS-14
35th	Hq Sec	M-87	Dobbins AFB, Ga.	CC	F	--(Headquarters, 35th Air Division)--		
	663	P-42	Lake City AFS, Tenn.	DC	F	FPS-10	FPS-10	FPS-10
WESTERN AIR DEFENSE FORCE								
25th	Hq Sec	P-4	McChord AFB, Wash.	CC	F	--(Headquarters, 25th Air Division)--		
	635	P-1	McChord AFB, Wash.	DC	F	CPS-6B	CPS-6B	CPS-6B
	636	P-32	Condon AFS, Ore.	DC	F	FPS-3	FPS-4	FPS-4
	637	P-40	Othello AFS, Wash.	DC	S-3	FPS-3	FPS-5	FPS-6
	638	P-6	Curlew AFS, Wash.	DC	F	FPS-3	FPS-5	FPS-5
	680	P-11	Yaak AFS, Mont.	SS	S-3	FPS-3	_____	FPS-4
	689		Portland, Ore.	DC	F	CPS-5D	FPS-4	FPS-4
	757	P-46	Blaine AFS, Wash.	DC	F	FPS-10	FPS-10	FPS-10
	758	P-44	Neah Bay AFS, Wash.	DC	S-3	FPS-3	FPS-4	FPS-6
	759	P-57	Naselle AFS, Wash.	DC	S-3	FPS-3	FPS-5	FPS-6
	760	P-60	Colville AFS, Wash.	DC	S-3	FPS-3	FPS-5	FPS-6
	761	P-12	N. Bend AFS, Ore.	SS	S-3	FPS-3	FPS-4	FPS-6
	917	C-19	Puntzi Mt, B. C. Williams Lake, B. C.	EW	L	FPS-3	FPS-4	FPS-4
	918	C-20	Baldy Hughes Mt. B. C.	EW	L	FPS-3	TPS-10D	TPS-10D
	919	C-21	Saskatoon Mt. Alta.	EW	L	FPS-3	TPS-10D	TPS-10D

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Air Div	Sqdn	Site Number	Location	Function	Oper Status	.arch Radar in Operation	Height Finder in Operation	Hei..t Finder Programmed
27AD	Hq Sec	P-84	Norton AFB, Calif.	CC		--(Headquarters, 27th Air Division)--		
	669	P-15	Santa Rosa AFS	DC	S-3	FPS-10	FPS-10	FPS-10
	670	P-39	San Clemente Is, Calif.	DC	S-3	FPS-3	FPS-4	FPS-6
	750	P-59	Boron AFS, Calif.	DC	F	FPS-10	FPS-10	FPS-10
	751	P-76	Mt. Laguna AFS, Calif.	DC	S-3	FPS-3	______	FPS-6
28th	Hq Sec	P-48	Hamilton AFB, Calif.	CC		--(Headquarters, 28th Air Division)--		
	666 (Detach A)		Fort Ord, Calif.	SS	F	CPS-5D	______	______
	666	P-38	Millvalley AFS, Calif.	DC	S-3	CPS-6B	CPS-6B	CPS-6B
	668	P-58	Mather AFB, Calif.	DC	F	CPS-6B	CPS-6B	CPS-6B
	774	P-74	Madera AFS, Calif.	DC	F	FPS-3	FPS-4	FPS-4
	775	P-2	Cambria AFS, Calif.	DC	S-3	FPS-3	CPS-4	FPS-6
	776	P-37	Pt. Arena AFS, Calif.	DC	S-3	FPS-3	FPS-4	FPS-6
	777	P-33	Klamath AFS, Calif.	SS	S-3	FPS-3	FPS-4	FPS-4

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CODE FOR OPERATIONAL STATUS:*

Inoperative (X): For any reason the site cannot be placed in operation in less than ten days.

Limited Operational (L): The site is integrated into an air defense or tactical control system but due to shortages of personnel and/or equipment cannot be operated continuously. The site can operate for a minimum of twenty-four hours on an emergency basis.

Sustained Operational (S); The site is integrated into an air defense tactical control system, minimum personnel and equipment are on hand to allow continuous operation, in accordance with the assigned mission, for a period of at least seventy-two hours. Complete coverage of the site need not be known (for radar sites only).

Fully Operational (F): The site is integrated into an air defense or tactical control system; complete coverage of the site is known (for radar sites only) either by calibration, evaluation, or operational experience; sufficient equipment is on hand to allow continuous operation, in accordance with the assigned mission; adequate trained personnel are on hand to properly maintain the equipment; and adequate trained personnel are on hand to operate the site in accordance with the assigned mission and approved SOP's.

Capable of Limited Operations (CL): No requirement exists for the site to operate in an air defense or tactical control system. The site could be integrated into an air defense or tactical control system within forty-eight hours and would be capable of limited operations in the system.

Capable of Sustained Operations (CS): No requirement exists for the site to operate in an air defense or tactical control system. The site could be integrated into an air defense or tactical control system within forty-eight hours and would be capable of sustained operations.

Capable of Full Operations (CF): No requirement exists for the site to operate in an air defense or tactical control system. The site could be integrated into an air defense or tactical control system within forty-eight hours and would be capable of full operations.

Definitions of Numbers denoting major limiting factors in operational status of AC&W System

1 - construction is major reason for current status.
2 - lack of personnel or insufficient training.
3 - lack of equipment is major reason.

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*Source: ADC Regulation 55-46, "AC&W Operations Status Report," 29 Dec 1952.

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TABLE III

PLANNED DEPLOYMENT OF SEMI-MOBILE RADAR STATIONS*

1st PHASE SEMI-MOBILE PROGRAM

Site	Location	Site	Location
M-88	Amarillo AFB, Tex.	M-110	Bucks Harbor, Me.
M-89	Sweetwater, Tex.	M-111	Dobbins AFB, Ga.
M-90	Walker AFB, N. M.	M-112	Hunter AFB, Ga.
M-91	Texarkana, Ark.	M-113	Charleston AFB, S. C.
M-92	Tucson, Ariz.	M-114	Fernandina Beach, Fla.
M-93	Winslow, Ariz.	M-115	Ft Fisher, N. C.
M-94	West Mesa, N. M.	M-116	Englehard, N. C.
M-95	Las Cruces, N. M.	M-117	Roanoke Rapids, N. C.
M-96	Almaden, Calif.	M-118	Burns, Ore.
M-97	Ellsworth AFB, S. D.	M-119	Oba Ont, Can.
M-98	Miles City, Mont.	M-120	Marathon Ont, Can.
M-99	Gettysburg, S. D.	M-121	Bedford, Va.
M-100	Mt. Hebo, Ore.	M-122	Dallas Center, Iowa
M-101	Rochester, Minn.	M-123	Berlin, Md.
M-102	Barrington, NS, Can.	M-124	Pope AFB, N. C.
M-103	N. Concord, Vt.	M-125	Burns, Ore.
M-104	Ft Dearborn, N. H.	M-126	Houma NAS, La.
M-105	Alpena, Mich.	M-127	Winnemucca, Nev.
M-106	Two Creeks, Wisc.	M-128	Kingman, Ariz.
M-107	Elizabethtown, Pa.	M-129	MacDill AFB, Fla.
M-108	Bowling Green, Mo.	M-130	Winston-Salem, N. C.
M-109	Grand Marais, Mich.	M-131	Owingsville, Ky.

2nd PHASE SEMI-MOBILE PROGRAM

Site	Location	Site	Location
SM-137	Carmi, Ill.	SM-151	Geiger AFB, Wash.
SM-138	Grand Rapids, Minn.	SM-153	Kamloops BC, Can.
SM-139	Willmar, Minn.	SM-156	Fallon, Nev.
SM-140	Sioux City, Iowa	SM-157	Red Bluff, Calif.
SM-141	Falls City, Nebr.	SM-158	Ferndale, Calif.
SM-142	Nevada, Mo.	SM-159	Aiken, S. C.
SM-143	Walnut Ridge, Ark.	SM-160	Poston, Ariz.
SM-144	Union City, Tenn.	SM-161	Shafter, Calif.
SM-145	Joelton, Tenn.	SM-162	Yuma AFB, Ariz.
SM-147	Great Falls AFB, Mont.	SM-163	Las Vegas, Nev.
SM-148	Robins AFB, Ga.	SM-164	Tonopah, Nev.
SM-149	Baker, Ore.	SM-165	Chattanooga, Tenn.
SM-150	Cottonwood, Ida.		

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3rd PHASE SEMI-MOBILE PROGRAM

Site	Location	Site	Location
SM-168	Truax Field, Wis.	TM-187	Sonora, Tex.
SM-169	Grandview AFB, Mo.	TM-188	Eagle Pass, Tex.
SM-170	Wright-Patterson AFB, O.	TM-189	Zapata, Tex.
SM-171	Andrews AFB, Md.	TM-190	Port Isabel, Tex.
SM-172	Geiger AFB, Wash.	TM-191	Rockport, Tex.
TM-173	Beaudette, Minn.	TM-192	Rockdale, Tex.
TM-174	Hastings, Nebr.	TM-193	Lufkin, Tex.
TM-175	Lake Andes, S. D.	TM-194	*Lake Charles, La.
TM-176	Andover, S. D.	TM-195	*Crystal Springs,Miss.
TM-177	Belfield, N. D.	TM-196	*Foley, Ala.
TM-178	Roy, Mont.	TM-197	Thomasville, Ala.
TM-179	Niarada, Mont.	TM-198	Tyndall, Fla.
TM-180	Klamath Falls, Ore.	TM-199	Eufaula, Ala.
TM-181	Lukeville, Ariz.	TM-200	Live Oak, Fla.
TM-182	Nogales, Ariz.	TM-201	Gillette, Wyo.
TM-183	Cloverdale, N. M.		
TM-184	Porvenir, Tex.		
TM-185	Castolon, Tex.		
TM-186	Pyote, Tex.		

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TABLE IV

GROUND OBSERVER CORPS: May 1954*

GROUND OBSERVER SQUADRONS (Designation, Location and Assignment)

EASTERN AIR DEFENSE FORCE
4670th Ground Observer Squadron - Roslyn, New York (26th Air Div)
4671st " " " - Willow Run, Mich. (30th Air Div)
4673d " " " - Syracuse, New York (32d Air Div)

CENTRAL AIR DEFENSE FORCE
4672d " " " - Ft. Snelling, Minn. (31st Air Div)
4674th " " " - Dobbins AFB, Fla. (35th Air Div)
4773d " " " - Gr. Falls, Mont. (29th Air Div)

WESTERN AIR DEFENSE FORCE
4770th " " " - McChord AFB, Wash. (25th Air Div)
4771st " " " - Norton AFB, Calif. (27th Air Div)
4772d " " " - Hamilton AFB, Calif. (28th Air Div)

TOTAL MILITARY STRENGTH OF GROUND OBSERVER SQUADRONS

	Authorized	Assigned
Officers	307	239
Airmen	704	690
Total Military Assigned		929

CIVILIAN VOLUNTEER STATUS AT FILTER CENTERS

1. Civilian Volunteers Required: 47661
2. Civilians Enrolled: 25914
3. Number Trained: 18810
4. Number Active: 7238

CIVILIAN VOLUNTEER STATUS OF OBSERVATION POSTS

1. Civilian Volunteers Required: 928171
2. Civilian Volunteers Enrolled: 330415
3. Number Trained: 264382
4. Number Active: 130744

STATUS OF GROUND OBSERVER CORPS OBSERVATION POSTS

1. Total Posts Required: 15884
2. Total Posts Organized: 13028
3. Number of Posts Operational: 5383

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*Source: Hq ADC, Command Data Book, June 1954, p 7.7.

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GROUND OBSERVER CORPS FILTER CENTERS: JUNE 1954**

EASTERN AIR DEFENSE FORCE

24-hour Operational

Albany, New York	Green Bay, Wisc.
Baltimore, Md.	Manchester, New Hampshire
Bangor, Maine	Pittsburgh, Pa.
Buffalo, New York	Richmond, Va.
Canton, Ohio	South Bend, Ind.
Chicago, Ill.	Syracuse, New York
Columbus, Ohio	Trenton, New Jersey
Harrisburg, Pa.	White Plains, New York
Grand Rapids, Mich.	New Haven, Conn.

Standby

Lexington, Ky.	Roanoke, Va.
Louisville, Ky.	Springfield, Mass.

CENTRAL AIR DEFENSE FORCE

24-hour Operational

Billings, Mont.	Minneapolis, Minn.
Bismarck, No. Dak.	Rapid City, So. Dak.
Fargo, No. Dak.	Sioux Falls, So. Dak.
Helena, Mont.	

Standby

Atlanta, Ga.	Knoxville, Tenn.
Charlotte, No. Carolina	Miami, Fla.
Casper, Wyoming	Nashville, Tenn.
Des Moines, Iowa	Omaha, Nebraska
Durham, N. Carolina	North Platte, Nebraska
Jacksonville, Fla.	Savannah, Georgia

WESTERN AIR DEFENSE FORCE

24-hour Operational

Santa Ana, Calif.	Portland, Ore.
Pasadena, Calif.	Seattle, Wash.
Oakland, Calif.	Spokane, Wash.
Sacramento, Calif.	

Standby

Boise, Idaho

**Source: Hq ADC, Operations Order 3-54, 1 Apr 1954, pp 5-6.

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TABLE V

FIGHTER INTERCEPTOR FORCE. June 1954*

EASTERN AIR DEFENSE FORCE

Air Div	Sqdn	Location	Base Assignment	Type Acft	Aircraft Assgnd	Aircraft Oper Ready	Crews Assgnd	Crews Oper Ready
32d	47th	Niagara Falls Municipal Arpt, N.Y.	ADC	F-86D	18	7	37	29
	58th	Otis AFB, Mass.	ADC	F-94C	19	11	14	11
	437th	Otis AFB, Mass.	ADC	F-94C	19	12	28	28
	60th	Westover AFB, Mass.	MATS	F-86D	25	13	36	20
	27th	Griffiss AFB, N. Y.	ARDC	F-94C	26	12	27	13
	37th	Burlington Municipal Arpt, Vt.	ADC	F-86D	26	14	44	21
	49th	Dow AFB, Maine	SAC	F-86F	25	4	33	3
	74th	Presque Isle AFB, Maine	ADC	F-89C	11	8	35	11
	57th	Presque Isle AFB, Maine	ADC	F-89C	5	4	33	18
26th	2d	McGuire AFB, N. J.	ADC	F-86D	25	10	38	34
	5th	McGuire AFB, N. J.	ADC	F-86D	25	16	36	22
	539th	Stewart AFB, N. Y.	ADC	F-86F	15	8	27	4
	330th	Stewart AFB, N. Y.	ADC	F-86F	24	13	32	15
	75th	Suffolk AFB, N. Y.	ADC	F-86D	23	12	41	32
	331st	Suffolk AFB, N. Y.	ADC	F-86D	26	17	38	34
	46th	Dover AFB, Del.	MATS	F-94C	22	10	36	27
	48th	Langley AFB, Va.	TAC	F-94C	26	14	31	30

*Source (unless otherwise indicated): Aircraft and Crew Status in Tactical Units, 5 July 1954 (RCS: CST-A10) (In AG Files, Hq ADC, Mgt 7-2-17).

[Y]Source: Hq ADC, Command Data Book, October 1954, p 1.3.

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EASTERN AIR DEFENSE FORCE

Air Div	Sqdn	Location	Base Assignment	Type Acft	Aircraft Assgnd	Aircraft Oper Ready	Crews Assgnd	Crews Oper Ready
26th	95th	Andrews AFB, Md.	MATS	F-86D	20	14	41	34
	96th	New Castle Co. Apt, Del.	ADC	F-94C	26	19	33	25
	332d	New Castle Co. Apg, Del.	ADC	F-94C	28	17	36	24
30th	42d	O'Hare International Arpt, Ill.	ADC	F-86D	24	17	42	26
	62d	O'Hare International Arpt, Ill.	ADC	F-86D	20	9	39	32
	97th	Wright-Patterson AFB, Ohio	AMC	F-86D	23	10	46	42
	432d	Truax Field, Wisconsin	ADC	F-86D	14	12	47	37
	433d	Truax Field, Wisconsin	ADC	F-89C	23	16	37	11
	438th	Kinross AFB, Mich.	ADC	F-89D F-94B	24 5	7	25	10
	56th	Selfridge AFB, Mich.	ADC	F-86D	26	9	39	19
	13th	Selfridge AFB, Mich.	ADC	F-86D	10	3	35	28
	63d	Wurtsmith AFB, Mich.	ADC	F-86D	21	14	32	20
	71st	Greater Pittsburg Arpt, Pa.	ADC	F-86D	23	7	41	28
	86th	Youngstown Municipal Arpt, Ohio	ADC	F-86D	24	10	39	29

CENTRAL AIR DEFENSE FORCE

Air Div	Sqdn	Location	Base Assignment	Type Acft	Aircraft Assgnd	Aircraft Oper Ready	Crews Assgnd	Crews Oper Ready
29th	54th	Ellsworth AFB, S. D. (formerly Rapid City AFB)	SAC	F-86D	23	6	32	22
	29th	Great Falls AFB, Mont.	MATS	F-94C	26	11	34	23
31st	11th	Duluth Municipal Arpt, Minn.	ADC	F-86D	21	6	35	24
	18th	Minneapolis-St. Paul Municipal Arpt, Minn.	ADC	F-89D	27	5	54	11

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CENTRAL A[illegible] DEFENSE FORCE

Air Div	Sqdn	Location	Base Assignment	Type Acft	Aircraft Assgnd	Aircraft Oper Ready	Crews Assgnd	Crews Oper Ready
31st	87th	Sioux City Municipal Arpt, Ia.	ADC	F-86D	23	13	34	27
	14th	Sioux City Municipal Arpt, Ia.	ADC	F-86D	20	8	31	24
33d	85th	Scott AFB, Ill.	ATRC	F-86D	24	16	35	24
	326th	Grandview AFB, Mo.	ADC	F-86D	22	3	33	
34th	93d	Kirtland AFB, N. M.	ARDC	F-86D	23	10	48	32
	15th	Davis-Monthan AFB, Ariz.	SAC	F-86D	19	13	48	23
35th	469th	McGhee-Tyson Municipal Arpt, Tenn.	ADC	F-86D	22	7	35	14
	460th	McGhee-Tyson Municipal Arpt, Tenn.	ADC	F-86D	5	2	32	5
	444th	Charleston AFB, S. C.	TAC	F-86D	12		34	1
WESTERN AIR DEFENSE FORCE								
25th	83d	Paine AFB, Wash.	ADC	F-86D	24	17	37	25
	317th	McChord AFB, Wash.	ADC	F-86D	26	10	32	20
	465th	McChord AFB, Wash.	ADC	F-86D	22	8	43	18
	497th	Portland International Arpt, Ore.	ADC	F-89D F-94A	25 11	4 9	29	
	445th	Geiger Field, Wash.	ADC	F-86D	21	10	42	22
	31st	Larson AFB, Wash.	TAC	F-86D	25	15	45	18
	323d	Larson AFB, Wash.	TAC	F-86D	17	8	37	26
27th	94th	George AFB, Calif.	TAC	F-86D	25	16	42	28
	354th	Oxnard AFB, Calif.	ADC	F-94C	24	15	35	30

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WESTERN A[illegible] DEFENSE FORCE

Air Div	Sqdn	Location	Base Assignment	Type Acft	Aircraft Assgnd	Aircraft Oper Ready	Crews Assgnd	Crews Oper Ready
28th	84th	Hamilton AFB, Calif.	ADC	F-94C	26	16	31	24
	325th	Hamilton AFB, Calif.	ADC	F-86D	22	20	40	

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TABLE VI

TACTICAL AIRCRAFT AND CREWS: June 1954*

	Type	Programmed	Assigned	Possessed
AIRCRAFT	F-86D	916	876	798
	F-89C	42	71	40
	F-89D	86	79	76
	F-94C	282	288	265
	F-86A/E		34	12
	F-86F	83	94	70
	F-94A/B		24	14

	Type	Programmed**	Assigned	On Hand
CREWS	F-86D	1374	1287	870
	F-89C	63	104	68
	F-89D	129	112	60
	F-94C	423	309	244
	F-86F	125	88	68

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*Source: Hq ADC, Command Summary, RCS: CST-U4, 30 June 1954, (in AG Files).

**Ratio of 1.5 Crews per Aircraft.

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TABLE VII

AIRCRAFT OUT OF COMMISSION RATES: May 1954*

	F-86D	F-89	F-94C	F-94(A&B)	F-86
Average No. On Hand	851	109	17	278	90
% Out for Maintenance	31	31	45	25	30
% Out for Parts	11	15	24	9	9
% Out for TOC	1	2	0	1	0
% Miscellaneous	1	1	0	1	4
% of Total Out of Commission	47	49	69	36	43

*Source: Hq ADC, Command Data Book, June 1954, p 6.5. Here a similar breakdown for each month of the period may be found.

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TABLE VIII

1957 INTERCEPTOR FORCE: (as programmed June 1954)*

EASTERN AIR DEFENSE FORCE

Sqdn	Base	Aircraft	Sqdn	Base	Aircraft
95	Andrews (Md)	F-86D	438	Kinross (Mich)	F-102
46	Dover (Del)	F-94C	301	Wurtsmith (Mich)	F-102
76	Dover (Del)	F-94C	305	Wurtsmith (Mich)	F-102
48	Langley (Va)	F-102	302	Lockbourne (Ohio)	F-86D
2	McGuire (N.J.)	F-86D	74	Traverse City (Mich)	F-89D
5	McGuire (N.J.)	F-86D	37	Burlington (Vt)	F-86D
96	New Castle (Del)	F-94C	329	Griffiss (N.Y.)	F-102
332	New Castle (Del)	F-94C	303	Griffiss (N.Y.)	F-102
330	Stewart (N.Y.)	F-86D	49	Hanscom (Mass)	F-86D
539	Stewart (N.Y.)	F-86D	47	Niagara (N.Y.)	F-86D
331	Suffolk (N.Y.)	F-102	11	Otis (Mass)	F-102
75	Suffolk (N.Y.)	F-102	437	Otis (Mass)	F-102
71	Gtr Pittsburgh (Pa)	F-86D	335	Presque Isle (Me)	F-86D
42	O'Hare (Ill)	F-86D	60	Westover (Mass)	F-86D
62	O'Hare (Ill)	F-86D	334	Westover (Mass)	F-86D
13	Selfridge (Mich)	F-86D	327	Marquette (Mich)	F-94C
56	Selfridge (Mich)	F-86D	27	Bunker Hill (Md)	F-94C
432	Truax (Wisc)	F-102	97	Wright-Patterson(Ohio)	F-86D
86	Youngstown (Ohio)	F-86D			

CENTRAL AIR DEFENSE FORCE

Sqdn	Base	Aircraft	Sqdn	Base	Aircraft
29	Great Falls (Mont)	F-102	444	Charleston (S.C.)	F-86D
497	Glasgow (Mont)	F-89D	337	Minn-St Paul (Minn)	F-89D
54	Ellsworth (S.D.)	F-86D	14	Sioux City (Iowa)	F-86D
324	Minot (N.D.)	F-102	498	Grand Forks (N.D.)	F-89D
15	Davis-Monthan (Ariz)	F-86D	57	Duluth (Minn)	F-102
93	Kirtland (N.M.)	F-86D	85	Scott (Ill)	F-86D
321	Walker (N.M.)	F-86D	326	Grandview (Mo)	F-86D
300	Seymour-Johnson (N.C.)	F-102	460	McGhee-Tyson (Tenn)	F-86D
336	Perrin (Mex)	F-86D			

*Source: Hq ADC, Program, 1 Jul 1954, Section II, pp 3-7

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WESTERN AIR DEFENSE FORCE

Sqdn	Base	Aircraft	Sqdn	Base	Aircraft
322	Geiger (Wash)	F-86D	98	Klamath Falls (Ore)	F-94C
323	Larson (Wash)	F-86D	94	George (Calif)	F-102
325	Larson (Wash)	F-102	319	San Diego Area (Calif)	F-86D
317	McChord (Wash)	F-102	354	Oxnard (Calif)	F-89D
465	McChord (Wash)	F-102	413	Travis (Calif)	F-102
83	Paine (Wash)	F-89D	538	Castle (Calif)	F-86D
304	Portland (Ore)	F-102	63	Hamilton (Calif)	F-102

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TABLE IX

ANTIAIRCRAFT FORCES: June 1954*

EASTERN AIR DEFENSE FORCE

Air Division Area	Location	No. of Battalions	Type of Guns
32d	Boston, Mass.	3	90 mm
	Niagara Falls, N.Y.	2	90 mm
26th	New York City, N.Y.	1	120 mm
		7	90 mm
		3	Guided Missiles
	Philadelphia, Pa.	4	90 mm
	Baltimore, Md.	3	90 mm
	Washington, D. C.	2	120 mm
		3	90 mm
		1	Guided Missiles
	Norfolk, Va.	3	90 mm
30th	Pittsburgh, Pa.	3	90 mm
	Chicago, Ill.	2	120 mm
		3	90 mm
		1	Guided Missiles
	Detroit, Mich.	3	90 mm
		1	Guided Missiles
	S. S. Marie	1	Skysweeper

CENTRAL AIR DEFENSE FORCE

29th	Ellsworth AFB, S. D.	1	Skysweeper

*Source: ARAACOM, Statistical Data Book, 1 Apr-30 Jun 1954, p 5.

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WESTERN AIR DEFENSE FORCE

25th	Fairchild AFB, Wash.	1	Skysweeper
	Hanford AEC, Wash.	4	120 mm
	Seattle, Wash.	1	120 mm
		2	90 mm
28th	San Francisco, Calif.	1	120 mm
		2	90 mm
	Travis AFB, Calif.	1	Skysweeper
	Castle AFB, Calif.	1	Skysweeper
27th	Los Angeles, Calif.	3	90 mm
	March AFB, Calif.	1	Skysweeper

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HEADQUARTERS, AIR DEFENSE COMMAND

SEMI-ANNUAL HISTORY NUMBER SEVEN

June 1954

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BOOK II

ALL WEATHER INTERCEPTOR WEAPONS TRAINING IN THE AIR DEFENSE COMMAND: 1950-1954

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HISTORICAL STUDY
NO. 7

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ALL-WEATHER INTERCEPTOR WEAPONS TRAINING IN THE AIR DEFENSE COMMAND

DIRECTORATE OF HISTORICAL SERVICES
HEADQUARTERS ADC
COLORADO SPRINGS, COLORADO
31 DECEMBER 1954

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FOREWORD

> Obviously, when we get the weapon into position to attack and the pilot has the heart to kill, all our effort and money are still wasted if he does not hit the target. Herein then lies the key to our combat training requirement, i.e., to train men to hit the target.
>
> Major General Bergquist*

The end product of the air defense machinery is the destruction of the attacking force. How successful this end product will be depends to a great extent upon the skill of the interceptor pilot in hitting his target. Regardless of how successful the other steps in the process of putting the interceptor aircraft into position were carried out, it would be for nought if the pilot could not obtain a kill. The purpose of this study is to tell the story of the all-weather interceptor pilot weapons training carried on within the Air Defense Command from the time the first all-weather jets were assigned through 1954.

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* ADC's Deputy Chief of Staff for Operations. Quotation is from a transcript of an ADC briefing for Major General Roger J. Browne, USAF Director of Manpower and Organization, 12 August 1952 (HRF 56).

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the ultimate force and therefore the development of skill in the use of weapons in these aircraft was the significant and important consideration.

In gathering material for this study, I was greatly assisted by the staff of the Systems Training and Operations Division of the Directorate of Operations and Training, Headquarters ADC. Special acknowledgment is made of the aid given by Major M.C. Johansen, Major V.E. Chandler, Captain T.R. Mitchell Jr., Captain A.M.L. Sanders, Captain J. Simonton, and Mr. R.W. Carvill. I assume full responsibility, of course, for any errors in fact or interpretation in this work. Notification of any errors or any important omissions found by any reader will be greatly appreciated.

Lydus H. Buss
Directorate of Historical Services

Colorado Springs, Colorado
31 December 1954

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THE GUNNERY PERIOD

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ONE

ESTABLISHING AN ALL-WEATHER INTERCEPTOR GUNNERY PROGRAM

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The First All-Weather Interceptors

Air defense interceptors had to meet two exacting requirements. First, they had to have the ability to fight in darkness and in any kind of weather. This meant that they had to have radar in order to "see" and to have such other devices as de-icers and instrument landing equipment so as to be able to operate in bad weather. Second, they had to have the rate of climb and the speed of jet fighters in order to cope with fast, high flying bombers. The relatively slow propellor-driven aircraft were practically worthless against the modern bomber.

Development of such an interceptor lagged far behind the need. Late in 1949, the Air Force accepted the proposal of the Lockheed Aircraft Corporation to refashion its twin-place jet trainer, the T-33, into a jet night interceptor by adding radar and armament so that an aircraft might be had which at least partially filled the bill. As the only twin-place jet aircraft in production at the time, the T-33 was the only aircraft which could be used. The modified aircraft, designated the F-94A, was first received by air defense squadrons in the fall of 1950. When the Air Defense Command was activated on 1 January 1951, sixty of the 365 aircraft assigned to the new command were F-94As. Delivery began to ADC squadrons of

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the first jet fighter designed for all-weather interception, the F-89A, some five months later, in June 1951.* By the end of 1951, of the forty-one squadrons assigned, five were equipped with F-94As, five had the improved "B" model, and two had F-89Bs and F-89Cs which were later versions of the F-89A.[1] At the end of February 1953, just before a wholesale conversion began to rocket-armed interceptors, of a total of forty-eight squadrons, three had F-94As, seven had F-94Bs, and three had a combination of F-94Bs, F-89Bs, and F-89Cs.[2] By mid-1954, the gun-armed all-weather interceptors had been practically phased out of the command. In all, there remained only thirty-nine F-89Cs, eleven F-94As, and five F-94Bs.[3] By the end of the year, none remained.

All told, twenty-four squadrons had at one time or another these interim gun-armed jet all-weather interceptors. The maximum number of squadrons possessing these aircraft at any one time (in September 1952) was sixteen.

All of these early all-weather interceptors were equipped with the E-1 fire control system.** This was an interim piece of equipment developed out of existing components to meet the need. The E-1 system was designed for two-man operation and consisted of a fire control radar, the AN/APG-33; an optical gunsight and computer, the A-1;

---

* The F-94A and F-94B were not truly all-weather aircraft because they did not have adequate de-icing equipment. A more accurate term was night-fighter. A de-icing equipment modification was undertaken in 1952, but the equipment proved to be defective and was eventually wired in the off position.

** Information on the development of the E-1 system, its components, and a description of its operation is given in Appendix I, this study.

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and two scopes, one for the radar observer and one for the pilot. With the E-1 system it was possible to track either visually or with radar.

All of these aircraft had fixed guns -- the F-94s the .50 caliber machine gun and the F-89s the 20mm cannon. With fixed guns it was necessary to use the lead-pursuit course attack because in order to deliver enough shells to score a kill, the guns had to be trained on a bomber for an appreciable time. To hit the target continuously and to provide the required lead angle for the guns, the aircraft had to be flown so that it was headed slightly ahead of the target and turned with the target.

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Requirements for Gunnery Training

To train all-weather crews in the complete use of their fire control system required special equipment such as: targets which the radar could "see," i.e., would reflect the radar beam; tow target cable reels which could handle a cable long enough to make the target and the aircraft towing it distinct on the radar scope; aircraft to tow this cable and target at realistic speeds and altitudes; and a recording device to provide a means of evaluating the pilot's use of the fire control system. Unfortunately, all-weather interceptors were used in the air defense system long before these devices became available. In fact, the E-1 system aircraft were on their way out before anything other than makeshift equipment was in use.

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Lacking also were sufficient locations to conduct aerial gunnery training. The growing Air Defense Command found it exceedingly difficult to find ranges over which its squadrons could fire their guns.*

The result of inadequate and improper facilities and equipment was a low state of gunnery proficiency. The situation was cogently summed up in a report on a survey of the Air Defense Command made in November 1951 by the Air Force Inspector General. The IG commented that:[4]

> The largest single training deficiency in Air Defense Command is the inability of the average fighter pilot to shoot accurately; the most vital phase of the fighter pilot's training has, as in the past, received the least emphasis. There are many reasons for this most serious deficiency which has plagued the fighter forces for the past five or six years. Basically, it stems from the lack of adequate planning and timely procurement of responsible agencies. The failure to provide adequate ranges, tow targets, and allied equipment, has long been the contributing factor.

<u>Gunnery Ranges</u>. The fundamental requirement for weapons training both for day and all-weather fighter squadrons was, of course, the use of areas over which firing could take place and nearby bases for the aircraft using the ranges. The ranges available to ADC (nearly all were in the north and over water) which were near to squadron bases were almost all unsatisfactory. Either they were closed much of the year because of inclement weather, or they were not large enough for jet air-to-air gunnery (100 by 50 miles was the desired size), or they were controlled by another command or service and they were crowded and their continued use was undependable. Some ranges had all three advantages.

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* See Appendix II for a list of the ranges available to ADC in 1951.

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The local range situation in the Western Air Defense Force was typical. Here four local air-to-air ranges were in use: the Queets, Washington Warning Area; the Oregon Coastal Warning Area; the Point Arena, California Warning Area; and the Camp Irwin, California Warning Area.[5] The Queets, Oregon Coastal, and Point Arena ranges were all controlled by the Navy. Bad weather prevented their use much of the time. The Army controlled the Camp Irwin range and its use was dependent upon the needs of that service.

To provide a supplementary range on which all of its squadrons could train, WADF began negotiating in 1950 for the use of the Williams Bombing and Gunnery Range in southwestern Arizona which was controlled by the Air Training Command. Because of the importance that this range and the staging base at Yuma, Arizona eventually assumed in ADC weapons training, emphasis at this point on their acquisition and initial development is warranted.

The Williams range was large enough for a number of squadrons to engage in either jet aerial gunnery or rocketry. Of great importance also was the fact that the weather conditions in this area permitted year-around operations. To use the range, a staging base was necessary. There were several bases in the area, such as Dateland Field, Gila Bend Field, Yuma County Airport (a former Army field), and Luke AFB. Only the latter, which was being operated by the Air Training Command, could be used immediately -- the other bases needed rehabilitation. Of the other bases, the Yuma County Airport required the least amount of work. It was also very well located for use of the range.

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An agreement for the use of the Williams range by ADC squadrons was completed on 1 March 1951.[6] Under the terms of the agreement, both ADC and ATRC aircraft were to have unhampered use of the range and ADC squadrons were to be based at Luke AFB as tenants. Looking to the future, an alternate plan was written into the agreement which provided that if ATRC's requirements prevented use of Luke AFB by ADC and the latter had to find its own base, the range was to be divided between the two commands. The alternate plan, written with the use of Yuma County Airport in mind, provided that the range was to be divided into an eastern and a western section. The western section plus a lane approximately ten miles wide adjacent to the Mexican border across the whole range was to go to ADC.

Headquarters WADF and ADC began almost immediately to take steps to acquire the use of the Yuma County Airport. Approval came from Air Force Headquarters for occupancy and rehabilitation of the field early in May.[7] Coinciding with this approval was an announcement by ATRC that an increase in its activities made necessary the full use of Luke AFB and that WADF units would have to move.[8] The process of acquiring the Yuma Airport was given to the Army's Corps of Engineers. A right of entry was obtained by the latter on 5 June 1951 from the county and the Bureau of Reclamation, both of which had rights to the field.[9*]

---

* During World War II, the Yuma field was used by the Air Corps Training Command as a gunnery school. In September 1946, the field was declared surplus by the Army and it was transferred to the War Assets Administration. The latter transferred it to the Bureau of Reclamation and also gave Yuma County rights to the field. After

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The following day, the gunnery detachment, which had been established at Luke AFB for support of WADF units, began moving in.** On 7 June the detachment was discontinued and the 4750th Air Base Squadron (Gunnery Training) was established at Yuma to operate the base.[10] This organization was assigned to the 1st Fighter-Interceptor Wing (later changed to the 4705th Fighter-Interceptor Wing) until 1 March 1952 when it was assigned directly to Headquarters WADF.

In the area occupied by the Air Force there were two warehouses, a post exchange, an operations building, a barracks, and a large hangar. Construction of new facilities and rehabilitation of existing facilities had to progress along with operation of the base. The

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*(Cont'd) securing the right of entry, the Corps of Engineers drew up a Memorandum of Agreement for the Bureau and an agreement for the Civil Aeronautics Administration which was representing the county. Under the terms of these agreements, the title to the land held by Reclamation Bureau was to be transferred to the Air Force. The Air Force was in turn to give the Bureau and the county rights to certain areas. The county was also to get the right of perpetual easement over the runways. Neither of these agreements were ever signed, however. Operations at Yuma continued under the original right of entry. Settlement of the issue did not come until 1954. First, in December 1953, the CAA informed USAF that it agreed to the transfer provided the rights of the county were observed. Then in March 1954, an agreement was consummated with the Bureau of Reclamation which provided that the latter, which had its facilities scattered around the field, would be resettled in one area and buildings constructed for it if necessary. On 29 July 1954, the Department of the Interior issued a letter of intent stating that it agreed to the transfer of its holdings to the Air Force. The latter agreed to grant to the Bureau permanent right to the use of certain buildings and areas. The county was to be given right to its area and perpetual easement over the runways. See reference note number nine.

** No request was made for activation of the Airport at the time of occupancy. A request was made of USAF and granted in February 1952. On 11 March 1952, ADC General Order number twenty-four placed Yuma County Airport on active status and assigned it to Western Air Defense Force.

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initial project -- repair of runways and taxiways, repair and modification of the fuel systems, and refurbishing of buildings -- was completed in November 1951.[11] Troops had to be housed initially in the hangar.

Yuma Airport opened for business at the end of July 1951 with the barest minimum of facilities for handling one squadron. The first squadron arrived in the first week of September.[12] WADF set up a schedule for each of its squadrons to go to Yuma for twenty days each six months. During the first six month period, only a few of its squadrons were able to go either because of a shortage of aircraft or crews, or of maintenance difficulties, or of other projects of higher priority, or of conversion to new aircraft types.

Early in 1952, as will be discussed in a subsequent chapter, ADC Headquarters decided, because of the common lack of gunnery ranges throughout the command, to establish a command-wide central gunnery camp at the Yuma Airport. By March 1952, although facilities were not entirely adequate -- troop housing, supply and maintenance support were insufficient -- ADC directed each Defense Force to send twelve to fifteen aircraft to Yuma County Airport monthly.

Meanwhile, the Eastern Air Defense Force, faced with a range problem similar to WADF's, acquired the use of the Air Proving Ground Command's Eglin range in Florida and the use of Eglin Auxilliary Field number six as a staging base.

The Air Proving Ground ranges in Florida were the only ones with nearby bases which were immediately available. Negotiations for the

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use of APGC facilities began in January 1951 when EADF asked the Tactical Air Command, which had control of Eglin Auxiliary Field number two, if their base could be shared.[14] TAC replied that they were using this base fully, but that they had no plans for the use of Auxiliary number six which they also controlled. Turning next to the APGC, EADF secured an agreement on 29 January 1951 which provided for the use by its squadrons of aerial gunnery ranges in the Eglin area on a coordination basis and of the Auxiliary Field number six.[15] The agreement was to run to the end of Fiscal Year 1952. Following establishment of the right to use the field, EADF set up a support organization similar to WADF's 4750th, the 4611th Air Base Squadron (Gunnery Training).[16]

At best this was a temporary expedient. Eglin was very crowded and its use could not be continued indefinitely. EADF began looking around for another range and another staging base with the idea of establishing a permanent gunnery camp as had WADF. Among those examined was the Sarasota, Florida range and the nearby bases, Venice, St. Lucie County, and Punta Gorda.

The Central Air Defense Force, activated on 1 March 1951, was no better off than the other two Defense Forces in having enough local ranges for its squadrons. All such ranges in its area were limited either in size or because of adverse weather conditions. The Lake Superior range, for example, was open only four months of the year.[17] CADF squadrons also used the Eglin facilities acquired by EADF whenever possible, and, as noted earlier, in 1952 began

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sending squadrons to the Yuma County Airport. As did the other Defense Forces, CADF studied various locations with the view toward establishing a central gunnery range for all of its squadrons. Consideration was given to the use of Houma Field near New Orleans, Louisiana. This plan, however, as well as EADF's, for establishing a permanent gunnery camp, was abandoned in favor of setting up a large, well-equipped, command-wide gunnery camp at Yuma County Airport.

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Training Equipment. At the time of ADC's activation in January 1951, the gunnery training equipment in use was suitable only for training in day fighters of the relatively slow propellor-driven type. The equipment was inadequate for jet fighters. There was none for all-weather gunnery training. The urgent need for more advanced training equipment had long been recognized and development programs had been initiated. As early as January 1950, the Continental Air Command, which had responsibility for air defense at that time, had expressed concern over the lack of equipment for all-weather weapons training and asked that such equipment be procured as soon as possible. ConAC wrote to USAF that:[18*]

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> The urgency for this action is emphasized by the fact that no firing training facilities are available even though this command will receive the F-94A in the spring of 1950, the F-86D in October 1950, and the F-94B in February 1951. The fact that these aircraft have radically different tactical and technical characteristics necessitates new training equipment and procedures.

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* The F-94A was not received until the fall of 1950 and the F-86D until the spring of 1953.

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Higher headquarters replied that it was aware of the great importance of such training items and that development programs were underway for equipment such as cameras, targets, recording devices, and firing error indicators.[19] However, the availability of these items in the field, USAF continued, would probably be some time off.

One of the basic needs for all-weather gunnery training was a radar reflective tow target. The targets available at first could not even withstand towing at high speeds and altitudes. The targets in use until late in 1951, the A-6B, the A-25, and the Aero 25-A, either disintegrated completely or were torn to shreds when towed above about 20,000 feet and 200 knots.[20] To prevent loss of the target, ADC squadrons resorted to such expedients as wetting the targets before a mission or sewing cotton webbing across the ends.[21] Toward the end of 1951, a new A-6B banner target made of a plastic material, polyethylene, which could be towed at realistic speeds and altitudes, was received by ADC squadrons.[22]

This satisfied the need for a target for jet gunnery, but not for a target which could be "seen" by radar. A satisfactory answer as to how to make a banner target radar reflective simply had not been found. ADC Headquarters made this clear in a reply to a complaint of EADF's over the lack of such targets. Wrote ADC, "The inadequacy of present target configurations is recognized throughout the Air Force and every effort is being made by the many interested agencies to resolve this problem. Unfortunately there is no immediate solution in sight."[23]

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ADC squadrons had to resort again to expedients in order to have a radar reflective target. One of the means used was to sprinkle the target with chaff and secure it by spraying the target with dope.[24] A more satisfactory method was to fasten a metal radar reflector to the target.

A closely allied need was an aircraft which could tow the target at speeds and altitudes required for realistic jet aerial gunnery. Until late in 1951, targets were simply laid out on the runways and pulled into the air by F-51s. This often resulted in damage to the target and in some cases to the aircraft. A banner target carrier was developed in 1951, the Aero A-1, which could be attached to the T-33 trainer and to most of the current tactical jet aircraft.[25]

The Aero A-1 was limited, however, in that it could handle only 900 feet of cable along with the target. While radar ranging and visual firing was possible on a radar reflective target towed at 900 feet with the E-1 system, a cable of much greater length was necessary for safe scope firing.

A requirement was submitted to higher headquarters in October 1952 for a large tow aircraft capable of sustained flight at high altitude and speed.[26] ADC wanted at least twelve aircraft assigned which were able to tow a twelve by sixty foot target on two miles of cable at 250 knots, and 35,000 feet. In justification, ADC gave the opinion that "synthetic trainers, although adequate for learning procedures, are inadequate in maintaining proficiency. Thus provisions must be made which allow interceptor crews to train under more

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nearly combat conditions."[27] Washington refused ADC's request, however, stating that it was not Air Force policy to procure an aircraft specifically designed for a towing mission.[28] Unit tactical aircraft should be used until a drone aircraft, currently being developed, could be made available.

This was unsatisfactory, ADC explained.[29] In rocket-armed interceptors, firing from the radar scope would be necessary and a means had to be provided for actually scoring hits. A banner target was the device for this. With the greater ranges of the fire control system on rocket-bearing aircraft, a larger target than the six by thirty foot one would be required. This large target and the long cable required could not be handled by jet fighters. Therefore, a large aircraft with high performance characteristics was needed. However, if the requirement for an aircraft specifically designed for towing could not be filled, ADC said that it would be satisfied with the B-57 Canberra.

At this writing, this question has not been settled. In the meantime, ADC received B-45 jet bombers for towing, the first of which arrived in December 1953. No squadron equipped with the E-1 system aircraft trained with B-45s, however. By the time the B-45 aircraft were in service, early in 1954, the E-1 aircraft, rapidly being replaced with rocket-firing interceptors, were no longer being sent to the central training base at Yuma where the B-45s were operating.

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Maintenance and Calibration

Peripheral to the actual training of pilots in gunnery, but nonetheless important in the acquisition of gunnery proficiency, was the maintenance and calibration of the guns and the fire control system and the maintenance of the aircraft itself. In several ways the condition of the equipment and the aircraft affected gunnery training: in order for the complete fire control system to be used, each component had to perform correctly; properly functioning equipment was necessary for the pilots to gain confidence in their fire control system; the guns had to be correctly harmonized in order for the pilots to get hits; and the aircraft including the armament system had to be in commission, of course, to be used in gunnery training. The latter problem, that of aircraft out of commission, as will be told later, became most serious in the training of crews in the F-89 equipped squadrons.

The problem in the acquisition of gunnery skill in the F-94 and F-89 squadrons, resulting from a lack of knowledge of the fire control equipment and the ability to maintain and calibrate it properly, was cogently expressed in a report made by the USAF Inspector General following his survey of ADC in October 1951:[30]

> It would be logical to assume the gunnery capability would rapidly increase now that new targets and accessories are in the offing. The establishment of central gunnery camps in both WADF and EADF, wherein units assigned will go for yearly concentrated gunnery training, should increase the over-all capability. However, the reverse is true. Air Defense Command's gunnery capability is rapidly decreasing with the delivery of each new aircraft.

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> The basic reason for this regression is the new fire control system installed in the new aircraft. Comparatively few pilots can qualify as expert aerial gunners with the new A-1CM gun sight APG-33 radar combination in the F-94 and F-89. Presently, the only fighter pilots that can consistently hit the target are flying F-51, F-80, and F-84 using the K-14 gunsight. The new fire control systems are undoubtedly vast improvements over the K-14 gun sight; however, the complete lack of qualified maintenance people to work on the fire control system, the lack of test equipment and spare parts to keep the set operational, and the extremely limited knowledge on the part of the operations personnel limits the sight's usefulness from the start. The additional factor of what really constitutes correct harmonization techniques has not been answered for the units in the field.

Proper maintenance of the fire control systems in ADC squadrons suffered from a lack of skilled people and sufficient spare parts and test equipment. From the Air Training Command's fire control system school at Lowry AFB, Colorado came enough weapons maintenance people, but they had to have intensive and lengthy on the job training before they acquired the skill required to adequately maintain the complex equipment. ADC had instituted a thorough OJT program, but it had difficulty making ground against the large turnover of personnel.* The result was a chronic shortage of skilled technicians. An idea of the unstable personnel situation can be gained from a report made in June 1952 which showed that in the preceding twelve months there had been a command-wide turnover rate of airmen of 168 percent.[31] The turnover rate did not lessen. During Fiscal Year 1953, there was an airman turnover of 161 percent.[33]

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* For a more complete accounting of the whole training problem at this time, see Chapter Nine, pp 158-184, Air Defense Command Historical Report, No. Five (hereinafter cited as ADCHR).

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Even the most qualified people could do little without the proper test equipment. There was a continual shortage of such items as mockups, calibrators, tube testers, boresight kits, and signal generators. This too was an Air Force-wide condition. Explaining the maintenance difficulties to a USAF representative at Colorado Springs in August 1952, Colonel Thomas DeJarnette, then Director of Operations and Training, said, "there just isn't enough [test equipment] to go around for all our squadrons, now or in the foreseeable future. We are still short of test equipment on the A-1C sight, which has been in our unit for over three years."[34]

Procedures for correctly harmonizing the fire control system and the guns of the F-94 and F-89 aircraft were worked out in projects conducted by the 325th and the 84th Fighter-Interceptor Squadrons at ATRC's Nellis AFB, Nevada, at the end of 1951. At these tests, the project personnel concluded that for the E-1 system to be effective, it had to be very carefully and properly harmonized.[35] To accomplish this, the project officers recommended that an adequate firing-in range be provided at each fighter base, that harmonization at 1000 feet be required, and that complete harmonization equipment be supplied to each squadron such as transits, leveling bars, and a small spirit level.[36]

Although the various items of equipment required for harmonization became available, no more firing-in ranges than those already in existence were ever built. Only a very small number of bases had a 1000 foot range. Most ranges averaged from 250 to 450 feet.

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Some bases had no range at all. A requirement was established by ADC with USAF for 1000 foot ranges early in 1952. However, Air Force Headquarters had no construction criteria for ranges with the exception of the flexible gunnery type which was more elaborate and costly than required by ADC.[37] A design was submitted finally by ADC for a much less costly range, the reason being that the larger range was not needed for fixed guns and the ranges would be required for only a limited time. With the change from gun-armed to rocket-bearing interceptors, to begin early in 1953, firing-in ranges would no longer be required. The upshot of the whole affair was that with no construction started and not even any firm criteria established by mid-1952, the ranges programmed were cancelled with the exception of the one at Yuma. The range at the latter installation was not completed until May 1954.*

As noted earlier, training of any type was almost impossible in the F-89 equipped squadrons during 1951 and 1952. For the first year that F-89s were operated, from June 1951 to June 1952, lack of enough spare parts, ground handling apparatus, and test equipment kept an excessive number of these aircraft on the ground.[38]** During these twelve months, the in-commission rate of F-89s did not exceed fifty percent.[39] By mid-1952, the difficulties in supply, caused to a

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* By this date, ADC was sending only rocket-firing aircraft to Yuma.

** For a more detailed discussion of F-89 maintenance during this period, see ADCHR #3, pp 232-236.

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great extent by lack of accurate consumption data, had been mostly ironed out, but an even more serious problem had developed -- an increasing number of engine failures.

Engine failures reached such proportion by April 1952 that all F-89 series aircraft were grounded until new or overhauled engines could be installed.[40] Engine and structural defects continued to crop up, however, and in September all F-89s were again grounded.[41] All of these aircraft were removed from the command beginning in January 1953 and sent to the Ogden, Utah Air Materiel Area depot and to the California plant of the manufacturer (Northrup) for overhaul. By mid-1953, all of the grounded F-89s had been shipped from ADC and overhauled F-89Cs were being returned. Neither the F-89As nor F-89Bs were returned to the command. Of the five squadrons which had F-89s at the time of their grounding, three were given F-94Bs which were reassigned from ATRC and the other two were re-equipped with day jets.[42] When the F-89Cs returned, they were given to two of the squadrons which were originally equipped with this type aircraft and to a newly activated squadron.

The result of the poor in-commission rate and the later groundings of the F-89s was an extremely low state of crew proficiency in these squadrons. The example of the 176th Squadron (redesignated the 433rd) at Truax AFB, Wisconsin illustrates the situation which was true of all F-89 units in varying degrees depending upon the length of time that the squadron had F-89s. The 176th received F-89C aircraft in March 1952. Between that date and the grounding

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of these aircraft in September, the 176th's F-89s were grounded four times for a total of ninety days.[43] Only 520 hours were flown on these aircraft during this period. On examining this squadron early in September 1952, a USAF Inspector General team reported that "the 176th Fighter-Interceptor Squadron is not capable of performing its assigned mission. Frequent groundings of F-89 aircraft by higher authority has prevented aircrews from progressing beyond the transition phase."[44]

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TWO

GUNNERY PROFICIENCY

The Proficiency Training Program

ADC crew training was conducted under a yearly flying training program, the aim of which was to raise and maintain the proficiency of crews to a level established by training standards which were issued by ADC for each type of tactical aircraft it possessed.[1*] These training standards were ultimate or maximum goals of knowledge and skill required by a squadron to perform its mission. In addition to these optimum goals, ADC prescribed certain minimum requirements of flying time and skill in the operation of the aircraft and its equipment which the individual crews had to accomplish in order to be considered ready for combat.

The first unit proficiency training directives under which ADC crews trained were issued by the Continental Air Command in 1950. The ConAC training directive for all-weather crews, number 10-9,

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* Before a pilot could start the proficiency training program, he had to complete a program of transition into the particular unit's aircraft. ADC Headquarters prescribed only the minimum requirements of this program and left the flying training phase and time to the discretion of the squadron commander. Training accomplished during transition which was required by the unit proficiency directives could be applied to the latter. For the ADC requirements on transition, see reference note number one. In October 1954, a thorough and standardized transition training program was being prepared by ADC headquarters. When this program was put into effect, the training accomplished under it was not to be applied to the proficiency training requirements.

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programmed a total of 180 flying training hours and included such phases as airborne tracking, formation flying, instruments, and navigation.[2]* For gunnery, five air-to-air missions at altitudes of from 10,000 to 20,000 feet, five camera gunnery missions above 25,000 feet, and two radar gunnery missions were required. These relatively low requirements lasted until June 1951 when ADC published its first proficiency directives. ADC required thirty-six aerial gunnery sorties, of which twelve were to be flown above 20,000 feet.[3]** A total of twelve camera gunnery sorties were to be made above 25,000 feet.

ADC again raised the training requirements at the end of the year to 220 flying training hours, of which forty-two were in gunnery.[4] It became apparent almost immediately that these

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* Radar observers participated, along with the pilot, in nearly all phases of proficiency training. In the ADC directives, the radar observer was required in gunnery, for example, to become proficient in tracking and locking on to a radar reflector during gunnery passes and to be able to furnish the pilot with accurate range and closing speed information.

** The ability to find and destroy a target did not result from the gunnery phase of training alone, but was the product of the combined training skills. Interception by an all-weather aircraft was the work of a team which included the intercept controller, the radar observer, and the pilot. Gunnery training is emphasized here, however, because the purpose is not to examine each and every phase of the intercept, but only the ability to shoot accurately.

It should be noted also that in addition to the flying training part, the unit proficiency directives had a ground training program which included armament training. This portion of the ground training provided lectures and demonstrations on the operation of the gunsight, loading and arming the weapons, changing film magazines, film assessing, boresighting, and the theory and tactics of gunnery. For a complete training program, see the document cited in reference note number six.

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requirements were too high to be accomplished in the face of continued aircraft shortage and low in-commission rates. It will be recalled that it was during this period that the F-89 squadrons were having so much trouble with their aircraft. Because of this situation, in April 1952, the training time was put back to 180 hours. Aerial gunnery for all-weather squadrons was reduced to thirty-four hours with each pilot required to fly forty air-to-air gunnery sorties per year, of which twenty were to be above 20,000 feet.[5] Eight camera gunnery sorties were to be made above 20,000 feet and ten below.

These requirements were considered to be approximately the maximum which could be accomplished. Therefore, although new training directives were issued in mid-1952 and again in January 1953 (the last for the E-1 system aircraft), no great changes were made in the requirements. Both of these directives required forty day air-to-air gunnery sorties and one night sortie.[6] At least twenty of these were to be above 20,000 feet. In addition, each required twenty camera gunnery sorties, half of which were to be flown above 25,000 feet.

This then was the gunnery training program for the E-1 system aircraft squadrons. At the end of the first year (1951), the all-weather squadrons had flown about half of the required aerial gunnery sorties and only about one-third of the required camera gunnery.[7] At year's end, seventy-eight of the 126 all-weather crews (which included radar observers) were combat ready. All of those combat ready were in F-94 equipped squadrons. Only a few squadrons were behind in completion of the required aerial and camera gunnery sorties at the end of

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the following year, but the ratio of combat readiness had not increased. Of 313 crews on hand (249 in F-94 squadrons, 64 in F-89 squadrons), less than half, or 137, were combat ready.[8] Again, all of those combat ready were in the F-94 squadrons. Inability to qualify in gunnery was the primary cause for crews not being rated as combat ready.

Qualification in Gunnery

Training standards, as was mentioned earlier, were issued by ADC for each type of aircraft which established the maximum goals of skill required for performance of the mission. A training standard for F-94 equipped squadrons was issued in July 1951 and for F-89 equipped squadrons in January 1952. For gunnery proficiency, both standards required qualification as marksman or higher in accordance with rules established by Air Force Headquarters.[9] The Air Force rules called for scoring four consecutive missions, two above 20,000 feet and two below 15,000 feet.[10] To qualify as a marksman, a score of seventeen percent hits had to be made on the missions below 15,000 feet and twelve percent above 20,000 feet.

The first regulation issued by ADC establishing criteria for determining crew combat readiness was published on 31 January 1951. Starting cautiously at first with the idea of seeing what could be accomplished and of raising the requirements as more experience was gained, the requirements were considerably below the Air Force standards. Considering only the gunnery requirements, to be rated combat

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ready, a pilot in an all-weather squadron had to complete a total of twelve aerial gunnery missions, of which two were to be above 20,000 feet.[11] He had to score a minimum of ten percent hits on one or more missions. No mention was made of the aircraft type in which qualification was to be accomplished. Presumably, it could be a different type from the one currently possessed by the pilot's squadron. If the pilot already possessed SSN 1058 (later changed to AFSC 1124B), i.e., rated as an F-89 or F-94 pilot, to qualify as combat ready he had only to accomplish the unit transition program and satisfy the squadron commander as to his ability.

Even with these relatively low requirements, the number of pilots qualified in gunnery was low. At mid-1951, of an average of 954 pilots assigned (both day and all-weather), a total of 695 or seventy-three percent had not qualified.[12] Of those who had qualified, only a small number were in all-weather squadrons. In the seven F-94 squadrons, four had no crews qualified and three had an average of twenty-eight percent of their crews qualified. The one F-89 squadron reported fifty-seven percent of its crews qualified. However, since the requirements did not specify qualification in the aircraft currently possessed by the squadron, there was no indication that qualification was accomplished in the all-weather types. In actuality, there were no F-89 crews qualified in this aircraft. This was shown when in September 1951, ADC rectified this discrepancy by requiring qualification in aircraft currently being used by the squadron.[13] When this standard became effective, no F-89 pilot

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could be reported as combat-ready, for no firing for record had been accomplished in this aircraft.[14]

According to the USAF Inspector General, gunnery qualification being accomplished was not in the prescribed manner. Following an examination of the command in October 1951, the IG reported that ADC squadrons were accepting the highest score on any one mission and recording this as the qualification score. Their report concluded that "this has long become a general practice. The gunnery scores reflected on paper in no way reflect the real unit capability."[15] The Air Force rules for qualification in gunnery required that the lowest score in any one phase determine the degree of qualification in that particular event. The USAF inspectors also felt that there was too much latitude in the requirements and that the reports were not accurate.

To correct these deficiencies, General Benjamin W. Chidlaw, ADC's commander, advised the Air Force IG that more rigid and definite combat readiness requirements would be established and that the procedures for gunnery record firing would be standardized.[16] The new combat readiness criteria went into effect on 15 December 1951. The requirements were much higher, but still did not equal those prescribed by USAF. In gunnery, a pilot in an all-weather squadron, regardless of whether he had SSN 1058 or not, had to score a minimum of ten percent hits on two aerial gunnery targets above 20,000 feet in unit equipment aircraft.[17] The previous regulations had required scoring ten percent hits on one or more missions only, not necessarily above

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20,000 feet. ADC's purpose and its plans for raising the level of gunnery proficiency was shown in a reply to a complaint made by the Eastern Air Defense Force that these requirements were too high:[18]

> In an effort to improve the level of gunnery proficiency within the command, the criteria for determining combat ready interceptor pilots has been raised periodically. It is anticipated that the criteria will eventually reach the level required for interceptor pilot weapons qualification in accordance with AFM 335-25...

The first step in raising the ADC requirements to this level was taken with the publication on 6 December 1951 of the second regulation of which General Chidlaw spoke. This regulation, "Interceptor Pilot Weapons Qualification," established rules and procedures for gunnery record firing. They were in accordance with those prescribed by Air Force Headquarters. Among the rules established were the following: use of a six by thirty foot target; firing four consecutive missions, two above 20,000 feet and two below 15,000 feet; and qualifying scores of thirty percent for an expert rating, twenty-three to twenty-nine percent for a sharpshooter rating, and fifteen to twenty-two percent for a marksman rating.[19] Qualification in accordance with the rules established by this regulation was not specifically required, however, until April 1952.[20] When the rules of this regulation were made effective, gunnery qualification requirements in ADC reached the level established by the USAF rules.

Qualification in gunnery, which was the best measure of the proficiency of pilots in gunnery, was always at a low level in the E-1 equipped all-weather aircraft squadrons. Qualification was never accomplished by any pilots in either F-89As or F-89Bs, and it was not

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until August 1953 that any pilots were reported qualified in F-89Cs (the 433rd Squadron reported nineteen percent of its pilots qualified).[21] Up to this time, only the F-94 pilots had been able to certify themselves as accurate gunners. Only a handful of F-94 squadrons could ever report all of their pilots qualified and none were able to reach this state until late in 1952. The chart on the following page shows the percentage of pilots qualified by quarter year, as far as possible, from the first reports to the spring of 1954 when the E-1 system aircraft had been reduced to an insignificant number.

Failure to Use the Complete Fire Control System

Neither the regulations establishing the standards for gunnery qualification, nor those establishing the rules and procedures for firing for record specified use of the AN/APG-33 radar of the E-1 fire control system. The criteria for gunnery qualification required only a certain percentage of hits in unit aircraft, and the weapons firing rules required only that missions be fired at ranges greater than 600 feet to be scored. Because of the emphasis placed on qualification in gunnery, the pilots wanted to get as many hits as possible and took the easiest way, the way that was most familiar, use of the sight only. The result was that pilots ignored their radar, placed the sight in a fixed position, and, moving in as closely as was permissible, fired visually. Most firing was accomplished from as close as 600 to 800 feet. Two reports of inspections made by the USAF Inspector General illustrate this situation.

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The first, a report of an inspection of the 2nd Fighter-Interceptor Squadron at McGuire AFB, New Jersey (F-94s), made in August 1952, revealed that "gunnery was being accomplished with the sight locked in a fixed position and at a range of 1000 feet."[22] The second, a report of an inspection made of the 121st Fighter-Interceptor Squadron at Andrews AFB, Maryland (F-94s), in the same month, made the following observations:[23]

> This squadron had recently completed one month of concentrated air-to-air gunnery training. During this period all participating pilots were qualified under existing gunnery proficiency criteria which does not require use of the AN/APG-33 radar.
>
> No attempt was made to use the E-1 fire control system as intended. All air-to-air firing was accomplished at medium altitudes, using the A-1CM sight with the APG-33 radar locked out.

Such training not only lacked realism, but left a great gap in the pilot's training so that qualification actually meant little. In commenting on this situation, the commander of the 84th Fighter-Interceptor Squadron, Lieutenant Colonel Philip E. Joyal, stated in January 1952 that:[24]

> Current lines of thinking toward qualification in aerial gunnery must be changed. This is especially true in the case of the All-Weather Interceptor Units. Emphasis should be placed more on firing at greater ranges rather than qualifying at certain altitudes. Any fighter pilot with any technique at all can learn to drive into minimum range and meet qualifying scores. This is unrealistic and is accomplished at the expense of skill at greater firing ranges; ranges at which he will and should be shooting under combat conditions.

ADC was not unaware of this situation, noting to EADF as early as the fall of 1951 the inherent dangers in pilots not using their

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GUNNERY QUALIFICATION IN E-1 SYSTEM AIRCRAFT*

(Percentage of pilots qualified as of the end of the month by quarter year so far as possible.)

Sqdn.	Acft.	Jul 1951	Sep 1951	Dec 1951	Apr 1952	Jul 1952	Sep 1952	Dec 1952	Mar 1953	Jun 1953	Sep 1953	Dec 1953	Mar 1954
2nd	F-94	5	6	35	19	13	8	23	conv.				
5th	F-94	14	7	71	47	37	34	48	48	34	0	conv.	
27th	F-89						0	conv.					
57th	F-89									0	0	47	48
58th	F-94				32	69	92	100	100	conv.			
59th	F-94	0	4	30	48	42	56	0/S					
61st	F-94	56	59	45	16	91	58	80	75	57	0/S		
74th	F-89					0	0	0	conv. to F-94B: 20	conv. to F-89: 0	no rpt.	71	41
82nd	F-94				0	0	0	62	0/S				
83rd	F-89				0	0	0	0	conv.				
84th	F-89	57	62	0	0	0	0	0	conv. to F-94B-93	0	conv.		
121st	F-94		73	0	65	59	55	95th 100	77	conv.			
142nd	F-94		40	0	34	23	35	96th 67	100	100	conv.		

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GUNNERY QUALIFICATION IN E-1 SYSTEM AIRCRAFT*
(Continued)

Sqdn.	Acft.	Jul 1951	Sep 1951	Dec 1951	Apr 1952	Jul 1952	Sep 1952	Dec 1952	Mar 1953	Jun 1953	Sep 1953	Dec 1953	Mar 1954
148th	F-94		0	0	0	55	51	46th 90	100	100	conv.		
176th	F-89					0	0	433d 0	conv. to F-94B: 0	conv. to F-89: 0	32	38	21
317th	F-94	0	7	0	33	30	16	55	37	59	21	conv.	
318th	F-94	0	0	0	45	33	33	30	59	O/S			
319th	F-94	0	0	25	O/S								
438th	F-94									0	0	47	48
497th	F-94										0	7	2

*SOURCE: ADC, Command Data Book, August 1951 to April 1954 (HRF 903).

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fire control system properly and in learning to go in as closely as permissable to the target. ADC urged that firing be done at greater ranges:[25]

> Firing at lesser angles and ranges with the A-1 series sights not only fails to utilize the designed purpose of the sight, but is also unrealistic tactically when the lethality of bomber armament is considered. It is believed that interceptor units can further their gunnery programs and combat technique development today by using the sight as it was intended to be used instead of closing to ranges which penalize the sight and which could be suicidal in the face of return fire.

ADC felt, however, that it was not possible to direct use of the complete system. Replying to the Inspector General's reports on improper use of the system, ADC excused the situation on the grounds that difficulties such as lack of test equipment, lack of suitable targets, and inadequate numbers of trained personnel, had prevented use of the complete system. Use of the fixed range feature for qualification, while definitely not the desired method, had given crews the experience in the basic elements of gunnery while these difficulties were being "ironed out." ADC concluded that, "As these difficulties are surmounted full use of the system will be stressed more and more."[26]

Firing at greater distances by the use of range information supplied by the radar was required by the Defense Forces by the fall of 1952. Because of the increased bullet dispersion at longer ranges and the lack of a target larger than the standard six by thirty foot size, getting hits was much more difficult. As a result there was a general lowering of gunnery scores for all-weather

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crews and a decline of interest in gunnery. To overcome this, ADC decided to give the all-weather crews a 1.5 for one scoring factor when firing at ranges of 800 to 400 yards (the actual number of hits were to be multiplied by 1.5).[27] This method of compensating for the bullet dispersion was incorporated in a revision of the weapons qualification procedures regulation issued in February 1953.[28] Actual scope firing with the E-1 fire control system was never required in training.

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THREE

A WEAPONS TRAINING CENTER

The Need for a Command-Wide Training Base

As has been seen, in order to give their crews more opportunity to fire gunnery than local ranges afforded, both EADF and WADF established central gunnery camps to which all of their squadrons could be rotated. WADF acquired use of the Air Training Command's Williams Range in Arizona and set up a staging base at nearby Yuma County Airport. EADF secured use of the Air Proving Ground Command's ranges at Eglin AFB, Florida and of the Eglin Auxiliary Field number six. Use of the APGC facilities were on a temporary basis only, however, and plans were made to establish a permanent gunnery camp at another location. For EADF, ADC programmed facilities at Punta Gorda, Florida in the 1953 construction budget.[1] To provide CADF with a similar installation, ADC programmed construction of facilities at Houma AFB, Louisiana.

These plans to provide a gunnery base for each of the three Defense Forces were abandoned, however, by early 1952 in favor of establishing one central gunnery training base for the entire command. ADC made this decision primarily because of the extreme Air Force-wide shortage of the equipment and personnel required for a successful gunnery program. There were not enough training aids,

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experienced armament maintenance personnel, test equipment, qualified instructors, fire control mock-ups, and associated line equipment to go around. If three bases had to share the existing resources, the result would have been that none would have been adequately equipped or manned, at least in the immediate future. But by pooling all of the people and materiel at one base, it was felt that this base could be fairly well equipped and manned.

Of all the possible locations for this center, the one at Yuma, Arizona had the greatest number of advantages. There was enough land at the field to accommodate considerable expansion and the range was large enough for either gunnery or rocketry. The weather in southwestern Arizona permitted almost year-around operation. Finally, there was little question of the continued availability of the field and the portion of the range given to ADC.

For these reasons, early in 1952, ADC chose Yuma as the site for its weapons training center and began construction of additional facilities.[2] To obtain USAF Headquarters approval of its plans which was granted in mid-1952, ADC cited the following interesting facts: of 50,000 gunnery sorties required to train the forty squadrons then assigned, only some 9,000 could be accomplished at home bases; as a direct result of this situation, only approximately one-third of its crews were qualified in gunnery; and when ADC strength reached fifty-seven squadrons and the entire force was all-weather equipped, the sortie requirement would be raised by fifty percent.[3]

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The need for this central training base was expressed perhaps most clearly of all by Major General Frederic H. Smith Jr., ADC's Vice Commander, in these words:[4]

> The philosophy behind this...is this: it is true that Training Command is required to turn out young pilots who have a fairly good basic grounding in gunnery and in such tactics as the Training Command is able to teach. But 90 percent of our on-hand strength are pilots whose proficiency must be maintained, and who have to be taught new techniques to fit new weapons as they come along. We have far too small a force in our programmed 57 squadrons adequately to defend this country. It means that when you do vector one or two all-weather fighters into an approaching hostile bomber, that if they don't kill we are in the soup. We either have to ram, which is expensive and a little difficult to teach Americans I think, or a man gets through.
>
> We believe that with a centralized gunnery establishment at Yuma, we can get a lot of these so-called qualified marksmen -- possibly experts. And we think we can do it fairly cheaply.

<u>Build-Up of the Training Center</u>

To fulfill the fifty-seven squadron training requirement, according to ADC's calculations at this time, the Yuma center had to be able to handle as many as one-hundred aircraft at one time.[5] As planned, construction of the facilities to handle this load, such as additional ramp space, extensions of taxiways and runways, maintenance shops, warehouses, airman barracks, officer quarters, messing facilities, fuel and oil storage, and utilities, was to be completed at least on an austerity basis by around mid-1954.[6] Prior to this time, the capacity of the base, one squadron, was to be increased in phases so that two, then three, and finally four squadrons could be handled rather than simply staying at a one squadron

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level until the base was ready for four. The capacity of the first phase was to be sixty aircraft and was to be reached by September 1952. The capacity of the second was to be eighty aircraft and was to be reached by mid-1953. By the time the final phase was reached (100 aircraft), ADC planned to have a radar station in operation so as to provide training for controllers, as well as pilots, in radar interception. Control of Yuma was to be left in the hands of WADF which was to direct the development and operation of the center.

The development of the training center as established in this original plan fell short of the goals. To the end of 1953, when the last gun-firing aircraft visited Yuma (development of the center for rocketry training which occasioned many changes in the original plan is discussed in subsequent chapters), the maximum number of aircraft being sent by each Defense Force monthly was twenty, or a total of sixty -- the capacity set for the first phase.[7] Among the causes for this delay in development were lags in construction of such facilities as maintenance shops, barracks, and warehouses; a shortage of skilled maintenance personnel and gunnery instructors; and insufficient spare parts and equipment.[8] The latter shortage resulted partly from the problem of one base attempting to provide support for a large number of aircraft of different types including jet and conventional.

In addition to the reduced number of aircraft that the weapons center could handle, the training program was limited in effectiveness by a lack of high speed and high altitude tow aircraft.

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There were sufficient numbers of F-51s at Yuma Airport (eighteen were assigned by October 1952) to provide the required sorties.[9] These aircraft could not, however, provide realistic training for jet interceptor pilots. At mid-1953, nine T-33s were assigned to the Yuma center.

During the last six months of 1953, with a great number of ADC squadrons equipped with or in the process of converting to rocket-bearing interceptors (none of which went to Yuma until early 1954), the volume of aircraft in training at the center declined. The greatest number of aircraft at this base at one time during this period was forty-four.[10]

The radar station which ADC envisioned in its original plan was established early in 1953. Late in January, a search radar set (AN/CPS-5) and a height finder (AN/CPS-4) were installed in a remodeled training building.[11] The station became operational in March, but the first intercept was not run until around May first.

To keep up with the continued growth of the training center, the support organization was reorganized many times to permit expansion. Originally, in June 1951, WADF had established the 4750th Air Base Squadron with an initial authorization of six officers and 122 airmen.[12*] Because of the increasing workload

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* It is to be noted that the strength figures given here are indications of the relative strengths at specific times only and are not to be taken as the absolute strength over a period changed only by the various reorganizations. This unit was organized as a table of distribution unit initially and therefore it was possible to vary the personnel strength as the requirements changed.

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and the greater number of people required, on 2 June 1952 this unit was reorganized into a group, the 4750th Air Base Group (Weapons Training), and three squadrons were established under it -- a base service squadron, a materiel squadron, and a training squadron.[13] The strength authorized was seventy-one airmen and 331 officers. A second change was made on 16 February 1953 when the organization was renamed the 4750th Training Group (Air Defense).[14] The purpose of this change was simply to provide it with a name which more aptly described its mission. Greater responsibilities and personnel requirements resulting from the launching of a rocketry and research program at Yuma necessitated a second reorganization in September 1953. At this time, the unit was moved up to wing status -- the 4750th Training Wing (Air Defense).[15] Two groups and four squadrons were set up and placed under it. The authorized strength was eighty-six officers and 881 airmen.[16]

A final change in unit designation was made on 1 September 1954. In order to more properly identify the Yuma organization and to avoid conflict with Air Training Command units, the 4750th Training Wing (Air Defense) was renamed the 4750th Air Defense Wing (Weapons).[17] There were at this time two groups and five squadrons assigned to the wing. The authorized strength of the wing and all subordinate organizations in October 1954 was 145 officers and 1154 airmen.[18]

Transfer of Control to ADC Headquarters

The very great importance that the Yuma training center had assumed by October 1953 plus the additional heavy responsibilities

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given to the organization, caused Headquarters ADC to take over direct control from WADF. Consideration of the need for command headquarters control of this organization had been going on for some time prior to this. As early as March 1952, ADC's Directorate of Operations and Training had recommended, after a study of the situation, that:[19]

> The Central Gunnery Camp at Yuma be placed directly under the control of Headquarters ADC. This is considered mandatory for the following reasons:
>
> a. To be effective, with command-wide equality, the operational control must be from a central agency. Therefore, if operational control is to be had by ADC, it is important also that support and logistics functions fall under the same line of command...
>
> b. Problems have already arisen because EADF has been dissatisfied with their participation in gunnery activities under control of WADF...
>
> c. The importance of a central gunnery camp to air defense combat effectiveness readily qualifies the need for direct attention and control from the over-all command headquarters.

Again in February 1953, the Deputy Chief of Staff for Operations at ADC Headquarters recommended placing the Yuma organization directly under this headquarters.[20] Among the reasons cited was the inability of WADF to properly man the base. Under WADF, "personnel requirements of Yuma are weighed against those of the tactical squadrons [with assignments made] as tactical considerations dictate...The skilled personnel required to do the job should be carefully selected to provide use of command-wide availability of skills rather than an inordinate drain of resources in one of the defense forces."[21]

Because of these considerations plus the assignment of numerous research projects and the whole rocketry training program to

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the Yuma center, on 1 October 1953, ADC Headquarters assumed direct assignment of the 4750th Training Wing (Air Defense) and all subordinate organizations.[22]

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Use of the Eglin Range Discontinued

The Eastern Air Defense Force continued to use the range at Eglin AFB, along with the Williams range, up to 1 July 1953, the expiration date of the agreement with APGC. The 4611th Air Base Squadron (Gunnery Training) was discontinued and the troop spaces authorized to this unit were transferred to the 4750th Training Group at Yuma Airport.[23]

EADF had more squadrons than the other two Defense Forces and therefore requested in late 1952 that it be allowed to send whole squadrons to Yuma rather than the specified maximum of twenty aircraft allowed each Defense Force.[24] ADC refused at that time because EADF still had the use of the Eglin range. A readjustment was promised after the first of July when EADF moved out of Eglin. By this time, however, a wholesale conversion to rocket-armed interceptors was underway, gunnery training was curtailed, and the change was not made. Not until rocketry training began in 1954 was an effort made to send more EADF squadrons to Yuma than were sent by the other organizations.

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T H I S P A G E I S U N C L A S S I F I E D

part two

THE ROCKETRY PERIOD

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FOUR

THE ROCKET-BEARING INTERCEPTORS

Rocket Armament and the Lead-Collision Course

The fixed-gun interceptor, sole weapon of the ADC Fighter force up to the spring of 1953, was limited in its effectiveness in an attack on a well-defended bomber. The reasons were as follows: In order to deliver enough bullets to score a kill, the interceptor's guns had to be trained on a bomber for an appreciable time. To hit the target continuously and to provide the necessary lead angle for the guns, the interceptor had to be flown so that it was headed slightly ahead of the target and turned with the target. This resulted in a curved course that brought the interceptor in on the bomber's tail as the attack progressed. A bomber, more heavily armed than the interceptor and being a more stable gun platform, had considerable advantage over an interceptor approaching from the rear. Therefore, with this type of attack, plus the fact that the relatively short range of gun armament made it necessary for the interceptor to move within range of the bomber's guns, the probability of a gun-armed interceptor obtaining a kill on a well-defended bomber was low.

Rocket armament removed many of these disadvantages, giving the interceptor a much greater kill capability. Armed with rockets, the interceptor had to be in firing position for only an instant,

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for a single salvo was sufficient to knock out a bomber. This obviated the necessity of following the bomber on a curved course and made it possible to attack a bomber in a straight line from any direction.* Finally, greatly increased range was possible with rocket armament.

In consequence of the increased probability of interceptor survival and of bomber kill that rockets provided, the Air Force designed its new all-weather interceptors to use this armament, thereby instituting a major innovation not only in equipment, but in tactics. The rocket-firing interceptors were of three types -- the F-86D, the F-94C, and the F-89D. Each carried the 2.75 inch folding fin air rocket. The F-86D was armed with twenty-four, the F-94C with forty-eight, and the F-89D with the amazing number of 104 rockets.

All new and even more highly complex equipment was required for rocket fire control. The control system in the F-86D was designated the E-4, in the F-94C the E-5, and in the F-89D the E-6. Although tailored to fit the individual needs of each aircraft, these systems were similar in function: they located the target regardless of conditions of visibility; when the target was found, they directed the pilot on a straight-line attack course

---

* A ninety degree side approach was the most advantageous, for in this position the bomber gave the largest cross-section to the interceptor's radar and rockets, it made the bomber fire into a cross-wind, and it gave assurance that the interceptor would not collide with the bomber.

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to a point at which the rockets could be launched; and at the correct instant for firing, they launched the rockets automatically. The equipment performing these functions consisted essentially of two parts -- a radar, the AN/APG-37 in the E-4 and the AN/APG-40 in the E-5 and E-6, and a computer, the AN/APA-84 in all three fire control systems.* On a B-29 type target, the detection range of the E-4, E-5, and E-6 systems averaged between fifteen and twenty-five miles.[1] These systems could automatically track a selected target from fifteen miles to a minimum of around 150 yards. The average lock-on range (at which point automatic tracking was initiated) on a B-29 was from ten to fifteen miles.

The F-86D represented the most radical departure from previous all-weather interceptors, for it was a single-place aircraft. The presentations previously placed on the radar observer's scope in two-place interceptors were combined in one scope for the pilot. This meant that the pilot was responsible not only for search and target acquisition, but also for target tracking and rocket firing.**

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* See Appendix III for a complete listing of the E-4, E-5, and E-6 fire control system components.

** An operational suitability test was conducted by the Air Proving Ground Command of the F-86D equipped 94th Fighter-Interceptor Squadron at George AFB, California during January and February 1954. On the subject of one man operation, the final report of this test concluded that, "Although this test does not provide material for comparison of the single versus two place concepts, it does tend to indicate that an average individual can perform both the pilot and radar observer functions acceptably if given sufficient training. At present, however, very close control from GCI is necessary and the degree of success under certain attack conditions is very limited. As average skills increase, the requirement for extremely close control can be relaxed." /APGC, "Final Report on F-86D Squadron OST (Proj. Lock-ON)," 6 May 1954, HRF 317/

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The straight-line course flown in an attack by the rocket-bearing interceptor was termed a lead-collision course. This attack course was flown as follows.[2] In the F-86D (E-4), during the initial search operations, the scope displayed an artificial horizon and a range trace (a bright vertical line sweeping in unison with the antenna). When the radar was locked onto a target, a steering dot and two concentric circles appeared. The steering dot indicated the azimuth and elevation steering errors. By steering so as to center the dot, the interceptor flew a lead-collision course with the target. The inner circle served as a reference for centering the dot and the outer circle indicated the time-to-go before the rockets would strike the target. At twenty seconds before rocket impact, both circles began to shrink so as to allow more precise steering and to show the seconds before the rockets hit. If the attack were made from a direction other than the side, this phase of the attack continued until the rockets were fired, at which time an X appeared. On a side attack, at four-and-one-half seconds to go the reference circle flattened into a straight line. This indicated that the computer was correcting for asimuth errors and that the pilot had to correct only for elevation errors. As before, an X appeared when the rockets were fired.

The two-man F-94Cs and F-89Ds (E-5 and E-6) operated in exactly the same way except that during initial search operations, only the artificial horizon appeared on the pilot's scope. All other information was displayed on the radar observer's scope. At lock-on, the steering dot and two circles appeared on the pilot's scope.

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One of the most important considerations in this type of attack, of course, was the possibility of collision between the interceptor and the bomber. How a collision would be avoided was explained by the manufacturer of the fire control system, Hughes Aircraft Company, as follows:[3]

> ...the lead-collision course differs from a true collision course only in that it allows for the rockets' traveling several hundred yards ahead of the interceptor and dropping a few yards as a result of gravity before they strike the target. It is by virtue of this relative travel of the rockets that the interceptor clears the bomber it attacks...
>
> The relative travel of the rockets in the direction of the interceptor's velocity is normally about 500 yards. This means that the bomber will cross the interceptor's course at a point about 500 yards ahead of the interceptor...
>
> For a side attack, the bomber will have traveled a considerable distance laterally with respect to the interceptor's course before the bomber comes abeam of the interceptor...For a nose or tail attack, there will be little or no lateral clearance between the interceptor and the bomber since the two courses will very nearly coincide...
>
> Three principal factors affect the vertical clearance between the interceptor and the bomber: (1) the allowance which the fire control system makes for the net vertical drop, (2) the vertical angle between the course of the interceptor and the course of the bomber, and (3) the sum of the pilot's steering errors...
>
> The net vertical drop of an interceptor's rockets depends upon the ballistics of the rockets and the angle of attack of the interceptor. On the basis of currently available data, the fire control computer has been adjusted so that when the interceptor's angle of attack is zero, a vertical rocket drop of about 20 yards will be allowed for...

Conversion to the Rocket-Armed Interceptors

Rocket-bearing aircraft had been scheduled for delivery to ADC as early as the end of 1951. Initially, the F-86D was programmed to arrive in November 1951 and the F-94C and F-89D during January to March 1952.[4] Various production and technical difficulties had by

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mid-1951 pushed these dates back to January 1952 for the F-86D and F-94C and June 1952 for the F-89D.[5] By the end of the year, arrival dates had slipped to May 1952 for F-86Ds and August 1952 for F-94Cs and F-89Ds.[6] The F-86D and F-94C finally arrived in March 1953 (the F-89D was delayed until January 1954), but once started they came in such a torrent that in a little over a year, the great majority of ADC squadrons were equipped with these aircraft.

The first F-94C arrived on 7 March 1953 and was assigned to the 58th Fighter-Interceptor Squadron at Otis AFB, Massachusetts. On 30 March, the first F-86D arrived and was assigned to the 94th Fighter-Interceptor Squadron at George AFB, California. By the close of the year, twenty-eight squadrons had F-86Ds and eight squadrons had F-94Cs[7] Headquarters USAF termed this "the greatest increase in modernization of the USAF combat force since the end of WW II..."[8]

F-89D delivery began in January 1954 with assignment of these aircraft to the 18th Fighter-Interceptor Squadron at Minneapolis-St. Paul Airport, Minnesota. At the end of September 1954, four squadrons had the F-89D.[9] At the same time, thirty-eight squadrons had F-86Ds and ten were equipped with F-94Cs.

The sudden conversion to new, highly complex aircraft, while creating a potentially more lethal force, brought almost overwhelming problems. All of the difficulties usually associated with a changeover to new weapons -- supply shortages, insufficient numbers of skilled maintenance personnel, crew inexperience, etc. -- were multiplied many-fold. The experiences of the 93rd Fighter-Interceptor

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Squadron at Kirtland AFB, New Mexico, which received F-86Ds in the fall of 1953, as related by the 34th Air Division, illustrate the situation:[10]

> Upon receipt of F-86D aircraft in the 93rd FIS, the following conditions existed.
>
> a. Approximately fifty (50) pilots were assigned. Twenty-five of these had been checked out in the F-86D at ATRC bases, but only five of these had over ten hours in the aircraft and over 500:00 total flying experience.
>
> b. Only a very limited amount of ground handling and test equipment was available.
>
> c. Maintenance personnel, although for the most part qualified on jet aircraft, were not qualified on the F-86D.
>
> d. Adequate logistic support was not available for the aircraft or the fire control system.
>
> Other factors bearing on the extended transition periods were the numerous groundings of the F-86D for Safety of Flight Tech Order compliance, lack of training material and experienced instructors to train maintenance personnel and the lack of a flight simulator to train the pilots in the use of airborne radar equipment and the intercept problem.

The 34th Air Division also pointed out that the 15th Fighter-Interceptor Squadron at Davis-Monthan AFB, Arizona, which was equipped with F-86Ds early in 1954, had identical experiences, "the only difference being that they came later due to the later conversion..."[11]

Both the F-86D and the F-94C were exceedingly difficult to maintain. Between mid-1953 and mid-1954, the in-commission rate of the F-86D averaged no higher than fifty percent and of the F-94C about sixty percent.[12] During this period, both of these aircraft were grounded many times for short periods for modifications and parts changes. The F-86D was grounded for over a week in November for rework of the fuel system. At the end of December, all F-86Ds were

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grounded for a major modification of the fuel system.[13] This modification required considerable work by factory specialists and all F-86Ds were not released for flight until the first week of March.

The simple fact was that during this painful transition period, the problems of which were magnified by the suddenness with which the interceptor force was switched to the new aircraft, ADC's capability was considerably reduced. That this would be the situation was recognized before the first rocket-armed interceptor arrived, but the increased potential which these aircraft would give made it necessary that the risk be taken. ADC's Vice Commander, Major General Frederic H. Smith Jr., pointed this out to the WADF Commander, Major General Walter E. Todd, when the latter expressed concern over the impending all-out conversion and suggested leaving a few proven aircraft in each squadron.[14] General Smith rejected the proposal, stating that:

> squadrons with a proven aircraft as a back-up would be prone to rely on these aircraft rather than concentrating on the F-86D and F-94C, delaying the development of the capability of the new aircraft. I don't think we can emphasize this too strongly. The increased capability of the new AI interceptors over our present day aircraft, warrants an all out effort to bring these units up to a combat ready status at the earliest date. With this in mind, we are prepared to accept a calculated risk during this critical period.

Despite this statement, a modified version of General Todd's idea was put into effect. One of the complicating factors in the transition to the new aircraft was that their arrival coincided with the increased alert schedule applied at the beginning of each spring and continued through the summer months -- the period considered to be the most

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advantageous for an attack on the United States. The problem of maintaining an increased alert was partially alleviated by leaving a few of the old aircraft in possession of the squadron to stand alert or by assignment of older model aircraft to newly activated squadrons for this purpose.

At the end of the critical summer period, as had been the policy in the past, the alert schedule was lowered. This time, however, it was reduced to a somewhat lower level than before.[15] As noted by ADC, "the reductions in alert commitments...do not reflect a change in the intelligence situation but are considered advisable to facilitate conversion and training."[16] ADC further reduced its alert requirements on 1 December so that almost full time could be devoted to conversion. ADC ordered that, "during December, January, and February command wide effort will be concentrated on solution to training problems induced by unit equipment changes and low skill levels in air and ground crews. An added degree of risk...will be accepted in order to facilitate your training in this period."[17] In addition to the lowered alert, ADC left fulfillment of the unit proficiency directives to the discretion of the field commanders, noting that any waiver must be made in "realization that we must aim for peak readiness by next spring."[18]

Armament Maintenance

Proper functioning of the fire control system was never before so vital as in the rocket-armed interceptors. The split-second timing of the lead-collision course attack required precision

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operation of all components of the system. As pointed out by the commander of the Yuma center, the fire control system simply had to be in correct working order:[19]

> In aircraft equipped with fire control systems designed for the use of machine guns, the proficiency of the combat crew was of prime importance and while the systems maintenance personnel, charged with the maintenance of the fire control system itself, were important, the fire control system allowed the pilot several alternatives for the accomplishment of his mission in the event that any part of the fire control system was not functioning properly. This situation no longer exists in utilization of the E-4 and E-5 fire control system.

During 1953, the only rocket firing accomplished was for familiarization and equipment checks. Perhaps this was just as well, for during this time and far into 1954, parts, test equipment, and personnel were inadequate to maintain the equipment on the level required for actual record firing. A picture of the situation was given by the 4707th Defense Wing located at Otis AFB, Massachusetts, in August 1953:[20]

> The radar and fire control systems are difficult to adjust and maintain. Maintenance crews have difficulty in correcting malfunctions. The system does not operate very long once adjusted... The fire control system did not arrive with maintenance or operational technical orders or a parts replacement schedule. In addition, special tools, test equipment and required power were not available. Certain items are still lacking. Maintenance technical orders have only recently arrived in the operating unit and the table of supplies is still incomplete...
>
> Personnel of the caliber needed to maintain the fire control system have not been available to this command in numbers great enough to maintain the equipment. Units of this command have not had enough trained personnel to even determine whether or not the system can be maintained in an acceptable combat-ready condition.

Fire control system test equipment such as mock-ups, range calibrators, and tube testers was severely short. For example, ADC had

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a total of twenty of the very important range calibrators, AN/UPM-11A, in October 1953 to meet the requirement of seven in each squadron.[21] These calibrators were still in short supply at mid-1954 with barely a minimum requirement on hand in each squadron.[22] Power supplies for bench mock-ups, not available initially, were eventually secured through local purchase in late 1953.[23]

Probably the greatest problem, however, was the shortage of skilled fire control system maintenance personnel. This was a chronic, Air Force-wide situation, as was discussed in connection with gunnery training, resulting from such factors as long training periods and a continuous turnover of airmen. In response to a request for more people, higher headquarters pointed out in October 1953 that little could be done since ADC manning was as high as that of any command. The world-wide average for five level (skilled) airmen was 79.2 percent and for ADC 81.1 percent.[24] For the seven level (advanced) airmen, the ADC average was 85.3 percent compared to the world-wide of 83.9 percent. It was up to ADC to raise the level of its airmen by on the job training, USAF continued:

> Shortages in the higher airmen skill levels prevail throughout the Air Force. This condition must necessarily be shared by all commands. The upgrading of airmen to the higher skill levels is a responsibility of the major commands and is being accomplished through vigorous training programs in the commands... In view of the worldwide shortage of personnel in critical areas, Air Defense Command is being provided with officer and airmen personnel to the fullest extent possible without adversely affecting the capabilities of other commands.

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To supplement the fire control system training provided by ATRC's Technical Training School at Lowry AFB, Colorado, ADC distributed an OJT "package" training program containing reference materials, course outlines, and training aids.[26] During this period, the Defense Forces, particularly EADF, instituted very thorough fire control system OJT programs.[27]

As late as the fall of 1954, however, there were still too few highly skilled fire control system maintenance people and an excess of apprentice level airmen. ADC advised USAF Headquarters in September 1954 that there were over 900 apprentice level (30) E-4, E-5, and E-6 fire control system maintenance people in the command for an authorization of less than 200; and at the same time that there were just over ninety airmen of the highest skill levels (70 and 71) for an authorization of nearly 500.[28]

The authorization for fire control systems maintenance people as well as weapons mechanics (the people who took care of rocket storage, loaded and unloaded rockets, etc.) was raised in 1954 at the request of ADC. The latter asked for more people after discovering through experience that the tables of organization, which were drawn up over a year before (January 1952) the first rocket-bearing aircraft arrived, did not allot enough men.[29] The number of weapons mechanics proved to be especially short and ADC asked than an additional fifteen be authorized each squadron which would bring the total to twenty. This was the minimum required to have a crew of four on duty at all times.

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USAF consented to an increase, although not as large as ADC wanted, and pending a T/O change, authorized eleven more people effective for January 1954.[30] New T/O's were issued in February 1954 for F-94C squadrons, in March for F-89 squadrons, and in September for F-86D squadrons. By these, the F-86D and F-94C squadrons were authorized sixteen weapons mechanics each.[31] The F-89, with its much greater load of rockets, was authorized thirty-seven men for this function. These same T/O's also increased the number of fire control systems maintenance personnel from twenty-nine to thirty-three for F-86D squadrons and to thirty-five for F-94C and F-89 squadrons.

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FIVE

THE ROCKETRY PROGRAM: AIRCREW TRAINING

The Problem

For the second time, ADC was faced with the problem of providing training on a new weapons system for which there were no suitable training equipment, or techniques. The old techniques were not applicable and the equipment used by the E-1 system aircraft squadrons simply did not meet the needs. For rocketry, greatly improved equipment was required: tow reels had to be able to handle a cable of much greater length; targets had to be larger and provide more reflectivity; and tow aircraft had to be able to pull a target and cable of the increased dimensions at high speed and high altitudes. Entirely new devices were needed -- there was no way of assessing rocket firing.

The lead-collision course interceptor pilots could not ignore their fire control system and fire visually for qualification as had been possible with the E-1 system aircraft. The old and relatively simple gunnery qualification procedures could no longer be used. The success of a lead-collision course attack was dependent upon team proficiency and not solely upon aircrew skill. New methods had to be developed for measuring combat readiness. Until these methods were worked out, ADC required that the rocket-armed interceptor pilots

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could be rated combat-ready simply by demonstrating proficiency in search, lock-on, and tracking through the breakaway signal; completing ten intercepts and thirty successful attacks; and showing knowledge of the use of the sight.[1*]

Adding to the problem was the fact that unlike the gradual, and never complete, conversion to gun-armed all-weather interceptors, the entire force was rapidly being switched to rocket-bearing aircraft. The need to bring together all of the right ingredients for training was urgent. But there were advantages over the 1950 situation. Most of the training equipment required was within reach, there was considerable experience in all-weather operation, and, possibly most important of all, there was a ready-made facility for establishing and conducting a training program -- the Weapons Training Center at Yuma, Arizona.

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The Centralized Training Program

ADC decided that the best way to train its crews in rocketry and to achieve a high level of combat readiness was through standardization of tactics and techniques. This concept required a centralized training program which, when possible, could be supplemented by home base training.

Authority was given to the Yuma center on 26 May 1953 to develop a lead-collision course and a controller training program.[2] This

* This was in addition to the requirements of skill in other phases of interceptor operation such as instrument flying.

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meant testing and development of equipment and procedures as well as the conduct of the training itself. Actual rocket firing training was to be accomplished no where else until the equipment and techniques for home-base training were developed. Local ranges were to be used in the interim by the remaining gun-armed aircraft equipped squadrons (after December 1953, no more gun-bearing interceptors were sent to Yuma). Initially, 1 October 1953 was set for the beginning of rocketry training at Yuma. As will be shown, the program could not be started until 1 February 1954. Six F-86Ds and six F-94Cs were assigned to the center early in May to carry out of the project.[3] It will be recalled that eight T-33s had arrived a short while after this date, and that a radar station had been set up early in the year.

Within a month after authority had been received, the weapons center personnel had evolved a concept for a rounded rocketry training program. Training for all three members of the air defense combat team -- the controller, the aircrew, and the maintenance personnel -- was envisioned. As explained by the center's commander, Colonel Robert F. Worley, all three had to be equally proficient, for the success of a mission in the lead-collision interceptors depended upon the skill of all three:[4]

> It follows then, that combat capability of an organization can no longer be measured with any degree of accuracy solely by an aircraft in-commission rate or combat crew status... effectiveness can only be determined by the overall effectiveness of the fighter unit combined with the AC&W unit... There exists then a requirement for proficiency training of aircraft controllers, and systems maintenance personnel, as well as fighter crews. This proficiency training should be conducted in several phases of operation which will weld the components referred to above into one team which can prove its combat effectiveness by actually firing rockets.

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To achieve this concept of combat team training, a three-phase program of instruction was to be established for both the lead-collision training and the controller course, geared to the time period set up for both. ADC decided that a squadron had to be at Yuma at least one month to receive the required training. The squadron training program decided upon was as follows.[5] The first phase was to provide familiarization and was to include lectures to aircrew members, armament systems personnel, and rocket-handling personnel. The aircrews were to make simple intercepts on T-33 target aircraft. A second phase of the same length of time, was to provide lead-collision "dry runs" on a towed banner target for target discrimination practice. The final phase, which equaled the first two in duration, was to consist of actual rocket firing passes on a towed banner target.

The controller course was to be of two-weeks duration, with a new class of eight controllers to arrive each week making a total of sixteen in training at all times. The three phases through which the course was to progress followed the lead-collision training program closely.* In the first phase, the controller was to direct a single interceptor against a target aircraft. In the second, he was to direct more than one interceptor on dry runs on a towed target. Finally, he was to direct actual rocket firing interceptions.

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* A more detailed account of the controller proficiency course is given in Chapter Six, this study.

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Equipment for the Central Weapons Training Program

Tow Aircraft. It was the lack of tow aircraft that was primarily responsible for delaying the start of rocketry training and for limiting it once it had gotten underway. Tow aircraft for rocketry had to meet very high requirements. To provide the distinct separation between the tow aircraft and the target on the radar scope required for safety, there had to be at least 5,000 feet of cable between the target and the ship towing it. To haul a cable of this length plus a large target at the speeds and altitudes required for realistic training was a job for a large jet aircraft. Back in October 1952, it will be recalled, ADC had requested that an aircraft meeting these requirements be developed and procured. Higher headquarters refused, stating that it was against Air Force policy to procure an aircraft specifically designed for towing. A second request was sent in December 1952, this time for the B-57 Canberra. No answer was received, so the requirement was again submitted in October 1953.[6] The B-57 requirement was still an open question at the end of 1954, although ADC's request was before the Air Council.[7]

While ADC continued to press for the assignment of B-57s as the only aircraft which had the performance to meet the required standards, other types of aircraft were tested for interim use by the ADC weapons center personnel. In addition, Air Force research and development agencies were testing various aircraft and tow reels. At Yuma, a B-29 was received from the Tactical Air Command on loan in August 1953 and a new tow reel, the Mark VIII which

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which could handle up to 12,000 feet of cable, was installed in it. Test of this aircraft showed that the B-29 was not satisfactory, being incapable of sufficient altitude and speed.[8] Yuma next tested a B-45 jet bomber, which was also borrowed from TAC, with the Mark VIII tow reel. This aircraft proved to be much more satisfactory.[9]

On the basis of this, ADC asked and received approval from higher headquarters for fifteen B-45s. However, only eight were to be assigned in 1954, with the remaining seven to be delivered in the fall of 1955. In vain, ADC objected to this, pointing out that eight B-45s could provide only half of the minimum sorties required for the total of four squadrons which it planned to send to Yuma monthly.[10] Eight aircraft could provide training for only two squadrons because for each squadron, a minimum of two aircraft had to be flyable at all times and the in-commission rate of B-45s was expected to be fifty percent.

At any rate, the first B-45 arrived at the end of 1953. Four were on hand by March and the remaining four to be delivered in 1954 were at Yuma by the end of June.[11]

Meanwhile, with no tow aircraft available, the beginning of rocketry training had to be pushed back from 1 October 1953 to 4 January 1954. Training could have been started on a very limited basis at this time, but the commencement of the rocketry program had to be delayed another month, to 1 February, because of the grounding of all F-86Ds at the close of 1953, which was mentioned earlier.[12]

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Once started, training was severely limited because of the small number of B-45s on hand and the very low in-commission rate of these aircraft.[13*] Also, the B-45s on hand were not too satisfactory because their J-35 type engine did not provide sufficient performance for realistic tow speeds above 20,000 feet nor long enough time on the range.[14] To rectify this, the eight B-45s assigned were to be retrofitted with a more powerful engine, the J-47. This modification was to begin in January 1955.[15]

Another deficiency was the shortage of tow pilots. For the fifteen B-45s, ADC was authorized thirty pilots. As late as September 1954 (eight B-45s on hand), only four B-45 pilots were assigned.[16] When pressed for more pilots, USAF advised that none were available and that the remainder would have to come from ADC sources. By September, ADC was checking out additional pilots in the B-45 at Yuma. In order to get more tow aircraft in the interim before additional B-45s were received (or B-57s were assigned), ADC agreed in August 1954 to accept B-29s.[17**]

Much of the training accomplished was by use of T-33s (there were sixteen at Yuma by May) to a greater extent than had been planned.

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* The first organization to go to Yuma, the 58th Fighter-Interceptor Squadron from Otis AFB, Massachusetts, accomplished a total of only fourteen rocket firing missions (39 sorties). For source, see reference note number thirteen.

** A total of thirty-six were to be assigned to ADC, twelve for the Yuma Weapons Training Center and twenty-four for the second training center. For information on the second center, see Chapter Seven, this study.

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Initially the plan was to use T-33s in the first or familiarization phase only. The shortage of B-45s made it necessary to use T-33s in the second or target discrimination phase.[18] This was accomplished by flying one T-33 aircraft 5,000 feet behind and 700 feet below another to simulate the tow ship and target arrangement. B-45s were reserved for the third or actual firing phase.

At one time it had been thought possible that the T-33 could be used for towing and the Mark VIII reel was installed in the rear cockpits of two of Yuma's aircraft early in 1954.[19] The testing which followed proved that T-33s were not capable of the tow job required.

The Mark VIII tow reel itself gave some trouble. With this device, around twelve minutes were required to launch each target and it was very difficult to reel in the large nine by forty-five foot target.[20] A requirement for an improved reel was sent to USAF, but none had been received by the end of the year.[21]

<u>Targets</u>. The only target available when the Yuma center began its research into a rocketry program was the six by thirty foot polyethylene banner which the E-1 system aircraft squadrons had used by tying a radar reflector to it. This target was not big enough because of the large rocket dispersion, nor was it sufficiently reflective with the one reflector for the greater radar detection and lock-on ranges of the rocket fire control system. To make possible the use of the maximum capabilities of the fire control systems and thereby provide realistic training,

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ADC wanted a large (at least nine by forty-five feet) target with self-contained reflectivity. One such target was in production at this time and various civilian and military agencies were working on others.[22] None of these, however, was entirely suitable. USAF's Air Proving Ground Command was given a project to develop a reflective target, but one had not become available at this writing.

In the meantime, the Weapons Center people discovered that a polyethylene banner with two ten inch spinning reflectors fastened to it gave fairly satisfactory results.[23] It was with these targets and reflectors that rocketry training was started in 1954. A larger banner target made of a lighter material, a nine by forty-five foot marquisette target, was supplied to Yuma in May 1954. The spinning reflectors were also used with this target.

Rocketry Scoring Equipment. In rocketry training, proper functioning of the equipment was as important as aircrew effectiveness. For this reason, measurement of proficiency required evaluation of the functioning of the entire system as well as of the performance of the pilot.

The method determined best for evaluating pilot performance was to record the attack display on the radar scope which, when played back, showed the pilot's steering techniques. The most satisfactory device for this purpose was a multi-channel magnetic tape recorder developed by the North American Aviation Corporation, called NADAR (North American Data Airborne Recorder). A requirement was established by ADC in May 1953 for installation of NADAR in all of its

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lead-collision course interceptors.[24] NADAR was slow in coming, however. The first aircraft (from production) equipped with the NADAR system were not delivered until early in 1955.[25] In the meantime, scope cameras were used for recording as they became available. The scope cameras and their mounts were also slow in coming. It was not until late in 1954 that most squadrons had them. Without scope cameras or NADAR, the only means of evaluation was counting hits in the target.

To evaluate the functioning of the system and along with it the proficiency of the maintenance crew, it was necessary to assess the rocket dispersion. Several devices for this purpose were under development such as electronic and accoustic firing error indicators, but in the interim, a method developed by the Navy was adopted and instituted at Yuma. This was the stereo camera method of assessment.[26] Two N-6 cameras, focused in a cross pattern, were mounted under the wings of the aircraft.

<u>Chase</u> <u>Aircraft</u>. In their research on rocketry training, the people at the Yuma training center determined that single-place fighters making lead-collision course interceptions should be accompanied by another aircraft to observe the firing. As explained by the 4750th Training Wing:[27]

> The purpose of a chase aircraft is simply to provide "life insurance" for the tow aircraft and its crew. By observing the relative positions of the interceptor and tow aircraft at the "20 seconds to go" point, the chase pilot insures that the interceptor's radar is not locked on to the tow aircraft. At "20 seconds to go" the chase pilot observes this relative position and instructs the interceptor pilot that he is clear to complete the pass or orders him to break off the attack.

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Both T-33s and the tactical aircraft of the unit at Yuma were used for this purpose. The slow rate of climb and speed of the T-33s in comparison to the tactical aircraft made them unsatisfactory, while use of unit tactical aircraft limited the amount of training that the squadron could accomplish. In August 1954, therefore, ADC asked USAF to assign fifteen F-86Fs to Yuma for use as chase aircraft.[28] Air Force Headquarters offered F-94Bs and F-84Fs, but ADC turned them down.[29] The F-94Bs were considered unsuitable because of speed limitations and the F-84Fs unsatisfactory because of engine and airframe deficiencies. ADC again expressed the need for F-86 type aircraft, but by the end of the year its wishes had not been granted.

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<u>Status of Rocketry Training at Yuma</u>

Training was started at Yuma, as noted earlier, on 1 February 1954. The first squadron to go to Yuma for rocketry training was the 58th Fighter-Interceptor Squadron from Otis AFB, Massachusetts. This squadron was equipped with F-94Cs. The extent and quality of training provided was very limited at first, only gradually increasing as tow aircraft, scope cameras, and associated equipment became available. During the first six months of operation, some eight squadrons went through the course.[30] No more than two squadrons were in training at Yuma at one time. All of the squadrons going to Yuma were either F-86D or F-94C equipped. The first F-89D equipped squadron did not go to Yuma until the last week of November.[31]

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The ADC Unit Proficiency Directive for E-4, E-5, and E-6 fire control system equipped aircraft, issued in September 1953, required forty aerial rocketry sorties per year.[32] Of these, twenty-four were to be scored. In addition, each crew was required to fly twenty-four radar scope recording sorties each year. According to a report of an inspection made in August 1954 by the USAF Inspector General, aircrews were receiving an average of sixteen firing sorties during their training there.[33] No figure for non-firing sorties per individual crew was given, but up to the time of the inspection, 1260 sorties were made on the average by each unit of which 720 were non-firing.

It was almost impossible at this early stage to determine the increase in squadron capability that resulted from training at Yuma, but in this same report the IG stated that "an educated estimate is from forty to fifty percent. This figure of increased capability was based on discussion with personnel at Yuma and two TDY squadron commanders. This appears realistic when it is realized that ADC units have fired few if any air rockets prior to training at Yuma, irrespective of the length of time UE aircraft have been assigned."[34]

Home-Base Training

To supplement the one-period per year central training, a means had to be provided for units to train at their home bases. The only type of home training possible at this writing was simulated air-to-air attacks. Recording of the attack display made evaluation of aircrew performance possible, but this training was

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limited. Without assessment of rocket firing, evaluation of the system and the maintenance crew could not be made. However, even scope recording was not possible by most squadrons until late in 1954. As noted earlier, scope cameras and mounts were almost as slow in being made available as NADAR.

For actual air-to-air rocket firing, suitable ranges, targets, reels, and tow aircraft had to be put at the disposal of the squadrons in the field. By late in 1954, considerable progress had been made toward making a complete home training program possible, however. A target system was under development by the Weapons Training Center. Being developed was a light-weight frangible type target which would shatter and cause no damage if struck by an interceptor, and a light-weight reel.[35] Use of the T-33 for towing was planned. To make more ranges available, ADC asked USAF late in 1954 to allow firing on ranges smaller than fifty by one-hundred miles.[36]

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SIX

THE ROCKETRY PROGRAM: INTERCEPT CONTROLLER TRAINING

On-the-Job Proficiency Training

Establishment of a proficiency course for controllers at Yuma was an important innovation in ADC training. Previous to this, the only means of increasing the skill of controllers within the command was on-the-job training. Institution of an OJT program was directed by Headquarters ADC in February 1951 following receipt of an Inspector General report which revealed that many controllers were unfamiliar with the flight characteristics of fighter aircraft under their control and the bombers to be intercepted.[1] The program was subsequently expanded and established in regulation form in August 1952. The Air Division commanders were directed by this regulation to evaluate continuously the proficiency of controllers and to implement a training program designed to correct deficiencies uncovered.[2] To assist the field commanders in evaluating proficiency and in establishing a training program, ADC outlined the minimum knowledge and skill required and directed that a written test be given controllers yearly. Controller training was quite general in nature, however, and wide variances were possible. Unlike aircrew training, there were no specific requirements, such as a number of monthly or annual intercepts to be completed or standards for combat readiness qualification.

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The skill of controllers on the whole never reached the level desired. Inadequate training was partly to blame for this, perhaps, but the major causes were factors beyond the control of ADC, such as personnel turnover. At any rate, a second Inspector General survey, which was made in October 1951, disclosed that the condition was much the same as it had been a year earlier. After tabulating the results of a questionnaire sent to controllers, the IG reported that "some improvement has been accomplished since a similar questionnaire was distributed one year ago, but general controller qualification is still considered unsatisfactory."[3] A third IG inspection, conducted early in 1953, showed that the over-all skill of controllers at the time rocket-firing aircraft began to arrive was at about the same level as in 1951. According to the IG report of the 1953 inspection, "the status of training of directors...was very low, less than 50% of them being considered fully qualified."[4]

Air Defense commanders were certainly well aware of this situation, for the advent of the new concept of the lead-collision course and the absolute requirement for controller skill had brought the deficiency into sharp focus. The need, ADC decided, was to establish minimum proficiency requirements for controllers on the order of those for aircrew proficiency.[5] Study of the needs was made during 1953 and at the end of December, a new regulation was issued which established a much more specific and comprehensive training program. Included was a minimum number of interceptions to be completed yearly, a ground training program, an extensive outline of knowledge and skill required,

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and instruction for evaluation of proficiency to be made every six months.[6] Following issuance of this regulation, in January 1954, ADC prescribed a written examination which was to be given to each controller semi-annually.[7]

In July 1954, ADC established the requirements for rating intercept controllers combat ready. Only those who had demonstrated their ability to conduct lead-collision course intercepts were to be considered combat ready. The other requirements were as follows:[8]

a. Passed the controller-director written examination... with a grade of 100%.
b. Performed satisfactorily five lead-collision course interceptions...with a minimum score of 32 points...
c. Performed satisfactorily two lead-collision course interceptions simultaneously...with a score of 30 points...
d. Have met the pro-rata monthly minimum proficiency requirements for directors...for a period of six months.
e. Have been evaluated as proficient...

Controllers Proficiency Course

The sudden and complete changeover from gun-armed interceptors to rocket-bearing interceptors and the critical importance that the controller assumed in the success of a lead-collision course attack made it impossible to continue to rely on an OJT program alone. Entirely new techniques had to be learned by the controllers, for the lead-collision course was a complete departure from the old curve of pursuit stern-quarter attack.

Early in 1953, Headquarters ADC told its Western Air Defense Force, which had control of Yuma at the time, to set up a controllers training school at Yuma to teach the specialized techniques of

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lead-collision course intercepts. The proposal made by ADC at that time was that the school should be started early in the year. WADF recommended against starting the school so soon, pointing out that neither personnel nor equipment were available and that there was no reason to get the course going until more units had rocket-firing aircraft.[9] WADF felt that the beginning of the controller course should be delayed at least until the critical summer period had ended.

ADC Headquarters agreed that the course could not be effective until an adequate number of aircraft and personnel were available and that a delay was in order, but declared that the course had to be ready at the end of summer period: "The importance of the school in aiding our controllers to maintain their proficiency and develop the best tactics and techniques to be employed places a requirement on the command that cannot adequately be fulfilled with measures currently in use or otherwise programmed."[10] October 1, 1953, therefore, was set as the opening date.

As matters turned out, it was not possible to start the course on 1 October. Not all of the personnel had been assigned or all of the equipment installed and tested by that date.[11] Further, as discussed earlier, the rocketry firing program could not be started at that time. Finally, the whole program including course outlines, equipment, instructors, etc. had yet to be tried out. The course could possibly have been started on 1 December, but if begun at that time, it would have had to have been broken off during the last part

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of the month for the Christmas holidays. For these reasons, ADC postponed the opening to the first of the year. "The months of November and December," ADC directed, were "to be utilized by the school staff as a 'shake-down' period..."[12] All was in readiness by year's end,[13] but the start of the course had to be delayed again because of the F-86D grounding. The first class finally got underway on 1 February 1954.

Each class had eight students (except the first which was purposely reduced to four) and lasted two weeks. Eight new students entered each week, making a total of sixteen in training at all times. Eight students was the capacity of each class in the school. Of these eight, four worked with the rocket-firing program and the other four were used for relief or received synthetic training and academic instruction.[14] In the first week of the course, the controllers received briefings on the rocket fire control systems, instruction in tactics and techniques of the ninety degree beam lead-collision course interception,[15*] synthetic training, and fourteen hours of actual control practice on familiarization (Phase I) missions. During the second week, each student spent sixteen hours

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* Because of the many advantages of the ninety degree beam approach, it was specified by ADC. Controllers had considerable difficulty at first, however, in putting the interceptor in a ninety degree beam approach position. One of the causes for this difficulty was the effect of wind masses aloft. A system for allowing and correcting for the wind masses was developed by Colonel Thomas Beeson at WADF and adopted by ADC. The Beeson method was taught by the Yuma controllers course. For a complete description of this method, see document cited in reference note number fifteen.

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controlling target discrimination (Phase II) and actual firing (Phase III) missions, and six hours as a senior director. For the training, all of the facilities normally found at an AC&W site were available.

Authorizations for students to be sent to the Yuma course were made equally to the three Defense Forces. During the period 1 February through the end of June, for example, each Defense Force was authorized fifty-four students.[16] In the first few weeks, as often happens in new programs, authorizations were exceeded or not met in some cases. Also, the directive of ADC to send only the most highly qualified officers was not always observed. In April, ADC Headquarters directed closer compliance with the requirements.[17]

As to the extent of training accomplished, 131 controllers were trained from 1 February through 30 June.[18] During this time 8275 interceptions were attempted, of which 6162 were completed.

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THE WEAPONS TRAINING CENTERS: STATUS AND REQUIREMENTS

Evaluation of the Yuma Center

Following his inspection of the Yuma weapons center in August 1954, the Air Force Inspector General declared that, "The 4750th Training Wing was not capable of supporting the air-to-air training requirements of the Air Defense Command."[1*] Among the reasons he gave for making this analysis were inadequate tow equipment and lack of suitable chase aircraft. These deficiencies were discussed in detail in Chapter Five. Other reasons which he listed were inadequate maintenance facilities, paucity of skilled maintenance personnel, insufficient fixed base facilities, and a too small rocket impact area for four squadrons.

These conditions were already known to ADC and programmed action or requests for action, if approved, would take care of these deficiencies. Shop and hangar facilities provided for in the Fiscal Year 1956 Public Works Program, plus facilities

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* The mission of the 4750th at the time of this inspection was as follows: a. To develop and conduct a weapons training program; b. To administer, train, and equip assigned units and personnel; and c. To develop standard tactics and techniques for full employment of the Air Defense Command weapons system. On 29 October 1954, to the above were added the requirements to assist appropriate agencies in the development of equipment pertinent to ADC and to recommend maintenance procedures and techniques. For source, see reference note number one.

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programmed earlier, were expected to provide adequate maintenance facilities.[2] On-the-job course outlines for training of maintenance personnel were available to the 4750th Training Wing and renewed emphasis was being placed on the OJT program. The number of skilled aircraft maintenance personnel was below command average, but it was being brought up to the command level. Any manning shortages were to be adjusted in accordance with the latest workload.

The USAF Inspector reported that base facilities were supporting two squadrons and when augmented by programmed construction should be able to support three squadrons, but that more housing than programmed was needed for four squadrons. ADC replied that two additional 133-man dormitories had been included in the Fiscal Year 1956 Public Works Program, but that these had been deleted by USAF because the Air Force program showed only a three squadron mission for Yuma.[3] Later, a four squadron mission was accepted by USAF. The requirement for two more dormitories was to be presented again.

As early as August 1953, personnel at Yuma had seen that the range area would be too small.[4] They sent a request to ADC, which the latter forwarded to USAF, for permission to fly over an adjacent area of Mexico. There was to be no firing over this area, but it was to provide maneuvering room for the interceptors. With this extra space, additional tow ships could be put on the range in the areas which, without the Mexican space, had to be used for positioning the interceptors.

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The Second Weapons Training Center

Four squadrons were the maximum that could be accommodated at the Yuma center. The range and the base could not be expanded further. To reach even the minimum level of combat proficiency, each squadron had to receive one month per year of centralized rocketry training. When the Yuma center reached its full capacity of four squadrons, only forty-eight could train there at the very most. This would be the total if four squadrons went every month. However, interruptions in training caused by lags between units, holidays, exercises, and the annual weapons meet made it impossible to train more than forty squadrons each year.[5] ADC was programmed for sixty-nine squadrons. When this strength was reached, with only the Yuma center, twenty-nine squadrons would be left over each year.

In order to give all squadrons at least one month training each year, the only solution, obviously, was to build another weapons center. A requirement for a new center, to be available by Fixcal Year 1957, was submitted to USAF in June 1954.[6] Air Force Headquarters approved the request and Buckingham Field, Fort Meyers, Florida, was chosen as the location.[7] While the new installation was being built, ADC acquired the use of ATRC's Moody AFB, Georgia, as an interim center.[8] The seventh of February, 1955 was set as the date for the first squadron to begin training from Moody AFB. Only F-94C and F-89D equipped squadrons were going to be sent to Moody AFB, for the distance to the Gulf of Mexico

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ranges was too great for the F-86D.[9] To operate the base and support the squadrons in training at Moody AFB, ADC activated, as of 7 January 1955, the 4756th Air Defense Group (Weapons) and the 4756th Air Defense Squadron (Weapons).[10]

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APPENDICES

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THE E-1 FIRE CONTROL SYSTEM*

The E-1 fire control equipment was developed on a crash basis by using existing bomber components with the least number of engineering changes possible to obtain an interceptor fire control system. The equipment used were the A-1C Gun-Bomb-Rocket sight without change, and the AN/APG-3 radar which was modified to the design later known as the AN/APG-33. Major engineering changes were made in the antenna, modulator, transmitter, and AFC circuits to increase reliability, range, and low temperature operation. The system was designed for installation in two-place fighters to detect targets in space forward of the aircraft, to present target data to permit the operator to select a target, and to cause the equipment to automatically track that target. Target data were then presented to the pilot to enable him to fly a computed lead pursuit course to the target for effective gun firing.

Two modes of operation were possible; one used optical tracking, and the other used radar tracking. Under conditions of good visibility, the target acquisition and tracking was performed by the pilot using optics. After selection of a target, the pilot flew the aircraft so as to maintain the optical tracking index in coincidence with the target. When stable flight had been established for a few seconds, the guns could be fired as soon as the target was within range. With optical tracking, either automatic radar ranging or manual stadiametric ranging was possible.

Under conditions of poor visibility, radar tracking could be used with the E-1 system. Both the pilot and the radar observer were provided with radar displays. The radar operator performed the function of target selection and acquisition. During radar search, the pilot's scope displayed only an artificial horizon. Following target acquisition, the pilot's scope displayed an artificial horizon, a tracking index in the form of a circle and a dot, and a range circle of variable diameter. Closing rate was displayed by the position of a break in the range circle. The pilot flew the aircraft so as to maintain the tracking index centered on the scope. When closing with the target, the diameter of the range circle began to decrease at the open fire range of 2,000 yards. When the range had decreased to 200 yards, the range circle shrank to the size of the tracking index circle. This was the signal to break off the attack.

Limitations in the systems included no provision for beacon navigation, limited range, attack on lead-pursuit only, and no blind firing on low-level attacks.

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* Drawn from "Evolution of Fire Control Systems," <u>ADC Communications and Electronics Digest</u>, I (March 1951), 17-18; and "Fire Control Systems," <u>ADC C&E Digest</u>, I (April 1951), 9-10. (HRF 904)

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APPENDIX II

BOMBING AND GUNNERY RANGES AVAILABLE
TO THE
AIR DEFENSE COMMAND IN 1951

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Alamogorda, N.M. Under the control of SWC. SWC's requirements preclude ADC use. Additionally, we have no units deployed close enough for convenient use.

Ajo-Gila Bend. Under the jurisdiction of ATRC. ADC has an equitable joint use agreement with the possibility that jurisdiction may be transferred to this command. Units will stage from Yuma County Airport. Appropriate recapture procedures for Yuma County Airport have been initiated and right of entry requested.

Atlantic City. Under the jurisdiction of McGuire AFB. Utilized for air-to-air gunnery.

Betsie Point. Under the control of ANG. ADC has a joint use agreement. Of no use to this command at the present time as there are no units deployed in the immediate vicinity. Additionally, weather prohibits year-round use.

Cape Cod, Mass. Under the jurisdiction of the Navy. ADC has a joint use agreement. Utilized for air-to-air gunnery by the 33d Fighter Group.

Casco Bay. Under the jurisdiction of the Navy. ADC has verbal joint use agreement.

Chincoteague, Va. Under the jurisdiction of the Navy. Joint use with TAC. Of little value to this command as there are no units located in the vicinity.

Criehaven, Me. Under the jurisdiction of ADC. Can be utilized by the unit at Bangor. However, weather conditions prohibit satisfactory year-round use.

Eglin. Under the jurisdiction of APG. Both ADC and TAC have joint use agreements. While a very satisfactory range, heavy requirements of other commands have made it unsuitable for ADC use. Therefore, staging bases in the vicinity of the Sarasota air-to-air range are currently under study by EADF, i.e., Venice, St. Lucie County and Punta Gorda.

Source: Incl #2 to ADC, Planning Committee Report 10-51, 30 Apr 1951 (HRF 902)

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Glen View, Ill. Under the jurisdiction of the Navy. ADC has informal joint use, but the range is too small for jet air-to-air gunnery.

Kirtland, N.M. Under the jurisdiction of SWC. ADC has joint use of this small air-to-ground range. This range provides little more than familiarization in air-to-ground firing.

Lake Huron, Mich. Under the jurisdiction of ADC. Utilized by units at Selfridge AFB. Limited by weather and ice conditions on the lake which prohibit rescue activities.

Lake Superior. Under the jurisdiction of ANG, Minnesota. ADC has joint use. Can be used to a limited degree by the unit at Duluth. Again, weather prohibits suitable year-round use.

McGuire, N.J. Under the jurisdiction of the Army. ADC has joint use agreement. Utilized for air-to-ground training.

Moses Lake. Under the jurisdiction of ADC. Utilized for air-to-ground training.

Naragansett. Under the jurisdiction of the Navy. ADC has joint use agreement but is not utilizing it at the present time as units are closer to Cape Cod.

Oscoda. Under the jurisdiction of ADC. Can be utilized by the unit at Niagara Falls. A small range, with year-round use limited due to weather.

Pt. Arena, Calif. Under the jurisdiction of the Navy. ADC has informal joint use agreement. However, no units are stationed close enough for satisfactory use. Weather precludes satisfactory year-round use.

Rapid City, S. D. Under the jurisdiction of SAC. ADC has informal joint use agreement. The altitude ceiling of 14,000 feet has been lifted to unlimited. CADF is taking necessary action to enlarge the danger and impact area of this range. Will be utilized by the unit at Rapid City

San Miguel, Calif. Under the jurisdiction of the Navy. ADC has informal joint use agreement. No ADC units in the immediate vicinity. Additionally, the Navy has a heavy requirement for this range.

Sarasota, Fla. Under the jurisdiction of SAC. ADC has informal joint use. Contingent upon activation of suitable staging base, as indicated under the Eglin range, units of EADF will utilize this air-to-air gunnery range.

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Sheboygan, Wisc. Under the jurisdiction of ADC. Small over-water range, limited in year-round use by the weather conditions.

Ship Shoal Island, Va. Under the jurisdiction of TAC. ADC has joint use. ADC has no requirement for this air-to-ground range.

Tilamook, Wash. Under the jurisdiction of SAC. ADC has informal joint use. No requirement for this air-to-ground range.

Underhill, Vt. Under the jurisdiction of ANG, Vermont. ADC has informal joint use. A small air-to-ground range. ADC has little or no requirement.

Wendover, Utah. Under the jurisdiction of SAC. ADC has informal joint use. The present impact area is too small for jet air-to-air gunnery. Hq USAF has refused our request for expansion of the range and rehabilitation of the base.

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DESCRIPTION OF FIRE CONTROL SYSTEMS EQUIPMENT*

1. E-4 Fire Control System (F-86D):

   a. AN/APG-37
   High powered X-band airborne pulse modulated fire control radar used in a single-place all-weather fighter aircraft. It also contains beacon and ground mapping facilities.

   b. AN/APA-84 Ballistic Computer
   This equipment is a rocket ballistic computer for use with collision course fire control systems, utilizing positional and rate information from the radar, it automatically computes the trajectory for air-to-air rocket firing. An additional function is automatic control of rocket firing mechanism.

   c. Elevation Computer
   Is used to automatically and continuously analyze quantities for computing the angle of attack of an airplane in flight, for use with a collision course fire control system, using rockets.

2. E-5 Fire Control System (F-94C):

   a. AN/APG-40
   High powered X-band airborne pulse modulated fire control radar used with a ballistic computer AN/APS-84 for computing collision straight line approach for use in two-place all-weather fighter aircraft. Also contains beacon and ground mapping facilities.

   b. AN/APA-84 Ballistic Computer
   Same as paragraph 1b.

   c. Elevation Computer
   Same as paragraph 1c.

3. E-6 Fire Control System (F-89D):

   a. AN/APG-40
   Same as paragraph 2a.

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*Source: ADC Manual Number 136-1, 1 Aug 1953, p 3. (HRF 301)

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b. AN/APA-84 Ballistic Computer
Same as paragraph 1b.

c. Elevation Computer
Same as paragraph 1c.

4. N-9-1 Fixed Reticle Gunsight (F-86D):

This equipment is a fixed reticle gunsight, i.e., non-computing sight, normally installed in aircraft using fixed guns. This sight provides a colimated image of the reticle pattern, which is reflected by a reflector glass to be visible from any point along the line of sight.

5. N-3-C Fixed Reticle Gunsight (F-94C):

This sight is similar to the N-9-1 and is used in the same manner.

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REFERENCE NOTES

Documents cited in this study are available in the Headquarters ADC Historical Directorate, the Headquarters USAF Historical Division, or in the files of ADC lower-echelon units. The document location is shown by the following abbreviations:

DOC____. indicates that the document is a supporting document to this study only and is located at the Headquarters ADC Historical Directorate and the Headquarters USAF Historical Division.

ADCHR # ____, Doc _____. (#1 covers period to June 1951, #2 to December 1951, etc.). indicates that the document has been used as a supporting document to a previous Headquarters ADC Historical Report, as shown, and is located at the Headquarters ADC Historical Directorate and the Headquarters USAF Historical Division.

ADC Unit, Semi-annual Period, Doc _____, e.g., WADF, 1951A, Doc 235. ("A" refers to the period 1 January to 30 June, "B" to 1 July to 31 December.). indicates that the document has been used as a supporting document in an ADC lower-echelon unit and is located in the particular unit's files, at the Headquarters ADC Historical Directorate, and at the Headquarters USAF Historical Division.

HRF ____. indicates that the document has not been used in a previous history and is located only in the Headquarters ADC Historical Directorate's Historical Reference Files.

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31. Interview with Capt. A.M.L. Sanders, ADC O&T, 9 Dec 1954; TWX, ADC to EADF, 22 Apr 1954 (DOC 46).

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