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WEATHER TRAINING IN THE AAF 1937–1945

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F O R E W O R D

This study, written by Sgt. Raymond Walters of the Administrative History Branch (AC/AS Intelligence) and edited by the USAF Historical Division, recounts the development of weather training in the AAF from its inception, under the Signal Corps, during World War I to its status immediately following World War II. Although emphasis is placed on the five main weather courses developed for enlisted men, cadets, and officers, some attention is necessarily paid to organizational and administrative problems of the weather service itself.

This monograph is one of a group which surveys the various individual training programs initiated by the AAF, such as aircrew training, bombsight maintenance training, and aircraft armament training. Like other monographs in this series, it is subject to revision and all comments, suggestions, and corrections are welcome.

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C O N T E N T S

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WEATHER TRAINING IN THE AAF,
1937 - 1945

INTRODUCTION

Man is a creature of the atmosphere not of the land: it is in the atmosphere that he lives and of the atmosphere that he breathes. What is more important here, however, is that man fights in the atmosphere—in an airplane through fickle and often treacherous air, in ships buffeted by strange seas and violent storms, in trucks, tanks, and on foot across terrain which is molded by the flow of wind and water.

The observation and prediction of that flow of wind and water is the business of the weather service, more particularly in the case of the air arm, the Army Air Force Weather Service. So that its aircrews could perform their flights through the changing elements safely and efficiently, the AAF instructed all of its pilots, navigators, and bombardiers in the elements of meteorology. So that its mission could be planned thoroughly and accurately, the AAF maintained a strategic global weather service: from its chain of stations a constant flow of long and short range forecasts and regular observations were relayed to all air commands—for training flights, ferry missions, strategic and tactical bomber missions, and aerial patrols—and to the ground forces.

Although there were numerous changes in the administration of the AAF Weather Service, the underlying principles upon which the original organization had been effected remained substantially unchanged. The administrative organization, however, only carried out the mission of the service by providing and directing the units which supply the essential services. The responsibility for the fulfillment of the mission, then, ultimately rested with the men who observed, analyzed, and forecast weather

in the field, whether they were in Alabama or Italy, Iceland or Burma, the men who made up the hundreds of individual weather stations. Except for a handful of administrative officers and non-technical personnel assigned to headquarters, special maintenance, and supply sections, they were divided into two main groups: forecasters and observers. Each group performed a special function; yet the work of each was inseparably linked with that of the other.[1]

Forecasters were either commissioned officers, warrant officers, or non-commissioned officers with grades of staff sergeant or higher.[2] It was their duty to analyze the weather maps and charts, prepare the official forecasts, brief flying personnel on their missions, and exercise general supervision over the weather observers. In addition, they prepared the weather data for flight plans so that proper decisions could be made as to aircraft clearance, and in combat zones they supplied forecasts and other pertinent meteorological data to staff weather officers—and other staff planners—for use in tactical and strategic decisions.

Weather observers were enlisted men, usually up to the grade of staff sergeant,[3] whose duties were to make and record weather observations, prepare the maps and charts for the forecaster's analysis, and maintain weather instruments. Although enlisted forecasters were on duty in most AAF weather stations, the majority of enlisted men were restricted to observation. Some of these, however, were specially trained in radiosonde or rawinsonde for observing upper air conditions for which they were given higher ratings.[4]

Although most weather officers, at least after 1943, held posts as duty forecasters, some served as chiefs of weather stations, essentially an administrative post, and some were also made members of weather reconnaissance squadrons, despite the fact that few of them had aircrew training.

And still others rose to be staff weather officers to advise the commanding officer of a tactical group or higher headquarters in planning operations.

To train its personnel for all of these duties, the AAF and its predecessors (the Signal Corps and the weather directorate) conducted extensive training programs in the weather stations themselves, at AAF technical and flying schools, and at civilian colleges and universities. The story of this training program, from the Air Corps' assumption of responsibility for weather service on 1 July 1937 to the end of World War II on 2 September 1945, is the burden of the pages which follow.

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Chapter I

THE WEATHER SERVICE, 1812-1945

One of the AAF's principal problems in instituting adequate weather training arose from the fact that the Army, except for the World War I period, made little progress in the field of meteorology. It is true, however, that the Army pioneered in that field during the Nineteenth Century, and between 1819 and 1870 the Medical Department had the best observational network in the country, employing some of the outstanding meteorologists of the time. In 1870, under an act of Congress, the Chief Signal Officer was made responsible for conducting weather observations and he established the first national forecasting service in the country. In 1891 the bulk of these meteorological duties were shifted to a civilian bureau under the Department of Agriculture, and for more than a quarter of a century thereafter the Army was out of touch with developments in the weather field.[1]

World War I Era

With the outbreak of World War I and the first extensive use of the air as a battleground, the Signal Corps effected a system of close cooperation with the U.S. Weather Bureau, which involved an extensive exchange of technical information, facilities, and personnel as well as providing Signal Corps Reserve commissions for a number of the bureau's best forecasters.[2] Under the direction of the Army's Science and Research Department, approximately 200 inductees were assigned to the Signal Corps between September 1917 and April 1918 and sent in small groups to Weather Bureau stations throughout the country for 8 to 10

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weeks of practical training as weather observers. After they arrived in France they were given a review course and special instruction on weather problems peculiar to the fighting fronts.

By the early spring of 1918 the Science and Research Department came to the conclusion that not enough enlisted men could be trained for weather service at the Weather Bureau stations alone. Accordingly, the Signal Corps established a school for weather observers at Camp McArthur, Texas,[3] moving it late in April to the Texas Agricultural and Mechanical College. At the Signal Corps School of Meteorology, as it was known, the student body was composed of approximately 300 enlisted men between 21 and 31 years of age, all either college graduates or having had several years of training as observers for the U.S. Weather Bureau. A typical student roster included more than 100 civil engineers, 75 mechanical and electrical engineers, 20 chemists, 40 observers, and 30 science and mathematics teachers. The course, which lasted two months, consisted of 41 lectures as well as practical laboratory and field exercises in the conduct and reporting of surface and upper-air observations. Before the school was closed following the Armistice, 550 men had been trained with 8 receiving commissions as second lieutenants in the Signal Corps Reserve. (One of these was Don McNeal who played a leading role in weather training for the Air Service during the following quarter century.) While 314 of the graduates saw service overseas, the other 236 were used for observation and research work in an extensive chain of stations throughout the United States.[4] In addition, during the war years sever leading universities in co-operation with the Massachusetts Institute of Technology offered elementary courses in meteorology for aviators.[5]

Interest in weather training did not slacken, however, with the return of peace: a regular course for Signal Corps enlisted men was established at Camp Alfred Vail, N. J. in January 1920. During this early period the academic preparation of most of the enlisted students was so inadequate that the five-to six-month course had to be conducted on a high-school level. After graduation, the men were assigned as weather observers to the meteorological stations of the Signal Corps.[6]

For a decade following the establishment of the Air Corps in 1926, weather observation and forecasting for all of the Army were performed by the Signal Corps. Enlisted forecasters and observers were trained in a 4-1/2 month course at Fort Monmouth, N. J., the successor to Camp Vail. Signal Corps officers--about two a year--were sent to Rutgers University to take an advanced course in physics in the belief that this would aid them in performing their weather duties. In addition, the Air Corps trained a few of its own enlisted men as observers on the job at air bases such as Langley Field, headquarters of the 2d Weather Wing.[7] Following the establishment of meteorology courses on a graduate level, a few Signal Corps and Air Corps officers--rarely more than 10 a year--were enrolled at the only two institutions in the country giving this type of work, Massachusetts Institute of Technology and California Institute of Technology. But up to 1937 weather training, like the weather service itself, was a neglected child of the Army.[8]

The Period of Expansion

In 1937, when the Air Corps was charged with primary responsibility for meteorological activity in the Army, its weather service had 180

enlisted men and a handful of officers; by September 1945, when World War II had ended, this number had grown to nearly 20,000 officers and enlisted personnel.[9] This rapid and prodigious growth was effected despite the many difficulties inherent in the relatively new field of meteorology. The fact that it was so new, with some of the most fundamental truths yet to be discovered, obliged Army officials to work closely with civilian and government scientists in conducting their training. For training on an advanced level they sent large numbers of officers and cadets to civilian universities, and in the case of training for more routine work performed by enlisted men, they sought the counsel of such agencies as the Joint Meteorological Committee, composed of representatives of the Weather Bureau, the Army, and Navy.

Experience had convinced Air Corps officials that so difficult were the duties of the weather service that only a very small percentage of men entering the Army were capable of performing them; one estimate, made in 1939, placed the number at 2 per cent.[10] The weather service thus found it necessary to stipulate that enlisted men recruited for its work possess unusually high ability--normally 120, as measured by the Army General Classification Test, scientific aptitute, and thorough preparation in physics and mathematics on the high school level.*[11] In

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* At the height of the AAF expansion period the weather service was obliged to lower these standards somewhat. A reduction in the number of recruits with high GCT scores available to the AAF made it necessary during the summer of 1943 to accept men with scores as low as 100 for observer training. (1st Lt. Lester R. Robinson, Div. Supervisor, TS Charute to Capt. Norton, Hq Wea Wg, 11 Aug 1943; Brig. Gen. B. M. Harper, AC/AS Training to CO Wea Wg, 1 Sept 1943 in WSHO files.) An order of the Technical Training Command, issued early in 1942, made it necessary for the school authorities to graduate 85 per cent of the men instead of the preferred 40 to 50 per cent taking the forecasters course. However, these relatively low standards were only a transitory exception to the general AAF practice.

selecting men to become weather officers, the weather service regarded as essential, besides the desired qualities of leadership, preparation in mathematics and physics on a college level and the potential ability to discuss and write about meteorological conditions clearly and persuasively for the information of pilots. The problems of training were mitigated somewhat by the fact that, to a good portion of the men qualified for it, work in weather was enormously fascinating—so fascinating, indeed, that many expressed intentions of making it their life calling, either in the Army or as civilians.

Although a large portion of the duties of the observer and radiosonde operator was routine in character, virtually all the work of the enlisted and officer forecaster required the exercise of intellectual powers. As a consequence, although practical, on-the-job methods or teaching could be used effectively in teaching observers and rawinsonde operators, in teaching forecasters it was necessary to rely heavily upon such time-honored classroom methods as lectures, recitations, and textbook study to give the men the requisite background of theory. Mathematics, physics, and other scientific subjects had to be taught pretty much as they traditionally were in civilian colleges and universities.

In general, during this period of expansion, the Air Corps concentrated its attention on five major courses:

(1) A course for enlisted observers, conducted at Patterson Field from 1937 to 1939, Scott Field from September 1939 to June 1940, Chanute Field after August 1940, and informally taught from time to time at various of the larger weather stations in this country and overseas.

(2) A course for enlisted forecasters, given at Patterson Field from September 1937 to June 1940, Chanute Field from July 1940 to April 1943, the AAF Weather Training Center at Grand Rapids, Mich. from April to July 1943, and Chanute after July 1943.

(3) A course for enlisted radiosonde operators, given at a Weather Bureau school in Washington, D. C. from June 1942 until January 1944 and at the AAF school in Grand Rapids from May 1943 until February 1944.

(4) A course in meteorology for cadets leading to a commission, given from October 1940 to June 1944 at Massachusetts Institute of Technology, New York University, University of Chicago, California Institute of Technology, University of California at Los Angeles, and from January 1943 to October 1944 at AAF technical schools at Grand Rapids and Chanute.

(5) A premeteorology course leading to the cadet meteorology course, one branch (the "B" course) given at 6 colleges and universities, the other (the "C" course) at 16 colleges and universities between February 1943 and February 1944.

Control and Training Difficulties

The exigencies of AAF expansion occasioned two notable departures from these basic categories of weather training, and contributed to the basic over-all problem of authority. Although most of the courses were conducted to meet the needs of the weather service itself, between 1937 and 1945 some half-dozen organizations asserted their right to share in its direction. Until 1941 the weather service was under the direct

control of the Chief of the Air Corps (although there were confusing and transitory exceptions in the case of the GHQ Air Force and its successor, the Air Force Combat Command). After 26 March 1941 enlisted training was carried on at several schools in the Air Corps Technical Training Command and at one operated under the direct supervision of the Office of the Chief of the Air Corps. Training on an officer and cadet level at civilian universities was also arranged by the latter.[12]

In March 1942 control over weather activities became more centralized: the Directorate of Weather was put in charge of weather service and the Directorate of Individual Training monitored the training of enlisted men in Technical Training Command schools. The weather directorate, however, also had an interest in the training program, since it had made most of the arrangements for the training of officers and cadets in meteorology. This question of authority came to a head when the proposed cadet meteorological program precipitated an administrative conflict during the autumn of 1942. At that time the cadet program was being substantially enlarged, and a premeteorological program involving thousands of students in an enlisted status was being organized. There were three parties to the dispute: the Technical Training Command and two civilian advisory committees of the Directorate of Weather, one representing the universities giving the cadet meteorological course, the other representing the colleges giving the premeteorology course. As the particular conflict was ultimately settled in February 1943, all responsibility for the program was delegated to the Technical Training Command, although the advice of civilian groups was welcomed.

But the autumn of 1942 saw a further conflict, one which potentially could have caused great damage to the weather program. At that time the weather service was hard pressed to find enough personnel to meet the demands of rapidly expanding AAF activities. Maj. Gen. Robert Olds, commanding general of the Second Air Force, was greatly irritated by the prospect that the weather service would be unable to provide enough forecasters for many months to come to service completely the satellite fields of his command. He attributed the situation in general to the failure of the weather service to do any advance planning, but he had another grievance as well: he balked at having any personnel servicing his command who were responsible to any authority other than his own. As he declared in a telephone conversation with Brig. Gen. T. J. Hanley, Jr., Deputy Chief of Air Staff: "I'll resent, or rather I'll campaign, to get direct control of the weather personnel as well as the communications and everybody else that go to make a part of the Second Air Force. It cannot be under anybody else's command or control."[13] In this spirit he arranged for enlisted observers to be trained at Fort George Wright, Wash., for enlisted forecasters to be trained at Washington State College and the University of Utah, and for commissioned officers to be trained as forecasters at the University of Utah.

The training at Washington State College, conducted briefly in early 1942, appears to have been carried on without the cognizance of AAF Headquarters, although only a few men were involved.[14] In the

case of training at the University of Utah and Fort George Wright, General Olds requested authorization from AAF Headquarters, although his plans were well advanced before the weather directorate learned of his intentions. Personnel being processed at the Second Air Force replacement pool were screened to find enlisted men with a high school education that included one year of algebra and one year of physics and officers with two years of college training that included mathematics and physics. Five officers and 75 enlisted men were entered in a five-month forecasters course at the University of Utah starting in the middle of September, and a second class, numbering 45 officers, was begun in the middle of November. The teaching staff was composed of the Weather Bureau's chief forecaster at Salt Lake City, a number of civilian instructors from the University of Utah and Brigham Young University, and five AAF sergeants, rated observers. Classes lasted 8 hours a day, 6 days a week for a curriculum which included approximately 275 hours on synoptic and dynamic meteorology, 450 hours on weather observation, map analysis, and forecasting, 175 hours of mathematics (including a review of algebra through differential and integral calculus), and 100 hours of physics (the equivalent of a first-year college course). Upon graduation, the officers were assigned to staff positions with bombardment groups and the enlisted men were assigned as assistants. No promotions were given the men for completing the course.[15]

On 10 October 1942 the Second Air Force notified the regional control officer of the 3d Weather Region that it was planning to establish at Fort George Wright a six-week course for enlisted observers that would include teletype operation; the 3d Weather Region was asked

to furnish for each class 15 to 20 students who, upon graduation, would be returned to the 3d Weather Region stations within the Second Air Force.[16] The weather region declined the request, holding that the regular AAF technical school at Chanute "will provide sufficient trained observers for our needs."[17]

By late September 1942 the weather directorate had become thoroughly aroused over the Second Air Force attempt to provide weather training and service at least partially independent of its authority. Having convinced General Arnold of the necessity for keeping control of the weather service in its hands, the directorate notified Second Air Force that service and training furnished by any individual command would be considered "sub-standard" by AAF Headquarters and was therefore disapproved.* Plans for further training at the University of Utah and Fort George Wright were to be dropped.[18]

Although this was perhaps the major instance, the problem of split authority still remained; control over weather activities was further confused in March 1943 with the dissolution of the directorates. Field weather service became the province of the Weather Wing of the Flight Control Command, and two new headquarters offices (AC/AS Materiel, Maintenance, and Distribution /MM&D/ and AC/AS Operations, Commitments, and Requirements /OC&R/) were given some control over weather operations. Weather training continued to be the official responsibility of the

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* More than a year after the conclusion of the Second Air Force sortie into weather training, in March 1944, the weather service gave a proficiency examination for 32 officers and enlisted men who had graduated from the University of Utah course. (Telg., CO Wea. Wg. to FCO's 1st, 3d, 4th, 8th, 9th, 16th, 24th, 25th WR's, 28 Feb. 1944, in Hist. AAFWS, IV, App. 52, attach. 3.) Eight officers passed the examination, 24 officers and enlisted men failed. (Extract, Capt. L. M. Server to CG AFFTTC, 24 Mar. 1944, in Hist. AAFWS, IV, App. 53.)

Technical Training Command, with supervision exercised by AC/AS Training.[19] To mitigate the confusion that inevitably resulted, in July 1943 it was agreed that thereafter all weather training matters would be "routed through" AC/AS Training.[20]

For the most part, AAF weather training and meteorology instruction was admirably standardized. With some notable exceptions that will be indicated later, admission to all courses was limited to men who met a rigid set of qualifications; not until he had satisfactorily passed the appropriate examination could a man be rated as an observer or forecaster and be promoted to the commensurate rank. The nature of the courses made it possible to use objective examinations calling for numerical, true-or-false, or short-phrase answers which could be scientifically weighted and graded. In the case of courses for enlisted personnel, examinations were prepared either by the Department of Weather at Chanute Field or by the regional control officers of the weather service using the Chanute examinations as a foundation. In the case of cadet training, too, the control of examinations was centralized—in the hands of the University Meteorological Committee, composed of leading civilian and Army meteorologists.

The manner in which the various conditions described in this chapter affected the training of personnel will be shown in detail in the pages which follow.

Chapter II

TRAINING OF ENLISTED MEN

When plans were being drawn up for the establishment of a separate Air Corps weather service late in 1936, Col. Rush B. Lincoln, Chief of the Plans Section, OC/AC, spoke approvingly of the "local training" of enlisted observers being conducted by the 2d Weather Wing at Langley Field and recommended that it be copied at other important bases. This system, Colonel Lincoln wrote, "will continue to produce good results wherever a trained meteorological officer is assigned to the weather station. The principal advantages of this system over that of centralizing the observer training in one place are economy of transportation costs, economy of barrack space, and the reduction of lost motion in training men who have no future in meteorology." He urged that personnel boards at the bases be instructed to select enough of "the most intelligent men available" among the recruits to fill up the approved tables of organization for this on-the-job training. By adopting such a policy Colonel Lincoln believed that within one year the entire authorized enlisted personnel of an independent and expanded weather service would be qualified observers or better.[1]

Following the authorization of the separate Air Corps weather service in March 1937, steps were taken to implement Colonel Lincoln's suggestion. The commander of every important Air Corps base was directed to institute immediately the selection of qualified enlisted men to bring his weather

station up to the new authorized strength. Five criteria were to guide the personnel boards in their selection of men: (1) as far as possible, men were to be chosen from among the recruits; (2) those selected must have an "alert, intelligent appearance"; (3) they must be high school graduates with preferably some college training; (4) they must have "a clear, legible handwriting," and (5) preferably they should have ability as radio operators or clerical typists. These qualities were all indispensable for forecasters, and it was expected that in time all observers would qualify as forecasters. Training of observers was to be started at once--or at least "at the earliest date consistent with careful personnel selection"--and was to be conducted under the direction of the meteorological officer or the noncommissioned officer in charge* of the local weather station. It was hoped that such training would provide a steady flow of 25 qualified observers to the forecasters course at Patterson Field every six months.[2]

Enlisted Observers Course

Training and recruitment under this decentralized system satisfied weather service officials for more than two years, but during the spring of 1939 the Air Corps, in setting up training facilities to meet the requirements of the first of its great expansion programs, determined that virtually all Air Corps enlisted recruits would be sent to Scott Field, Ill. During one month there they would receive trade tests and

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*. To facilitate the administration of the weather station, the senior enlisted forecaster is ordinarily designated the Station Chief or non-commissioned officer in charge (NCOIC) to assist the station weather officer in his responsibilities. In this capacity he handles the bulk of the administrative detail and is responsible for the preparation of work schedules and the supervision of the record procedures in addition to his forecasting duties.

basic military and technical training, following which they would proceed to Chanute Field, Ill., and Lowry Field, Colo., for more specialized technical training. As soon as this plan went into effect, Lt. Robert E. L. Eaton, post weather officer at Scott Field, pointed out in a personal letter to Lt. R. M. Losey, chief of the Weather Section of OC/AC, the danger irherent in such a plan. Recruits would arrive at Air Corps bases already trained in a technical specialty and would thus be unavailable for assignment to the local weather station. The situation was all the worse because only 2 per cent of Air Corps recruits possessed "an educational background and temperament suitable for weather training."

To correct this situation, Lieutenant Eaton proposed that a centralized three-month school for observers be established at Scott Field, operated largely by personnel from the Scott weather station. This would enable the weather service to pick the cream of the recruits as they were being trade-tested at Scott and would avoid the disruption of regular weather station operation at the bases, which seemed inevitable if on-the-job training were continued under the expansion program. In addition it would facilitate the maintenance of standardized observer training.[3]

The suggestion was received warmly by Lieutenant Losey who wrote Eaton that his plan was "excellent. . . , much more satisfactory than our originally contemplated plan of conducting the training, as now, at a number of the larger base stations."[4] When General Arnold asked the opinion of Scott Field's commanding officer as to the feasibility of

the proposal,[5] Col. A. G. Fisher answered that he liked the idea. He submitted plans for a 12-week course and for monthly student increments not to exceed 25 men; "it is expected," he said, "that [these] monthly increments will be considerably reduced by elimination during this period." To provide the instruction, he asked that the weather personnel authorized Scott be increased by seven enlisted men and one officer.[6] His plans were promptly approved by the Chief of Air Corps with the exception of the request for additional personnel: so scarce was weather personnel at this time that no additional officers and only "several" enlisted men could be authorized. To enable the present staff to cope with its new teaching duties, the Scott station was reduced from "base" classification to "post", thus making available as instructors personnel of the base weather station.[7]

Under these conditions the first class of 7 men met at Scott early in September 1939; additional classes, usually numbering 10 men, were started every four weeks thereafter. The acute need of the GHQ Air Force for more trained observers led OC/AC to permit the combat arm to send five of its assigned personnel to the course each month. Such requirements as these led to a gradual increase in the size of classes at Scott, until the one entering early in April 1940 numbered 40 men.[8]

Even while the observer course was in the discussion stage, it had been generally assumed that the school was to remain only temporarily at Scott. In the spring of 1940, as the demand for enlisted weather men mounted, it was decided that it would be best to concentrate all Air Corps training at one place so that training might be more easily standardized and the scope and extent of the training more readily

developed to meet the growing needs. Authorization was obtained for the transfer of both the observer course at Scott and the course for forecasters being given at Patterson Field to one of the centers of Air Corps technical training--Chanute Field. Accordingly, after the graduation of the June class, the observer course was moved to Chanute, and training resumed under the newly organized Department of Weather in the following August.[9] From the summer of 1940 to early 1944, during the period when the AAF was undergoing its period of great expansion, the observers course was given continuously under the auspices of the Department of Weather at Chanute Field. In addition, during April, May, and June 1943--when the pace of expansion had become most accelerated--an identical course was offered at the AAF's Weather Training Center at Grand Rapids.

The files of AAF Headquarters do not indicate that during the expansion period any careful study was made of the weather service's long-term requirements for observers. Such planning as was done was piecemeal. In late 1941, just before Pearl Harbor, the Operations Section of OC/AC declared that on the basis of "a study of the needs of the Weather School [Service?]" it appeared desirable to increase the enrollment of the observers course to 600--a suggestion which was subsequently acted upon.[10] Again, in the middle of 1943 the Weather Wing estimated that at the rate of training then being maintained, there would be a shortage of 3,375 observers by the end of 1944. To this prediction AC/AS Training eventually replied that under a new table of organization there would actually be a surplus of 6,518 observers by December 1944.[11] Such instances lead one to the conclusion that during this crucial period, observer training in general was conducted without the benefit of systematic over-all estimates of requirements, which were the province of AC/AS Personnel and AC/AS OC&R.

With or without plan, the number of men enrolled in the observers course rose steadily from the middle of 1940 to the middle of 1943. During the fiscal year 1941 a total of 374 men were graduated; the fiscal year 1942 saw 1,334 graduates; and during the fiscal year 1943 there was a total of 4,651 graduates. An all-time high was attained during the month of June 1943, when both Chanute and Grand Rapids were giving the course: at this time a total of 1,763 men were under instruction. From then until the discontinuance of the course in April 1944, enrollment gradually declined. Over the six-year period, 1939 to 1944, 8,514 men were graduated as observers from courses in AAF technical schools.[12]

When the original course was established at Scott Field in 1939, the rather vague criteria which OC/AC had set up for the selection of students in 1937 were continued--through early 1940: a man had to be a high school graduate with courses completed in mathematics and physics, and must score 45 or better out of a possible 75 on the Otis intelligence test.[13] With the overhauling of Army classification procedures in the summer of 1940 and the contempory movement of the observers course to Chanute Field these requirements had to be restated. Now a General Classification Test score of 120 was required--the highest score required for any technical school course, and equalled only by the score required for cryptography. In addition, a man had to have satisfactorily passed courses in physics and trigonometry in high school or college.[14] With the rapid expansion of the weather service during 1943 and a consequent critical shortage of trained observers, this requirement was lowered to a GCT score of 110 and later 100, although no reduction was made in educational prerequisites.

The changes were made with some reluctance, for on the whole academic failures in the course at Chanute were proportionately greater among students with lower scores.[15]

During its existence the length of the observers course varied between 60 and 100 instructional days; the tendency as time went on was to shorten it by curtailing or omitting material not strictly connected with the routine duties of a weather observer--for example, meteorology, mathematics, and physics. Primary emphasis was placed on practical exercises in surface weather observations, wind-aloft soundings, maintaining and repairing weather instruments, weather recording, and in plotting of data on weather maps and all types of auxiliary charts. Inasmuch as it was part of the observer's duties to operate a teletype so as to be able to transmit and receive reports from other stations, material on teletype operation was included.*

Important revisions were made in the course on two separate occasions. The first was in the autumn of 1942 after Chanute officials became convinced that some adjustment should be made in the time allotted to the various subjects; no important change was made in the subject matter covered, however, and the over-all length of the course remained unchanged.† The second modification was made late in January 1943, when all Technical Training Command schools adopted a 6-hour rather than a 7-hour instructional day, which meant that the course now had to be given in 360 classroom hours rather than 420. Unlike most other courses affected, where the time allotted all phases could be uniformly reduced by one seventh,

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* For a full description of each phase, see the complete curriculum given in Appendix A.

† See Appendix B.

certain irreducible phases of the observer course were left unchanged, while other less important phases were cut drastically. Thus, after 26 January 1943, meteorology, for example, remained at 60 hours while plotting atmospheric soundings, isentropic charts, and vertical cross sections was reduced from 62 hours to 36.[16]

In 1943 and early 1944 the course at Chanute was in a constant state of revision as the Department of Weather undertook to emphasize the practical aspects of weather observation and minimize the theoretical. During February 1943 Capt. George F. Taylor, assistant director of the department, called his instructors together to consider the problem. The tendency toward excessive theory, he pointed out, was especially marked in three phases: meteorology, weather instruments, and surface observations. He directed that the phase on meteorology was hereafter to be known as "Descriptive Meteorology," and discussions of such academic topics as "the polar front" and "the gas laws," to which several days were then devoted, were to be eliminated. In the phase on weather instruments, the laboratory method was to be used throughout. Students were to spend almost all their time in the assembly and disassembly of instruments according to specially prepared laboratory guide. In connection with surface observations, Captain Taylor estimated that men were actually taking and reporting observations only 50 per cent of the time they were at Charute. To increase this percentage, he ordered that men go out of doors to observe sky conditions for 10-to-15-minute periods at least once a day from the first to fourth week inclusive; and these observation periods were to be made even more numerous on days when the weather conditions made the sky more interesting.[17]

Three months later, in May, a drastic revision of the Chanute curriculum itself was made in an effort to further increase the practical aspects of the course. This time, upon the suggestion of the Weather Wing, meteorology was dropped entirely, on the ground that much of it was "theory" and had "no true bearing upon the efficiency of the Weather Observer." Approximately 20 hours of the subject matter which had been given in the phase and which was considered "practical" and "helpful to the efficiency of the Observer" was to be taught in connection with other related subjects during the rest of the course. For example, the method of converting one standard value of pressure to another standard (that is, changing of inches to millibars) was to be taught in the course on surface observation where the student was faced with such a problem. The dropping of the separate phase on Meteorology saved about 40 hours, which were distributed among surface observations, plotting of charts, and upper air observations to increase the amount of time devoted to practical exercises.[16]

The use of a pedagogical device known as a "student job outline" was introduced along with this revision in order to increase the practical quality of the instruction. At the start of each phase the student was provided with a loose-leaf folder containing outlines of the subject matter to be learned and a series of exercises to be performed during the phase. At the conclusion of each of these exercises or "jobs," the student was given a practical examination on it. For example, during the course on surface observations, the student might be told: "You are taking an observation. You notice that six-tenths of the sky is

covered by stratus cloud bases at 1000 feet, moving from the southwest. The remainder of the sky is covered by cirrus clouds at 28,000 feet, direction of motion unknown." The student would then enter on a Form 94 the ceiling, sky conditions, clouds, etc., to test his ability in making entries properly.[19]

Experience showed that the majority of these changes were worth while, with the exception of the omission of the meteorology phase and its partial presentation in other phases. In October the Department of Weather ordered that meteorology be reestablished as a separate phase. Now, however, it was to be taught by instructors who had graduated from the Enlisted Forecasters Course and were therefore presumed to be better qualified in meteorology than graduates of the observation course.[20]

A complaint by the Weather Wing that Chanute graduates still showed a lack of practical experience when they went to work in the field led the Department of Weather to make two more important changes in the course during the autumn of 1943. "Some form of actual weather station operation [should] be made available to observer trainees," the commanding officer of the Weather Wing wrote in October, "so that they may acquire a knowledge of actual working conditions in weather stations."[21] It was not a novel idea: the previous July the Chanute authorities had set up five "model weather stations" and during the ninth and tenth weeks of the course, students spent half of their time in these stations performing all the routine duties of observers. The practice had to be abandoned after only a few weeks because it tied up too many of the Department of Weather's limited number of instruments at a time when

enrollment was increasing rapidly.[22] But the need for this type of instruction, as urged by the Weather Wing, led the Chanute authorities to make arrangements for instruments to be used in the stations. Late in November the course was lengthened by six instructional days so that this work might be given in a special, final phase. The five model stations were put into operation so that each day the student could be assigned to a different phase of weather observation; thus, at the end of the six-day period each student would have some practical experience in every job an observer performs. Each station was supervised by an instructor, some of whom were graduates of the forecasters course, most of them graduates of the observers course. A number of forecaster graduates were used because it was felt that since they had the ability to analyze maps and charts prepared by the students, they could give the student observers a clearer notion of what their future work would be like.[23]

The other addition made to the course at the suggestion of the Weather Wing was instruction in the code and cipher system by which the weather service was accustomed to transmit data from station to station. There had been some discussion as to the desirability of this move the previous spring, but several difficulties had stood in the way. For one, it was felt that all students would have to be cleared for security reasons before they could be given such information, and for another, different codes were used in different weather regions, creating a question as to which code or codes should be taught. Weather service and training officials studied the problem, and a conference of Weather

Wing officers met at Asheville, N. C. before a proposed solution was formulated. Finally it was agreed that 18 hours of instruction in the code be given at Chanute--despite the fact that Chanute officials thought that the course ought to be lengthened to 36 hours. Outmoded ciphers and codes were used for practice purposes, thus obviating any necessity for security clearance of students.[24]

Observer training at weather stations. Prior to the establishment of the Scott Field Enlisted Observers Course, observer training was done for the most part at AAF weather stations under the tutelage of station weather officers or a noncommissioned officer. In the autumn of 1940, however,--about the time the observers course was moved from Scott to Chanute--the in-station training of observers by the AAF was ordered discontinued.[25] Four days after Pearl Harbor under the pressure of outright war, the control officer of the 4th Weather Region directed all weather officers under his command to "accelerate" the in-station training of observers "to qualify trained men for Weather Service duty in new stations."[26] It is likely that other regional control officers issued similar orders about the same time. At any rate, arrangements were made during 1942 with the Technical Training Command to assign basic soldiers qualified for the weather service who could not be accommodated in classes at Chanute to the weather regions for in-station training.[27]

The question of the advisability and efficacy of this type of training continued to be debated in weather circles throughout 1942. The weather directorate felt that only weather stations in the central United States ought to be required to give the training; stations on the east and west coasts were to concentrate on the problems arising from defense.[28] Some

of the stations best equipped for training were in the coastal areas, however,[29] and finally, in September the Director of Weather took the formal stand that "it is contrary to the policy of this Headquarters to conduct in-station Weather Observer Training. However, until such time as the urgency of the present personnel shortage decreases, it is considered advisable to conduct a limited amount of in-station training."[30] The inability of the Chanute school to train all the observers needed caused the weather directorate to accord its wholehearted approval to in-station observer training and on 11 December it ordered the 1st, 2d, 3d, 4th, and 9th Weather Regions to begin this type of training "on as . . . extensive a scale as possible without seriously disrupting station observations."[31]

Throughout 1943 and 1944 the Weather Wing kept insisting that large quotas of recruits be assigned to its stations for training[32] and it took a keen interest in the administration of the program, undertaking to standardize it and broaden its scope. The chiefs of the various stations receiving recruits were told by their regional control officers to begin the training of these recruits as soon after their arrival at the stations as was possible. Instruction was to be conducted so that it would familiarize the men with all the routine duties of a weather observer; emphasis was to be placed on "practical exercises in surface weather observation, wind-aloft soundings, maintenance and repair of instruments, the preparation of weather forms and records, and the plotting of weather data on maps and charts." To accomplish this goal, a small school with a regular instructional staff and a set curriculum was established. A room adjacent to either the

the plotting and records room of the office of the weather officer was set aside as a classroom and equipped with a blackboard and a set of instruments. Two enlisted men were to be designated as instructors--the weather observer teletypewriter maintenance repairman as the chief instructor and the weather observer clerk as his assistant or understudy.[33] The curriculum proposed by the Weather Wing for use at the station schools was almost identical with that in use at the time by the Department of Weather at Chanute.* This was done so that graduates of in-station training would be well prepared for the forecasters course at Chanute. A total of 420 hours of formal instruction over a period of 10 to 12 weeks was suggested.[34]

Another step to standardize the in-station training was taken by the Weather Wing late in 1943. The commanding officer requested AAF Headquarters to prepare a standard qualification examination for observers based upon the official curricula in use at Chanute and at the station schools. The two-hour examination he desired would be objective in character: 100 questions, 50 of them involving detection of error or omission, 30 multiple choice, 10 true and false, and 10 numerical problems. The request was rejected by AC/AS Training on the ground that some degree of diversification in observer training was desirable. In qualifying weather observers, this office at AAF Headquarters held that written examinations ought to be supplemented by practical exercises designed to

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* Compare the Chanute curricula in appendixes A and B with the "Suggested in-station course for AAF weather observers" printed in T.O. 00-25-27 and reproduced in appendix C.

test proficiency in such subjects as surface observations, teletype observations, plotting map signals, plotting wind-aloft charts, and plotting atmospheric soundings. AC/AS Training thought it would be better if the observer examinations in use at Chanute were forwarded to the regional control officers so that they might use them in composing examinations for use at stations under their control. This was subsequently done.[35]

Some notion of the relative efficacy of observer training at the technical schools and at the stations was provided by a comparison of the records made in the forecasters course by graduates of the two types of schools. In March 1943 the Assistant Director of the Department of Weather at Chanute reported that the graduates of in-station training had done quite poorly in the advanced course. Of 55 students eliminated from the last 3 classes for failing grades, he reported, 44 had received their observer training at a station.[36] An explanation as to why this condition existed was suggested by the Director of Weather: the technical schools emphasized the theoretical aspects of the course more than did the station schools, which naturally gave graduates of the former a headstart in the predominantly theoretical forecasters course.[37]

Despite this apparent proof that technical school training was superior, the observer course at Chanute was completely terminated early in 1944. This was largely a result of AAF Headquarters' belief that, because of the relatively small numbers of recruits becoming available to the AAF at that time, virtually all basic technical training should be given on the job in tactical and operational units.[38]

Replacement training. Weather Wing headquarters, however, assured AAF Headquarters that it was ready to assure responsibility for meeting the attrition requirements of key domestic and foreign weather stations.[39] Some indication of the extent to which it performed this responsibility was provided in a survey conducted by the Weather Wing the following June: in 7 continental weather regions a total of 458 observers were receiving in-station training at 76 stations. In general, regional control officers employed the same methods of in-station training they had in the past.[40]

Training on this scale proved inadequate to meet the increase on observer personnel caused by large transfers of men to other branches of the AAF, and the operation of the Army point system for discharge. In the summer of 1945 the Weather Wing estimated that by the summer of 1946 it would need 4,306 men trained as observer replacements, and recommended that this training be reestablished at Chanute.[41]

AAF Headquarters responded by ordering the reestablishment of the course at Chanute starting 27 August 1945. A new class of 240 enlisted men with a minimum GCT score of 110 and physically qualified for overseas duty was to be entered every two weeks, and the old 10-week curriculum was to be employed with little change.[42]

Just as the course was about to begin, Col. Don. L. Yates, chief of the weather service, pleaded that since his organization's need for observers had become so acute with the quickening pace of the discharge system the Chanute course could to be reduced to 8 weeks, and that 72 hours of practical station-type instruction be given to the students after their

assignment to a weather station. The proposal was frowned upon by AAF Headquarters, which pointed out that "although the time spent on indoctrination training is one-fifth of the course, . . . it represents a more important fraction of the course value inasmuch as it provides for the application of techniques learned during the previous eight weeks."[43]

Despite the recognition by the AAF and the Training Command of weather service training requirements, personnel were not entering training in sufficient numbers to satisfy these requirements. Commitments would be made early in 1946 to preserve the world-wide meteorological network,[44] and this necessitated the maintenance of the weather observers training program with 256 enlisted men entering every two weeks. On this basis, 1,256 men were authorized to enter training during the period 10 December 1945 to 28 February 1946, whereas in reality only 252 enlisted men had entered the training. In order to remedy this dangerous deficiency in the number of basic soldiers eligible for training, Maj. Albert F. Corwin, AAF Weather Service liaison officer at Chanute, succeeded in getting the GCT score requirement lowered to 100. This, coupled with a rescreening of basic personnel at Chanute Field itself, made more and more students available, so that by 30 June 1946 the number of trainees and the weather service quota were adequately balanced.[45]

Enlisted Forecasters Course

When a separate Air Corps weather service was still in the planning stage, in 1936, the CC/S envisioned the removal of the Signal Corps enlisted forecasters course from Fort Monmouth to some Air Corps station. Capt. Randolph P. Williams and Capt. Don Wheat, who were detailed to

survey possible sites, recommended that Patterson Field be chosen because it was fairly centrally located and possessed "the best physical plant available."[46] A plan, subsequently evolved by OC/AC, called for two five-month courses each year, with 25 men in each class, so that the number of enlisted forecasters on service with the Air Corps would be increased to about 250. To be eligible for the Patterson course, an enlisted man would have to have one year's service with a meteorological station at an air base, be classified as a weather observer, and have the recommendation of his base or detachment commander.[47]

These suggestions were approved when virtually all Army meteorological functions were transferred to the Air Corps in July 1937. To help relieve the acute need for forecasters until the transfer could be consummated, the Signal Corps had agreed to conduct a special class for 15 Air Corps men at Fort Monmouth beginning in February 1937.[48] McNeal, who had been in charge of the Fort Monmouth school, was appointed officer in charge of the new Air Corps Meteorological School at Patterson.[49] The following July McNeal, 10 enlisted instructors, and 9 enlisted students taking the course at the time, as well as the technical equipment, made the move--to specious accommodations occupying the entire first floor of Patterson Field's new administration building. The first class under Air Corps supervision, numbering 25 students, got under way on 1 September 1937.[50]

From the middle of 1937 to the middle of 1940, the Patterson school taught two 25-man classes every year. In the spring of 1940, when plans were being drawn to concentrate all Air Corps technical training at a few large fields, orders were issued that the forecasters course--as well as

the observers course then being given at Scott Field--was to be moved to Chanute Field as part of a new Department of Weather. Since the Patterson forecasters school had been an activity of the Weather Section of the Air Corps, it was necessary officially to disband it and transfer its mission, personnel, and equipment to the Air Corps Technical School. Captain McNeal and his staff of enlisted instructors, as well as students taking the forecasters course at the time moved to Chanute during June 1940, when McNeal became the director of the Department of Weather, with responsibility for both the forecasters and observers courses. The students resumed their studies on 15 July, while the first forecasters class enrolled at Chanute started the following September.[51]

The history of AAF enlisted forecaster training from September 1940 to the end of the war is the history of the forecaster course at Chanute--with two exceptions: during four months in 1943-April through July--the course, its teaching staff and equipment were moved to the short-lived AAF Weather Training Center at Grand Rapids, and for approximately two months in the summer of 1944, the course was not given at all.

As was the case in training observers, Chanute and Grand Rapids authorities were greatly handicapped by the lack of adequate advance surveys of requirements for enlisted forecasters. The case already cited--when OC/AC estimated in 1936 that only 50 graduates a year were needed by the Air Corps at a time when the shortage was more acute--is only symptomatic. In November 1941, "in compliance with a directive from the War Department," the Training Section of OC/AC developed plans to increase the volume of forecasters trained by 50 per cent. Whether this was not

enough or too many for the Air Corps' future needs is not clear,[52] and in July 1942 the Directorate of Weather talked of the need for training 1,200 forecasters a year--a year in without indicating upon what information it based the estimate.[53] In October 1943, AC/AS Training announced that the needs for forecasters up until 1944 would "soon be met,"[54] while three months later a study by AC/AS personnel revealed a "surplus" to exist.[55] This confusion concerning requirements and the real lack of a definite goal imposed handicaps on the conduct of training at Chanute and Grand Rapids. In the early stages of expansion, class strengths were sometimes doubled without warning the schools to make preparation for instruction personnel.[56]

Quantitatively, the course in forecaster training paralleled that for observers. In the three years the course was given at Patterson and the first year at Wilmington and Chanute, its growth was slow and steady. In the fiscal year 1937 there were 2 classes with a total of 35 graduates; during 1938, 2 classes with a total of 51 graduates; during 1939, 2 classes with a total of 50 graduates; and during 1940, 2 classes with a total of 77 graduates. The fiscal years 1941-43, however, saw tremendous increases: in the former year 258 men were graducted; in 1942, 1,040; and during 1943, 931. Over the 7-year period there were 2,263 graduates.[57]

Procurement of students presented one of the most difficult problems in administering the forecaster course. Many of the difficulties arose from the fact that the duties of the forecaster at the average weather station required sound theoretical as well as practical knowledge, a high

general intellectual capacity, and, as in the case of observers, an unusual combination of personality and intelligence. The educational requirements for admission to the forecasters course were somewhat higher than those for the observers course: "thorough knowledge of mathematics, physics, and elementary trigonometry"--which meant second year college level--was considered essential.[58] If a man did not have these qualifications when he entered the weather service, however, he could acquire them by taking observer training at a technical school or at a weather station.[59] In fact the school at Chanute usually selected a number of high-ranking graduates of its observers course to remain to take the forecasters course, even though the bulk of the places in the forecaster classes was allotted to the Weather Wing for sub-allotment among the various weather regions. During the early period of the course, weather officers desiring forecaster training for their men had to apply through channels for copies of an examination prescribed by the Department of Weather at Chanute. This examination was designed to test the candidate's knowledge of "the elementary phases of physics, arithmetic, geometry and trigonometry" and was graded locally. If the man made a passing grade, and if there was room for him in the quota of his weather region, he was assigned to the next class at Chanute.[60] In some instances the Chanute authorities found men in their classes who did not possess the scientific and mathematical knowledge necessary to pass the examination--which led them to suspect that the grading done at the stations was not always objective. To avoid having to waste time on inferior student material, the school authorities instituted the practice of giving the men a re-examination upon their arrival at Chanute.[61]

Later, a few of the weather regions modified this procedure slightly, and the manner in which the 4th Weather Region allotted its quota in the middle of 1942 is interesting in this respect. The control officer of this region notified each weather officer under his command that he should offer his men the opportunity of taking three tests: (1) an examination in mathematics, physics, and trigonometry prepared at Chanute Field, the papers to be graded by regional headquarters; (2) the regular weather observer qualification examination prepared and graded by regional headquarters; and (3) the Otis intelligence test. The regional control officer reminded his weather officers that they should be conducting a training program at their stations which would qualify their share of the men for the course.[62]

Frequently, however, it was found necessary to deviate from this pattern of qualification and assignment. Sometimes Chanute as well as regional headquarters authorities had to "modify" the examination so that enough students would pass to fill the quota. Regional headquarters were constantly urging the Department of Weather to make the examination less and less comprehensive in character. A study made in July 1942 showed that in the preceding five years only about 40 per cent of the students taking the course were fully qualified, and of the 600 students enrolled in the forecasters course at the time, only 250 had qualified.[63]

In early 1943, when the weather service's need for forecasters was growing rapidly, the weather directorate considered admitting to the forecasters course recruits fresh from the reception centers. Four factors led to the rejection of the proposal: (1) the course, as given

at that time, included no instruction on observational methods, since all of this had been concentrated in the observers course, despite the fact that a knowledge of observational procedure was essential for a qualified forecaster; (2) the course was so difficult that only qualified observers were likely to benefit from it; (3) the morale of observers would improve if the opportunity for advanced training were kept open to them at all times; and (4) there were not sufficient numbers of observers available to fill the forecaster classes for some time to come.[64]

The fourth situation obtained because late in 1942 the Director of Weather had adopted the policy of giving observers stationed overseas the opportunity of returning to the United States for forecaster training. Reports on a number of inspection trips had indicated that morale among observers overseas was poor because they could not be promoted above the third enlisted grade without such training.* At the same time insistent demands for more forecasters came from such active theaters as the North African. The vicious circle was closed by the fact that the best source for forecasters was the ranks of qualified observers--and the best observers had been sent overseas.[65] Following the adoption of this policy, in February 1943 a letter was sent out over the name of the Secretary of War to the commanding generals of all overseas air forces authorizing them

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* In fact, early in 1943 General Spaatz requested permission to establish a forecaster school near Algiers in order to "improve the morale" of observers in his theater. In line with the prevailing policy of centralized forecaster training, however, this request was rejected. (R&R, AFDWS to [illegible], 9 Mar. 1943; tel., CG [illegible] to CGUS[illegible]F, Algiers, 10 Mar. 1943)

to send up to 5 per cent of the enlisted observers assigned to their weather squadrons back to the United States to attend the forecasters course. To be eligible, all personnel were to pass a qualifying examination prepared by Chanute's Department of Weather; assurance was given that once the men had completed the course they would be returned to the weather region in which they had been serving.[66]

This plan worked out very satisfactorily, on the whole: with few exceptions the foreign air forces made full use of the opportunity to have their men receive more advanced training. Occasionally, as in the case of the Eleventh Air Force, which found 10 per cent of its personnel qualified for the course, it was necessary to request that replacements be sent so that the men could be spared.[67] By late 1943 all the men taking the course were returnees from foreign theaters.[68] Some difficulty was encountered in dispatching copies of the qualifying examinations to stations scattered all over the world. In certain instances when copies did not arrive, substitute examinations were prepared locally, but AAF Headquarters frowned on this practice, maintaining that the use of a standardized examination helped improve the quality of training. Examinations were not to be prepared in the field except "in extreme situations."[69] After a survey revealed that the weather service had a surplus of forecasters in January 1944, the practice of returning men from overseas to Chanute was discontinued.[70]

From the time the forecasters course was first set up under Air Corps auspices at Patterson Field in August 1937, its curriculum, like that of the observers course, was under steady revision. In general, the tendency

was to increase both the length of the course and the thoroughness of its treatment of forecasting procedures, many of the revisions being prompted by advances and changes in theoretical meteorology and weather analysis. At the time of its establishment at Patterson Field, the course called for 640 instructional hours given over a 24-week period, a little over half that time being allotted to weather forecasting, the rest (with the exception of field station operation and organization which received only 25 hours) equally divided between mathematics, physics, and meteorology.[71]

When the course was moved to Chanute in 1940, it was lengthened to 910 instructional hours in 26 weeks. The switch of AAF schools from a seven- to a six-hour day early in 1943 did not materially affect the conduct of the course, according to school officials; they estimated that the change meant a loss of only 43 hours to the entire course.[72] The amount of attention given to meteorology and weather forecasting problems was constantly increased through the years. A notable step in this direction was taken when the course was moved from Patterson to Chanute: qualifications for admission were changed at that time to require preparation in mathematics and physics, making it practicable, it was thought, to drop the phases devoted to those two subjects and give instead more instruction in meteorology and weather forecasting (the latter being broken up into sub-divisions for the purposes of more intensive teaching).*

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* A complete description of the material in each phase is given in the syllabus for the Weather Forecasters Course, School Year 1941-1942, reproduced in Appendix D.

The specialized needs of the weather service in foreign theaters led to the introduction in June 1942 of a new 54-hour laboratory phase known as "spot weather forecasting," in which the weather characteristics of the various regions to which the men might be assigned as forecasters were treated. To make it possible to include this additional material without increasing the over-all length of the course, almost all discussion of problems peculiar to the work of the observer was omitted from the curriculum. This was considered practicable now that the requirement to admit only qualified observers to the course was being more rigidly enforced.[73] It was soon felt, however, that even this added time did not permit adequate treatment of the peculiarities of the constantly increasing number of theaters in which the weather service was operating. Therefore, in February 1943 a lecture phase known as "Physical Geography and Climatology" was introduced to meet this need, the time allotted to it being taken from the phase on meteorology.[74]

About this same time the last change was made: the Chanute weather authorities had come to the conclusion that they were wrong in their assumption that qualified observers would have a sufficient grasp of elementary mathematics to handle adequately the duties of a forecaster. Inability to add, subtract, divide, and multiply, as well as a lack of familiarity with the most fundamental concepts of algebra and physics, had been observed more often in the schools and in the field. Accordingly, a phase on meteorological theories, somewhat similar to that offered when the course was given at Patterson Field, was introduced.[75]

The forecasters course was recognized by the Technical Training Command as the most difficult technical course given by the AAF.[76] In consequence, the course had several administrative problems peculiar to it, all of them dealing with eliminees. Through the years an elimination rate of somewhat more than 50 per cent obtained, almost all for reasons of academic deficiency; the elimination rate of virtually all other technical courses was 10 per cent or under. Early in February 1942 when the demand for qualified forecasters began to be felt acutely, the Technical Training Command directed that the elimination rate be cut immediately to 15 per cent. The Chanute authorities carried out this order, although not without considerable misgiving that the quality of forecasting in the weather service would suffer.[77]

The subsequent careers of some eliminees not only caused the Chanute authorities some distress but also helped lower the morale of graduates of the school. After being dropped from the course, many men were returned to the weather stations from which they had been sent. Pinched for personnel by the rapid expansion of the weather service, many stations assigned the returned eliminees to duty as forecasters and gave them rapid promotions, even before their former classmates had completed the course. By January 1943 the need for additional forecasters had become so great that the Directorate of Weather abandoned its position that only graduates of an AAF technical school course in forecasting were to be qualified as forecasters[78] and authorized the qualification of men in the following categories: (1) men who had graduated from the weather forecasters course at an AAF technical school or had passed a forecasters

rating examination administered by the regional headquarters; (2) non-graduates of the AAF technical school forecasters course, who had made an average of at least 70 in both meteorology and forecasting, and after taking the course had served three months in a weather station as "student forecasters"; and (3) non-graduates who had made an average of at least 65 in both meteorology and forecasting and had served one year in a weather station as "student forecasters."[79]

In the spring of 1943, however, the end of the expansion period was reached and the AAF was taking steps to curtail as much of its technical training as possible. The AWC proposed that the enlisted forecasters course at Chanute be discontinued, but it left the final decision to the Weather Wing, which was assuming more and more interest in the training of personnel for the entire weather service. The question provoked spirited discussion among various offices at the Wing headquarters. As one A-3 officer pointed out, there were three compelling reasons for continuing the course, even though there was only a slight shortage of forecasters at the time: (1) the Weather Wing had promised the regional control officers in the foreign theaters to provide forecaster training for 5 per cent of their observers at a technical school in the United States, at least until the end of 1943, in an effort to help maintain the morale of observers in those theaters; (2) the possibility that they might qualify for higher ratings by training as forecasters had led many superior enlisted men to seek assignments as observers in the weather service, and if there were no more enlisted forecaster training, only in rare instances could a man in weather service be promoted above the

grade of staff sergeant; and (3) since it appeared likely that after the war most Regular Army Air Corps officers would be pilots, most routine forecasting would have to be provided by Regular Army enlisted men, in which case there would be considerable advantage in continuing the enlisted forecasters course on a token basis in preparation for these requirements.[80] These points were concurred in by a number of other officers at Weather Wing Headquarters.[81]

Meanwhile, another notion was being favorably considered by many officers at the wing headquarters. The work which enlisted forecasters performed differed very little from that done by officer forecasters; indeed, it was often said that a soldier good enough to be a rated forecaster was good enough to be a commissioned officer. Since pilots usually preferred to discuss weather problems with fellow officers a forecaster with a commission was more useful than one without. Proponents of this view suggested that enlisted forecasters who did not possess the qualifications necessary in an officer be derated and assigned to station administrative duties; all the others should be given commissions automatically. It inevitably followed that the enlisted forecaster course was recommended for discontinuance "as soon as possible."[82] In spite of the favorable comment this plan excited, the Weather Wing never recommended it to higher headquarters; instead, the wing suggested that the enlisted forecasters course be continued indefinitely on a token basis, with first priority given to overseas and by overseas stations. This plan was put into practice, although the frequency and size of the classes were reduced constantly.[83]

When the enlisted observers course at Chanute was discontinued early in 1944, the decision was also reached that no more forecasters classes were to be entered. The Weather Wing immediately asked that the equipment at Chanute be transferred to it so that it might train observers as forecasters at its stations. The plan was disapproved by AAF Headquarters on the ground "that of the several categories of weather personnel, that of the weather observer is the only one for which on-the-job training is suitable." If the weather service needed more forecaster training, AAF Headquarters added, the course at Chanute would be continued and expanded.[84] The Weather Wing did not express any such need at that time and the course was ordered suspended with the graduation of a class on 16 September 1944. The civilian instructors were released, and most of the enlisted instructors dispatched to service in the field.[85] Even as these steps were being taken, however, the Weather Wing changed its mind and asked that forecaster training on a limited basis be continued indefinitely to provide replacements, allow observers with exceptional qualifications to become forecasters, boost the morale of observers, and maintain a continuous training program.[86] Accordingly, AAF Headquarters directed Chanute to resume the course on a token basis on 27 November 1944. A new class(between 20 and 75 men) was to enter every 24 weeks for instruction over a 22-week period. Almost all students were to come on quotas allotted to weather regions in all parts of the world, with a few from the instructor staff of the school itself who had fortunately been retained (as map analysts) in case they would be needed as in an instructors in just such an emergency.[87]

In January 1945, scarcely three months later, a survey of the weather service was made which revealed that, based on the current authorized war Department troop basis, there was a surplus of 340 enlisted forecasters.[88] On the basis of this, Col. Joyce L. Hood, chief of the Weather Division, recommended that the forecasters course now in be shortened, although physical facilities should be retained pending a decision on weather needs for enlisted forecasters. AC/AS Training, however, had learned its lesson from its experience of the previous year and refused to concur. As Col. G. S. Bond pointed out, it was now the policy of AAF Headquarters to continue training on a token basis in such situations because the discontinuance of a course meant the loss of highly skilled instructors, and a delay in re-establishing the course after the war.[89] The vindication of this decision was provided the following year when new plans for the stepping up of the aerial war against Japan produced a shortage of 324 enlisted forecasters. On the basis of this, Col. D. N. Yates, Colonel Hood's successor in the Weather Division, now urged that the course be continued by all means, although still only on a token basis.[90] Through all this debate the forecasters course continued uninterruptedly at Chanute.

On 21 June 1945 authorization was requested for advanced weather forecaster courses for the remainder of 1945 and on into 1946 to train some 733 enlisted forecasters.[91] Most of these were to replace men released from the weather service to civilian life, but since the closing of stations and general reduction of AAF activities should have permitted separation of many men without replacement, AC/AS Manpower felt that it

would "be a rather unenviable position for the Army Air Forces if, after all these months of operations, we have to expand further in order to reduce."[92] The estimate was revised accordingly and as of 6 September 1945, the enlisted forecaster quota for V-J plus 12 months was set at 632.[93]

WAC's in weather training. An experiment in training members of the Women's Army Corps as forecasters was conducted briefly in the spring of 1944. Ten women, qualified observers through on-the-job training at weather stations, were sent to the forecasters class which began at Chanute on 17 April.[94] They attended the same classes and took the same examinations as male personnel, which made it possible to compare the work of the two sexes. Five of the 10 women failed to complete the course, 2 ended with grades above the class average, and among the 70 persons in the class, the 3 highest ranking women placed 2d, 26th, and 32d. There was no positive correlation, however, between the scores which the women had attained on the General Classification Test and the ranking they achieved in their course work: the WAC with the lowest GCT score placed highest among the women, while the WAC with the highest score placed second.[95] At any rate the results did not encourage Weather Bureau officials to enter any subsequent groups of WAC's.

In general, throughout its career of modification and fluctuation, the curriculum of the enlisted forecasters course closely resembled that used in training aviation meteorology cadets and weather officers, as will be shown later in this study. The high quality of the work performed by the enlisted forecasters in weather wing stations all over the world during World War II is splendid testimony of the success of the courses as given at Chanute and Grand Rapids.

Radiosonde Operators Course and Rawinsonde Training

Although the Army Air Forces trained a comparatively small number of enlisted men as radiosonde operators, its experience in this connection has significance for at least two reasons: it demonstrated the fashion in which the AAF carried on training for a new meteorological technical device during wartime, and it provided an interesting comparison of training done simultaneously in military and civilian schools.

The radiosonde is an ingenious device designed to determine the distribution of pressure, temperature, and humidity at different altitudes in the atmosphere. Evaluation of this data permits the meteorologist to estimate the icing level, degree of turbulence, and height of cloud layers, and with numerous soundings, to determine upper air pressure patterns. Originated by Russian meteorologists in 1930, radiosonde was further developed for the U.S. Navy by the U.S. Bureau of Standards. It consists of a one-tube radio transmitter which sends out a timed signal; connected with the transmitter is an aneroid barometer and two tiny resistance elements. When a radiosonde observation is to be obtained, the operator attaches the device to a large, hydrogen-filled balloon capable of rising as high as 20 miles before bursting. As the balloon and radiosonde ascend--and the air pressure correspondingly decreases at a known rate--the variations produced in the resistance elements by the changing conditions of the atmosphere aloft modify the frequency of the radio signal. These alterations in frequency, caught by the observer through a receiver on the ground, are translated into specific readings of both temperature and humidity at various altitudes. Taking the two together, and using calibration charts, the observer can produce data on the pressure of the upper air.[96]

From the time the AAF began to make limited use of radiosonde in 1938 until 1942, it made arrangements with the Signal Corps to have its personnel trained at Fort Monmouth. By the latter year its use of the device had grown to such an extent that AAF weather officials arranged with the U.S. Weather Bureau to train officers and enlisted graduates of the observers and forecasters courses at the bureau's radiosonde school located at Washington National Airport, D. C. The first AAF group began the Weather Bureau course in June 1942 and training continued there until early in January 1944. The number of AAF men taking the course was never very large: in an early class there were 5 enlisted men and 1 officer and during the last months of the course the enrollment reached 36 AAF men. The students were observers and forecasters who were selected by their commanding officers to fill quotas allotted by AAF Headquarters, and they attended the same classes as the civilian employees of the Weather Bureau who made up the regular clientele of the school. The instructors, who were bureau experts, were furnished at no cost to the AAF.

At the time the AAF started sending its men to the Weather Bureau school, it considered the arrangement as temporary, one which would be discontinued just as soon as the projected Weather Training Center at Grand Rapids was opened. At this center it was expected that instruction in radiosonde could be given regularly, either as a separate course or in connection with the meteorology cadet and enlisted forecasters courses.[97] The expectation that it was to be only temporary caused the Weather Bureau school to follow a somewhat chaotic course. No housing for the students was built; and after a series of misadventures in tents during a

snappy Washington autumn and much correspondence with AAF Headquarters, the men were put on quarters and rations, to their own satisfaction and the AAF's relief.[98] The limited classroom space and equipment available likewise provided the officer-in-charge with a series of headaches, but eventually this difficulty was solved--after a fashion--by putting the school on two shifts.

Another vexing problem was that of obtaining students who were sufficiently acute intellectually to benefit from the difficult instruction.[99] The officer-in-charge suspected that inasmuch as weather station commanders were not assured that the men they sent to the course would be returned to them on graduation, they did not delegate their best men to fill the quotas. He observed that the students displayed a "passive attitude" toward the instruction and were not of a caliber comparable to that of the students in the Chanute forecasters course.[100] The elimination rate for the course ran somewhat over 10 per cent, which weather officials considered too high.

After the course had been under way at the Weather Bureau school for some months, careful preparations were made for radiosonde instruction at the Grand Rapids Weather Training Center. It was decided that it would be impracticable to teach radiosonde operation in connection with other courses and accordingly a syllabus for a separate eight-week course was developed.[101] Owing to the tardy arrival of balloons, instruments, and other necessary equipment, the Grand Rapids course, with 50 students in the first class, did not get under way until 10 May 1943. While this class was under instruction, orders were received from Washington that the Grand Rapids school was to be discontinued, and all its courses, teaching personnel, and equipment were to be moved to the Department of

of weather, Chanute Field. Thus, with the graduation of the first class on 3 July 1943, radiosonde training at Grand Rapids came to an end.[102]

Despite some difficulty in finding a barracks area free of electrical interference for use as a classroom building, the school authorities made the move from Grand Rapids to Chanute smoothly enough. The first class of 51 men entered on 15 July 1943, and new classes were entered every four weeks thereafter, permitting two classes to be under instruction at one time. At Chanute, just as at Grand Rapids, the course lasted eight weeks. The material presented fell into three classes: (1) theory, operation, and maintenance of equipment (48 hours, given one hour each day throughout the course); (2) radiosonde code (18 hours); and (3) radiosonde observation (222 hours, including laboratory instruction in radiosonde observations, preparation of forms, etc).*

During the first four weeks of its study a class was known as the "beginners class" and operated on a single shift, daily except Sunday, from 0600 to 1200 to receive theoretical background for the subject, mostly through lectures. In the last four weeks, as member of "the advanced class," students were grouped into four sections and given instruction in four different time shifts during which they had plenty of opportunity to apply through practical work the principles learned during the first four weeks. Experience convinced the school authorities that a student could not perform the practical work of the last half of the course if he had not mastered the theoretical aspects. To make certain that unqualified students did not proceed to the practical phase, a quiz was [illegible] in August 1943 to rate the [illegible] of all students during the first four weeks [illegible], and those found deficient were [illegible] from the second half of the course.

* For a detailed syllabus, see App. L.

The use of four shifts in the latter part of the course had two advantages. By having each group of students spend one week on each of the four shifts, it was possible for them to observe typical diurnal changes and their effect on radiosonde operation, and it made the school's limited equipment go four times as far.[103]

During the first ten months in which the course was given at Chanute, the chief administrative problem was the maintenance of a satisfactory student-instructor ratio. In the first month, a number of additional radiosonde receivers became available to the AAF, and AC/AS Training ordered the number of students entering the Chanute course each four weeks increased from 51 to 65.[104] The Chanute authorities had to make several requests to obtain authorization for even a slight increase in the instructional staff. During one period, when the Department of Agriculture was required to send a certain number of its instructors to the field noncommissioned officers school, the ratio of instructors to students dropped as low as 1:6.5. This was considered particularly serious, because in the latter half of the course extremely close supervision of the students was imperative for satisfactory teaching.[105]

The authorities at Chanute, like those at the Weather Bureau school, became convinced that many of their station commanders were failing to send their best men to the course for fear that they would not get them back again. In October 1943 the Chanute officials requested that thereafter only graduates of the school's observers course were to be entitled to the course, students whose records, general background, and

qualification for overseas duty indicated they were promising radiosonde operator material. In acting on the request, higher headquarters prescribed a procedure that did not entirely solve the situation. Hereafter, Central Technical Training Command headquarters directed, all graduates of the Chanute observers course were to be investigated with a view to their potentialities as radiosonde operators. Those considered suitable were to have a notation on their AGO Form 20 that they were "recommended for Radiosonde Operators Course." This would guide station officers in selecting men for the course after they had served a period in the field as observers.[106]

During the summer of 1943 the supervisor of the Chanute radiosonde course learned informally that radiosonde operators in the field were experiencing some difficulty because they did not know how to repair and maintain the ground equipment. Strictly speaking, this type of work was the duty of weather equipment technicians, but many officials believed that radiosonde operators ought to be capable of making repairs in an emergency. During September and October the Chanute supervisor attended a course in the maintenance of radiosonde ground equipment and other weather instruments at the Signal Corps Weather-Equipment Technicians School at Fort Monmouth. While he was away, his assistant submitted a recommendation to the heads of Chanute Department of Weather that the radiosonde course be lengthened to 10 weeks so that instruction of this nature might be made a regular part of the course. As things stood, the assistant supervisor pointed out, Chanute students were receiving only four weeks of actual work with ground equipment, while those at the Weather Bureau school were

getting seven. The request for the extension was denied, but after the supervisor returned from Fort Monmouth, more work in maintenance problems was introduced into the last four weeks of the Chanute course.[107]

By the time the AAF got its own radiosonde course into regular operation during the middle of 1943, the number of radiosonde sets which were becoming available each month had so increased that officials of the Weather Wing and AAF Headquarters concluded that the AAF technical school could not train enough operators to make use of them. They decided, therefore, that the AAF continue training operators at the Weather Bureau school indefinitely. The size of the classes at the Weather Bureau school was increased to 36--the maximum military capacity for the school.[108]

About this same time Dr. Michael Ference of the University Meteorological Committee paid a visit to the Weather Bureau school and Paul A. Arnerich, Assistant Meteorologist of the Weather Bureau, visited the Chanute school. The reports which these men submitted provide a basis for comparing the work of the Army and the Weather Bureau schools. The civilian school, Dr. Ference reported, was now offering a 9-week course--324 instructional hours, 6 hours a day, 6 days a week; the class of 36 AAF enlisted men and 5 Weather Bureau employees was divided into 2 groups, one studying during the morning, the other in the late afternoon. The material taught, in Dr. Ference's opinion, was divided into "small, easily digestible units," and was "well organized and unusually complete." Little material of a theoretical-background nature was presented, since it was supposed that

the interpretation of the data collected by the operator would be made by the forecasters. Dr. Ference found the physical plant and equipment "excellent" and the instruction on its care "good." The proximity of the Weather Bureau's radiosonde checking division permitted the students to see examples of field radiosonde work, and the school's seven instructors all had had field experience, although not all of them were professional meteorologists.[109]

Arnerich found the Chanute course operating "very well," the curriculum, which he noted "derived from the same basic pattern" as the Weather Bureau course, "well planned and executed." The plant, set up in a two-story barracks, resembled a radiosonde station in the field "fairly closely." None of the instructors, he observed, had had any field experience, but were either former instructors at Grand Rapids or graduates of the Weather Bureau school;as a group they were "relatively inexperienced but interested." He thought it would be a good idea if some men with field experience were added to the instructional staff. In addition, he had several suggestions as to how the work of both the Chanute and Weather Bureau schools might be improved. Steps should be taken, he declared, to keep the instruction more closely attuned to actual field practices and problems. As it was, Weather Bureau operational procedure and practices were being taught at both schools, but these obviously were not always the best ones for AAF purposes. He thought it would be advantageous to permit a more direct method of communication between the two schools for the discussion of their common problems.[110]

It was not until the middle of October 1943 that the Weather Wing undertook to discover just what the AAF's probable ultimate need for radiosonde operators would be and to make plans to meet it. A survey indicated that on 1 January 1944 the AAF would need 504 operators; the number of men already in service plus those scheduled to be graduated by that time was 437, leaving a shortage of 67. It therefore appeared certain that considerable curtailment in the rate of training would be advisable in the near future. AAF officials agreed that it would be well to discontinue sending men to the Weather Bureau course, but they had varying opinions as to what should be done about the Chanute course. Col. William O. Senter, commanding officer of the Weather Wing, urged that although there would be need for only a small number of new graduates during 1944, the course be continued indefinitely, even if on a very small scale. In this way a replacement pool of radiosonde operators could be created to provide for the 10 per cent of disqualifications which normally appeared at overseas replacement centers.[111]

At first it appeared that Colonel Senter's suggestion was to be adopted. The AAF planned to discontinue sending men to the Weather Bureau school after the term ending 8 January 1944, and in December 1943 AC/AS Training gave orders that a class of 10 enlisted men should be entered at Chanute every eight weeks throughout 1944.[112] Six weeks later, however, on the basis of a new calculation of AAF troop needs for 1944, it was suddenly declared that a sizable surplus of radiosonde operators existed: the number authorized for the year 1944

was only 501 and as of 1 January 1944, 545 were assigned to the Weather Wing.[113] Holding that the "demand for radiosonde operators had been met," AC/AS Training ordered that all training cease after the graduation of the class of 18 February 1944.[114]

Little more than a month later, however, in the belief that a shortage of qualified radiosonde operators was imminent in overseas theaters, the wing directed the regional control officer of the 2d Weather Region to establish a radiosonde course at Scott Field. There was in existence at Scott a radiosonde operators pool, which contained a number of men who had been instructors in the discontinued Chanute course; these, the Weather Wing directed, were to be used to give the new course.

The RCO of the 2d Weather Region was in the midst of establishing the course, as directed, when Col. Floyd B. Wood, Acting Chief of the Weather Division at AAF Headquarters, learned what was happening from a perusal of the minutes of the special staff meetings at Weather Wing Headquarters. Colonel Wood promptly pointed out that under War Department policy it was the duty of AAF Headquarters to conduct training for overseas assignments, and that according to the figures furnished his office by the Weather Wing there was a surplus of 48 radiosonde operators in the domestic weather regions. If the Weather Wing needed more operators, he concluded, AAF Headquarters would make arrangements for training them.[115]

Although the Weather Wing insisted that there was an immediate need for 54 additional radiosonde operators, and AAF Headquarters

approved a plan for reestablishing the course at Chanute,[116] the matter became sidetracked when a larger problem appeared during the spring and summer of 1944. By this time the use of the SCR-658 direction finder set was becoming so general throughout the weather service that the need now was not for radiosonde training alone, but for radiosonde plus SCR-658 (called for short "rawinsonde") training. With this, radiosonde training as a separate course of instruction was completely cancelled.

So technical were some phases of rawinsonde training, however, that it did not seem advisable to AAF Headquarters to attempt to offer all of it at Chanute. Rather, the program was divided into three parts: a Radiosonde and Radio Directional Finder WindsAloft Operation course to be given at Chanute, a course in SCR-658 maintenance to be given at the Army Electronics Training Center at Harvard University, and a course in radiosonde maintenance to be given at the Signal Corps Ground Signal Agency, Spring Lake, N. J. The first course was to be an amplification of the old Chanute radiosonde course; the course at Harvard would use some of the same equipment, teaching personnel, and subject matter employed in training AAF and Signal Corps officers in radar; and the last course would be given in conjunction with the Signal Corps, which was still charged with maintenance of all weather equipment of the Army.[117]

All three of these courses were difficult, the one at Harvard particularly so. For this the authorities specified as prerequisities a thorough knowledge of mathematics (including calculus) and successful

completion of the school's entrance examination. They added that a degree in electrical engineering or electronic physics was also most desirable.[118] After looking over the field, weather service officials concluded that the likeliest candidates for such training would be graduates of the "C" premeteorology course,* who would have had 12 months of physics and mathematics. The Weather Wing allotted each of the continental weather regions a quota for the rawinsonde courses to be filled from the group of "C" graduates who had been sent them for in-station training and service as weather observers.[119]

The Chanute course was 10 weeks in length, the Harvard course 17 weeks, and the Spring Lake course 4, and although they were each operated independently and could be taken in any sequence, a man had to pass the course he took first before he was permitted to enter another. An elimination rate of 20 per cent was expected. To make the most economical use of the facilities of three schools operating under such conditions, AAF Headquarters assumed supervisory responsibility for the courses and worked out a complicated schedule, for the assignment of students, on 16 October 1944.[120]

By the spring of 1945 it became apparent that the need for rawinsonde operators and mechanics would continue indefinitely, and in April the War Department authorized an increase in the number of "R"-type stations--the type of stations which used such equipment--from 173 to 230. On the basis of this increase, AAF Headquarters in June estimated that there was still need for training 400 rawinsonde men.[121] A month later

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* See below, p.101.

this number was raised to more than 1,200 to allow for replacements that appeared likely to develop during 1945-1946 on the basis of an "assumed separation rate of 5 per cent of personnel each six month period."[122]

Since the programs at the Army Electronics Training Center and the Ground Signal Agency were scheduled to wind up during the summer of 1945, a new problem appeared: where was this training to be accomplished? On 6 June AAF Headquarters directed that all three courses were to be combined into a single "rawinsonde" course to be given at Chanute starting in the middle of July, with course quotas filled with observers furnished by the Weather Wing, and the course "given exactly as it had been at Harvard, Spring Lake, and Chanute": basic radio and electricity (13 weeks), SCR-658* maintenance (4 weeks), radiosonde and power unit maintenance (4 weeks), and radiosonde and radio-directional-finder winds aloft operation (10 weeks).[123]

These then were the three main courses given to enlisted men of the weather service--observers, forecasters, and radiosonde-rawinsonde training. The success of each varied, as has been noted, and a great deal of fluctuation and modification in course content was necessary to adapt the training to expanding needs. Despite jurisdictional, administrative, and educational difficulties, the wide range of this training can be said to have been notably effective in providing an indispensable service for U.S. air--and ground--forces.

*The weather services also used the rawin equipment SCR-584 at this time, and a small number of officers and enlisted men were trained in its use at Spring Lake and Harvard.

Chapter III

CADET METEOROLOGY PROGRAM

Early in 1940 when the German army was overrunning western Europe, the air arm of the American army had fewer than 30 officers who had received advanced training in meteorology at the Massachusetts Institute of Technology or the California Institute of Technology. Only 4 of them were assigned to the GHQ Air Force, although one for each of its 17 weather sections had been authorized. This shortage may be traced to certain Air Corps traditions, among them the beliefs that to be eligible for meteorology training a man had to be a pilot officer; that it was desirable, if not precisely necessary, that he have four or more years of commissioned service; and that his application for such training be reinforced by a recommendation from an officer who had already taken a meteorological course. Most important, however, was the practice of not assigning more than eight officers a year to such training.[1] To ameliorate this shortage the GHQ Air Force on 10 January 1940 recommended to the Chief of the Air Corps that the annual quota of officer meteorological training be increased to 12, the 4 additional men to be assigned after graduation to the GHQ Air Force.[2]

Training in the Defense Period, 1940-1941

Before any action was taken upon this proposal, there developed a new and larger need for officers with weather training. Late in May 1940 the Air Corps was making plans to step up aircrew training to

a basis of 7,000 pilots a year, and to carry out such a program it was estimated that it would be necessary to have 26 instructors in meteorology, either commissioned or civilian.[3] The files were combed for men who had been eliminated from flying cadet training for "flying deficiency" but who had the necessary educational qualifications. Twenty of these were appointed nonflying "flying cadets" and enrolled in a 10-1/2-week summer school at M.I.T. starting early in July under the direction of Dr. Sverre Petterssen.[4]

The training of this small group of nonpilot cadets set a precedent that was used to solve one of the problems growing out of the rapid Air Corps expansion of 1940. By the middle of the year, plans for Air Corps activities had grown so ambitious that the 17 weather officers authorized for the GHQ Air Force now seemed a paltry few; the newly-approved program called for 31 weather officers in the organization by April 1941. Yet on 8 July 1940 the GHQ Air Force and other Air Corps tactical organizations found themselves with a total of one man, specifically assigned as meteorological officer. He was stationed at GHQ Air Force headquarters at Langley Field.[5]

This dire situation convinced the OC/AC Weather Section that, desirable as it was that weather officers be pilots, the expansion of the Air Corps made it imperative that considerable numbers of men without pilot training be used as weather officers. Pointing out that there was "no appreciable reservoir of already trained weather forecasters upon which the Army could draw," it recommended that 30 recent college graduates with training in mathematics and physics be enlisted

as nonflying "flying cadets" and assigned to the regular 9-month graduate course in meteorology given at several universities starting the following September. Upon completion of this course these men would be commissioned second lieutenants in the Air Corps Reserve "and ordered to extended active duty with tactical organizations."[6] The proposal received the prompt approval of General Arnold and was forwarded to The Adjutant General. But instead of 30 cadets, General Arnold asked for 40. These were to meet all the requirements exacted for flying cadets except that they must pass the Form 63 instead of the Form 64 physical examination.[7]

While awaiting a decision from The Adjutant General, officials of the weather service gained a keener appreciation of the magnitude of the training task they had to perform from a comprehensive survey of the situation made available on 26 July. This indicated that there were then in the United States only 377 qualified forecasters, of whom the Army had 62, commercial airlines 94, the Weather Bureau 150, the Navy 46, educational and other institutions 25. There was need for 280 to 285 more forecasters: 175 for the Army, 25 to 30 for the Weather Bureau, and 80 for the Navy.[8] When a report of this survey reached General Arnold, he concluded that the proposal then afoot to train 40 cadets was grossly inadequate. "Not satisfied," he wrote of the weather service's plans; "if we have need for more than we are training, why not make plans to cover the discrepancies?"[9]

With its hand thus strengthened, the Training and Operations Division launched on a far more ambitious program. Its objective now

became the training of 150 cadet meteorologists during the next academic year. Every one of the five universities in the United States then giving meteorological training was questioned by radiogram to ascertain its maximum training capacity. It was found that among them 150 Air Corps students could be accommodated.[10] The task of recruiting this number in the short time available promised to be made far easier by enlisting the assistance of the placement bureaus and alumni associations of the five universities. Massachusetts Institute of Technology distributed details of the cadet plan and solicited applications from between 150 and 200 universities and colleges in the eastern United States; a similar campaign was carried on in the western United States through the joint efforts of the California Institute of Technology and Capt. Ivan Farman, regional control officer of the 1st Weather Region. Later the University of California at Los Angeles joined the drive, Professors Athelstan Spilhaus and Gardner Emmons of New York University expressed their willingness to do some recruiting, and Professor C.-G. Rossby of the University of Chicago distributed 200 application blanks. Some newspaper publicity was obtained for the program. An agreement was made with F. W. Reichelderfer, in charge of recruiting meteorologists for the Civilian Pilot Training Program, that an effort would be made to induce some 25 to 50 of the 100 men studying under that program to become Air Corps Reserve officers.[11] In his eagerness to get the program under way with the best available students, Capt. Arthur F. Merewether, chief of the Weather Section, scrupulously examined each of the applications received,[12] and by early October 116 cadets were enlisted and studying at the five universities.[13]

The courses they took were under the direction of some of the most distinguished living meteorologists: Dr. Sverre Petterssen at M.I.T., Dr. Irving Krick at C.I.T., Dr. Carl-Gustav Rossby at the U. of Chicago, Dr. Jakob Bjerknes at U.C.L.A., and Dr. Gardner Emmons at N.Y.U.[14] Despite the fact that at the start the course of instruction differed from one university to another, there was a basic similarity inasmuch as all were modifications of the course given at M.I.T., pioneer in meteorology training in this country.*

During these early days the cadets lived a life not unlike that of their civilian fellow-students: they did not wear uniforms nor did they participate in drills and parades; and they lived in quarters of their own choosing. However, the subject matter they had to master to complete the course satisfactorily was sufficiently difficult to prevent their lives from becoming too easy. By June 1941 the 112 men who had satisfactorily completed the course were sent to selected air bases for a month of military training, after which they were commissioned second lieutenants.[15]

In the middle of May 1941, before the class had been graduated, the Air Corps announced that the course would be repeated: again 150 cadets would be trained at the five universities over a nine-month

* The curriculum in effect during 1940-41 at the U. of Chicago, which was offering a course in meteorology for the first time that year, may be considered representative: synoptic meteorology (4 hours a week, first and second terms); meteorological laboratory (16 hours a week, all three terms); descriptive meteorology (4 hours a week, first term); dynamic meteorology (4 hours a week, all three terms); physics of the high atmosphere (4 hours a week, third term); and laboratory in upper-air observations (4 hours a week, third term). (Ltr., A. H. Compton, U. of Chicago to C/AC, 27 Aug. 1940, and attachments, in AAG 353.9A, Meteorological Training). In addition, during the third term, visiting lecturers offered instruction in pressure of the very high atmosphere and physical oceanography. (Hist. AFTD U. of Chicago, 18 June 1942 to 31 Dec. 1942, p. 22).

period beginning 1 July 1941. The Air Corps and the universities had little difficulty recruiting this second group since the rolls were declared closed 11 days after they had been officially opened, and when classes started, 182 men were under instruction.[16] The entry of the United States into World War II the following December created such an acute and immediate need for additional weather officers that this second class was graduated and commissioned on 15 February 1942, a month and a half ahead of schedule.[17]

Beginning of Wartime Training

After the attack on Pearl Harbor, AAF officials did not immediately attempt an estimate of how many officers would be needed for the prosecution of the war, but they assumed, naturally, that the number was large. On 15 February 1942 there were approximately 330 trained weather officers in the weather service; to provide adequate weather information for the 115 tactical groups which the AAF was planning to put in the field, 1,000 officers would be required. Each of the universities was canvassed to discover its maximum capacity for training cadets, and on the basis of this survey, 440 started taking the course at all five universities on 16 March, while at three of the universities which indicated they could handle two classes simultaneously--N.Y.U., U.C.L.A., and the U. of Chicago--another group of 400 men started training the following September. Thus by October 1942 there were 840 cadets in training.[18]

Ambitious as these training plans seemed, they were dwarfed by the AAF's first complete survey of wartime weather training needs. In the autumn of 1942 Brig. Gen. H. M. McClelland, Director of AAF

Technical Services, returned from Great Britain convinced that the number of weather officers must be increased prodigiously. On the basis of his report it was estimated that by June 1943 the AAF ought to have a total of 1,350 weather officers, by September 1943 approximately 3,500, by January 1944 about 5,000, and by early 1945 a total of 10,000.

General McClelland's next step was to confer with Dr. H. G. Houghton of M.I.T. as to how much the universities could step up the rate of their meteorological training. After Dr. Houghton talked the situation over with representatives of the other institutions, it was agreed that on 16 November a record-breaking class of 1,750 cadets be entered at the five universities.[20] To augment the training facilities further, plans were drawn up for the training of meteorological cadets at a regular AAF technical school where the curriculum, caliber of instructional staff, and academic standards were all to be on a par with those of the civilian universities. The newly established Weather Training Center at Grand Rapids was chosen as the location of the AAF school. Earlier the Grand Rapids area was slated for the establishment by the weather directorate of a "Weather Service Replacement Center" to assemble, equip, and complete the unified training of various types of weather units destined for theaters of operation and special projects such as ferry routes.[21] In the course of planning and preparation, however, the scope and objectives were markedly altered from the original conception, and instead of providing unit weather training, it was determined that the center should provide individual training, relieving the load on the universities and AAF

technical schools already giving such training. Thus on 4 January 1943 a class of 586 cadets entered and a second class of 887 on 29 March. Men connected with the Grand Rapids center considered the set-up ideal for a weather training school: classrooms, laboratories, barracks, and drill grounds had all been arranged with the exact needs of such an institution in mind, and a well-trained, experienced teaching staff, composed of approximately 400 officers, enlisted men, and civilians, was assembled. Its combined enrollment, at one time in the neighborhood of 3,600,* made it the largest school devoted exclusively to weather training in American history. With the graduation of the first class at Grand Rapids in September, however, the installation was inactivated, and the second class moved to Chanute to complete its training. A third class, numbering 467 cadets, entered Chanute on 4 October.[22]

Meanwhile the pace of training was maintained at the five universities. Throughout the year 1943 at least one of the schools started a new cadet class every 12 weeks or more frequently. A class of approximately 1,750 cadets entered the five universities on 4 January, another class of 500 began studying at three of the universities on 21 June, and a third class of about 1,400 students at all five universities on 4 October.[23]

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* This included the enlisted observers course, the enlisted forecasters course, the enlisted radiosonde operators course, the cadet meteorology course, and a special cadet course for weather instructors.

Problems of Wartime Recruitment

It was no easy task to find enough men to fill these large classes, for with the nation at war, men with the scientific ability and educational background necessary for meteorology training--never very numerous--were in increasing demand by industry and other branches of the armed services. Even many of the qualified men entering the Army were being drawn into other types of activity and so were permanently lost to the weather service. In an effort to counteract this loss, in February 1942 a committee of Air Corps, university, Navy, and Weather Bureau representatives evolved a plan whereby qualified civilians might be enlisted in a reserve status and permitted to continue their education at civilian schools until such time as the Air Corps had facilities available to train them as meteorology cadets. In May The Adjutant General authorized the enlistment of college students in the Air Corps Reserve under such conditions.[24]

The problem of procurement was also reduced by the easing of admission requirements. These were modified soon after Pearl Harbor to make eligible men still in their senior year at college but over 20 years of age. Educational prerequisities still called for courses in mathematics, including differential and integral calculus, and in physics, including heat and thermodynamics; in addition, some training in differential equations and vector analysis was considered desirable. At the same time the course was opened to Army officers, provided they possessed the necessary educational qualifications and agreed to serve three years on active duty with the Air Corps after graduation.[25] As

time went on and qualified men became more difficult to find, further modification of the requirements became necessary. Both AAF and university officials were reluctant to reduce the amount of academic preparation necessary: the best way to avoid this appeared to be the raising of the age limit for applicants. The upper limit for ground duty cadets had long been 26 years, and a survey showed that there was a considerable body of qualified men above that age. Besides, as the weather service pointed out, a weather officer performs "duties requiring mature judgment and emotional stability more often associated with men" over 26. Accordingly, late in the spring of 1942 the upper age limit was raised to 30.[26] Only a few months later it became necessary to reduce the educational prerequisites as well: beginning on 5 October 1942 two rather than three years of college were required. During his college years the applicant still had to have specialized in science or engineering and have "satisfactorily completed thorough courses in mathematics, including differential and integral calculus, and physics, preferably including a study of heat and thermodynamics." Thus reduction in the amount of scientific preparation required was only slight.[27]

Although the Army made some efforts to find suitable cadet material within its own ranks and among civilians, as time went on the task of procurement fell more and more into the hands of the five universities. Shortly after Pearl Harbor, in order to expedite the processing of applications, the Operations Division of AAF Headquarters waived its right to review them. Aviation cadet examining boards continued nominally to watch out for the interests of the weather

service in the selection process, but actually the admission authorities of the universities did most of the work.[28] By the autumn of 1942, however, the universities began to find their recruitment efforts bringing diminishing returns, and the Army's efforts to discover suitable men in its ranks were meeting only moderate success. The latter was apparently due largely to inadequate publicity for the program within the camps: the Army found it difficult to impress officer candidate boards with the urgency of the need and caliber of the men desired, and commanding officers were slow to indorse the applications of worthy men. This situation was one of the factors which caused General McClelland to propose in October that the five universities form a University Meteorological Committee to effect closer and more efficient coordination with the AAF in the training program. Each of the universities and the AAF appointed two representatives to the committee, with Dr. C.-G. Rossby of the U. of Chicago acting as chairman of the executive subcommittee. An office was set up at the Institute of Meteorology of the U. of Chicago with Dr. Joseph Kaplan of U.C.L.A. as chairman of the Joint Recruiting Board for the committee.* A branch of the AAF Military Personnel Division was set up in the UMC's office to coordinate its work with the Army.

Under the direction of the UMC, an extensive publicity campaign was started in November. Newspaper articles, radio programs, direct mail advertising, and other standard promotional media were used.

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* Subsequently Kaplan was succeeded by Robert Kimball, assistant director of admissions at M.I.T.

Men with the necessary qualifications were invited to write "Weather, University of Chicago" for brochures describing the program and application forms. Although applications were still being received by Army recruiting stations and aviation cadet examining boards throughout the country, the response to these particular appeals was highly gratifying: of the large number of applications received, approximately 50 per cent were from men considered potential weather-officer material.[29] All applications, whether submitted through Army channels or directly to the U. of Chicago, were examined by a staff of experienced college transcript evaluators and AAF representatives at the UMC headquarters.[30]

This recruiting was considerably complicated by the sudden issuance on 5 December 1942 of an executive order by the President of the United States forbidding any voluntary enlistments in the armed services effective the 15th of that month. The recent large increase in training facilities at the universities had drawn so heavily on the backlog of eligible candidates that the Military Personnel Division feared that it would be unable to fill the large class scheduled to begin at the universities on 4 January 1943. One way to get around this situation was to order the immediate termination of the inactive status of enough men in the Air Corps Enlisted Reserve to fill up the class; inasmuch as only two years of college work was now considered necessary for meteorology training, enough adequately prepared men could be found in this way. Yet, when the Military Personnel Division requested the permission of G-1 to issue such an order, it was refused: there were enough regular applications still

pending to make the order unnecessary, G-1 maintained. If the Military Personnel Division desired, it might canvass the men in the enlisted reserve, suggesting that they volunteer before 15 December.[31]

This was the immediate effect of the presidential order ending voluntary enlistments, and although there were other orders far longer lived which presented problems more difficult to solve, the suddenness of this one left the AAF weather officials uncertain as to how they were to procure meteorology cadets in the future. By the end of the month the AAF had so impressed the urgency of its need upon the Secretary of War that it obtained permission to accept 1,600 "voluntary inductees" for meteorology training up to 31 January 1943. Applicants were to be examined by aviation cadet examining boards, and those considered qualified were to be furnished with a letter certifying their qualifications. The applicant was to present this letter to his Selective Service Board when reporting for "voluntary induction" within a specified number of days. After processing, the inductees were to be sent to the AAF Basic Training Center at Boca Raton, Fla. for basic military training, pending transfer to one of the universities or to the AAF technical school.[32] Thus, although the executive order virtually ended all participation of the UMC in the procurement program, it did not cease to exist: the new responsibilities of monitoring the academic program at the universities and furthering research in meteorology were taken on.

The exact number of meteorology cadets obtained during this period of "voluntary induction" is uncertain, but it seems probable that it was not more than "several hundred."[33] At any rate, the number was small enough to make AAF officials anxious to terminate "at the close of the current college semester, term or quarter" the deferred status of

Air Corps Enlisted Reserve students who enlisted for meteorology training and to dip into the backlog of 1,000 enlisted reserve communications students to make up the quotas. Permission was granted for the former plan, but not the latter.[34] By late March the quotas for the classes to start 29 March and 21 June had been filled, and during the next few months it was determined that only applications from enlisted forecasters already in the weather service would be considered.[35] During this period of recruitment approximately 30,000 applications for meteorology training were screened and processed, and of these about one third were accepted.*[36]

Academic Supervision of the Course

Supervision of the curriculum proved to be one of the most vexing problems of the cadet meteorology program. At the outset each university used the curriculum of its own graduate meteorology course in training cadets; if modification or standardization of some point were necessary, this was accomplished informally between the university men themselves and with A-3 and the Directorate of Weather in AAF Headquarters. A complication developed in July 1942 when administrative detachments of the Technical Training Command, consisting of one officer and five enlisted men, were established at each of the five universities. The purpose behind this step appears to have been to make the routine of the meteorology cadet conform more closely to the traditional pattern of Army cadet life. Uniforms, drills and parades, and cadet barracks

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* Not all of these, however, were for admission directly to the cadet course. A considerable number were for admission to the two premeteorology courses leading to the cadet course. For a discussion of these premeteorology courses and recruitment done for them, see Chap. IV.

life all were superimposed upon the regular course of study. But besides being responsible for these strictly military activities, the detachments were informed by the Directorate of Weather that they would "also function as administration officers [sic] and will represent this office in matters pertaining to the meteorology training program."[37]

In view of the fact that the Directorate of Weather had no immediate control over the Technical Training Command, it would appear inevitable that an order so loosely phrased as this would lead to a jurisdictional dispute. It did. By the middle of the following September the Director of Weather was complaining to the Director of Individual Training that

> in some cases the detachment commanders under the jurisdiction of the Technical Training Command have had a misconception of their duties as pertains to the technical training itself and have interfered with the technical training program. Instruction at these schools was intended to be solely the responsibility of the university providing the instruction. In some cases military training and administrative requirements imposed by detachment commanders . . . have interfered seriously with the technical training schedules of instruction.

These representations led the Director of Individual Training to order that detachment commanders be informed

> that their functions are purely administrative and military in nature and that they have no connection with the technical training program outside of maintaining friendly and cordial relations with the school authorities. . . . Any interference with the highly concentrated and highly technical training program at these schools will be held to an absolute minimum in the preparation and announcement of military schedules.[38]

This order seems to have solved the problem for the time being, since two months later the Acting Director of Weather complimented the detachment commanders on their "high degree of consideration and individual activity beyond the normal discharge of routine," and he declared

that the program was producing "a fine type of officer well schooled in essential military characteristics and requirements."[39]

The jurisdictional conflict was revived by the tremendous expansion program begun in November 1942 and the concomitant establishment of the University Meteorological Committee in Chicago. It was vaguely understood that the UMC, besides conducting recruiting, was to exert some sort of supervisory control over the academic program. This situation made certain high Technical Training Command officials resentful, a civilian adviser to the Director of Weather learned while visiting TTC headquarters in January 1943. To him, Brig. Gen. Clinton W. Howard criticized the fact that academic authority was exerted from Chicago, which he felt was too far away from TTC's headquarters at Southern Pines, N. C. Maj. Gen. Walter R. Weaver, commanding general of the TTC, complained of "the attitude of the Director of Weather," "the present low quality of weather forecasting in the Air Forces," "the commissioning of meteorologists," and "any external control over any course under his command."[40]

Like dissatisfaction surged up elsewhere. At AAF Headquarters the Directorate of Weather pointed out that it was charged with the establishment of training programs; this responsibility implied that it must inspect training facilities and check the quality of training. Yet under present organization the directorate could communicate with the commanding officers at the detachments only through channels: the Directorate of Weather to the Director of Individual Training to the commanding general of the TTC to the commanding general of the district TTC to the detachment commander. At TTC headquarters Lt. Col. James F. Thompson, Jr., the assistant G-3, was officially in charge of the meteorology programs but, knowing little of their background, he

went slowly in making decisions. At Chicago although the UMC was uncertain of its exact status, it proceeded to act on the assumption that it possessed academic control over the program and was responsible only to the weather directorate. Some of the university officials, quite naturally confused over the delegation of authority, addressed questions directly to the weather directorate, but that office declined to reply on the ground that it did not have the authority to do so.*[41]

The situation was finally clarified by a conference held on 5 February 1943 between representatives of the weather directorate and the Technical Training Command. The agreement which was reached reduced considerably the influence over the cadet meteorology program exercised by the UMC, and to some degree the influence of the Directorate of Weather. Hereafter supervision of the program was to be carried out strictly through military channels. All programs and program modifications were to be approved by the Director of Individual Training acting in the name of the Commanding General, AAF. The channel to be followed was: Commanding General, AAF to commanding general, TTC to commanding general, district TTC to commanding officers of the detachments. From now on the UMC was to act in an advisory capacity only--on training programs to the commanding general of TTC, on meteorological research and technique to the Directorate of Weather.[42] The UMC was invited, however, to maintain a continuing study of the curricula in use at the five

* Another important factor contributing to the dissatisfaction arose out of the problems of supervision and administration of the two pre-meteorology programs which were getting under way about this time. For a discussion of this matter, see Chap. IV.

universities and the AAF Weather Training Center at Grand Rapids. Its recommendations would be passed on to the Directorate of Weather which, if it approved, would pass them on through military channels for compliance.[43]

At least one distinguished member of the UMC was none too happy about this resolution of the jurisdictional question. On 18 April 1943 Dr. Rossby complained to Dr. Edward Bowles, special assistant to the Secretary of War, that

> this is to my knowledge the only country in this World War or in the previous World War in which the outstanding leaders in professional meteorology are used merely for basic training purposes at the universities while policy forming and technical utilization of meteorology is left in the hands of people who have at the most eight months of basic course in meteorology, which certainly is not sufficient to make a man a professional meteorologist.

Dr. Rossby pointed out that the staffs of the two offices which now controlled the meteorology training program--the weather unit of AC/AS OC&R and the weather section of AC/AS Training--had between them a maximum of four officers who could be described as professional meteorologists. Dr. Rossby wrote at length to emphasize how difficult the coordination of meteorological training had been because of the reorganization of the AAF in the spring of 1943. This had split the functions performed by the Directorate of Weather among three organizations: the Weather Wing of the Flight Control Command, with headquarters at Asheville, N.C., in charge of field service; the Weather Information Service, part of the Air Staff at Washington; and the Technical Training Command at Southern Pines, N.C., in charge of training. To illustrate how "inadequate" this organization was,

he cited an experience of the UMC. Two weeks before, to meet "legitimate criticisms" that had been made of the cadet course, the UMC had requested AC/AS Training to prepare a set of charts containing observational material to be used in teaching tropical meteorology. Thirteen days later he learned that nothing had been done, and it was then too late to give the desired training to the present class before graduation.[44]

As time went on, a measure of the antagonism between the university committee and some of the AAF authorities disappeared. Colonel Thompson transferred his office from Southern Pines to Chicago in the late spring of 1943, permitting closer coordination between the TTC and the UMC.[45] Following the assumption of the TTC's functions by the AAF Training Command, Maj. B. L. Wiggin, formerly of the AC/AS Training office and like Colonel Thompson, a trained weather officer, was placed in charge of meteorological training matters at Fort Worth, headquarters of the Training Command. Major Wiggin's "understanding of the program" was, in Dr. Rossby's words, "of great aid to the committee."[46] In determining the length and content of the meteorology course, the university officials and the AAF officers got along amicably. Most problems of this type were ironed out at frequent meetings of the UMC, to which all five universities and the AAF technical school sent representatives, and between meetings, Dr. Rossby, chairman of the UMC executive subcommittee, kept in close touch with the AAF officials.[47]

Length and Content of the Course

During the autumn of 1942, when the need for additional weather officers was so acute, the Directorate of Weather concluded that the

length of the cadet course ought to be reduced from nine months to seven. The UMC in the person of Dr. Rossby resisted "rather strongly."[48] He urged adoption of a course 33 weeks in length, divided into three terms of 11 weeks each, with a week's recess between terms--an idea suggested by the AAF representatives on the UMC.[49] Each of the universities and the AAF technical school were invited to submit to the Directorate of Weather a course outline to fit this time so that instruction might become more nearly standardized. None of those submitted by the universities seemed satisfactory to the directorate, although it did approve of the one drawn up by Colonel McNeal, Director of Training at Grand Rapids.[50]

As ultimately worked out, during the 33 weeks of the meteorology course, cadets at the universities spent an average of six hours a day attending classes and four in supervised study hall throughout a six-day week. About two hours were spent in laboratory and field work for each hour of lecture. Some laboratory time each week was devoted to discussion, usually among groups of 30 to 40 students, of work currently being presented in the lectures. An examination covering all subjects was given weekly, and final examinations were given in each course. After the establishment of AAF detachments at the universities, classes on military subjects, drills, etc. were held in the period between the cadet's arrival at the university and the start of academic classes, during whatever free time the cadets had while the meteorology course was under way, and in some instances during recess weeks.[51] The routine followed at the AAF technical school was slightly different: there, cadets were engaged in classroom work seven hours a day, six days

a week, and took in addition military and physical training for an hour and a half each day and a compulsory, supervised study period 2-1/4 hours each day.[52] In the latter part of 1943 cadets were sent to Cadet Basic Training Center No. 1, Boca Raton, Fla. for a short basic military training course, permitting them to concentrate on meteorology once they had arrived at the universities.[53]

The curriculum used at the universities was in essence a modification of the meteorological course developed at M.I.T. over a period of 15 years.[54] Early in 1944 the Training Command, following its usual practice, issued a memorandum listing the principal features of the course as it was given at that time.* When a draft of this document was submitted to the UMC for approval, Dr. Horace R. Byers, acting chairman, expressed the hope that its issuance did not mean the "freezing" of the curriculum. Standardization had accomplished much good, he agreed, but since meteorology was still a young and rapidly developing science, it was important that the AAF remain ever ready to modify its meteorology training to keep step with it.[55]

Model Weather Stations and "Practical" Training

Dr. Byers' words were a warning against what might happen rather than a criticism of anything that had occurred. As a matter of fact, during its entire history the cadet meteorology course was constantly being adapted to meet the advances of the science, and particularly to respond to the requirements and experience of the weather service in

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* See Appendix F.

fighting the war. Early in 1943, at the time the UMC was making an attempt to standardize the curriculum, Col. H. H. Bassett, Acting Director of Weather, gathered from inspection reports and reports from the field a number of criticisms of university-trained weather officers. These fell into two main groups: lack of scientific knowledge and of the qualities necessary for a technical officer. Few officers, it was charged, were capable of analyzing and forecasting upper-air flow and other problems peculiar to the tropics, or had an adequate knowledge of general problems of the weather observer. Moreover, many officers lacked a "scientific curiosity and professional pride" as well as "drive and enthusiasm"; they lacked the ability to make a sound analysis and forecast on the basis of all the data available, without over-emphasizing some factors at the expense of others; they lacked the ability to give their forecasts orally--to "talk" weather to a pilot so that he could understand it; and too many officers knew too little about the administrative duties of a weather officer, especially the proper way to fill out weather service forms and records, aircraft clearance forms, etc. "It is desired to emphasize," Colonel Bassett concluded in forwarding these criticisms to the UMC, "that the great need at the present time is for a well-rounded weather officer who can run a weather station and turn out a good practical operating forecast under almost any condition."[56]

One step taken by AAF Headquarters to correct this situation was the incorporation into the cadet curriculum of a course in weather station operation and administration. AC/AS Training recommended that it be allotted 30 hours, distributed among the background and organization of the weather service in the U.S. (4 hours), weather station administration

and operation (20 hours), and duties of a weather officer (6 hours).[57] The university officials complained that they were unable to give such a course properly because they did not have the necessary instrumental equipment and because their instructional staffs lacked weather-station experience. In this circumstance, Colonel McNeal suggested that it might be better to drop the course from the curriculum at the universities and offer it as a postgraduate course at some central point like Grand Rapids. Such a procedure, he recalled, had been contemplated when plans were originally drawn up for a weather training and replacement center at Grand Rapids. Lt. Col. Nicholas B. Chavasse of AAF Headquarters replied that the need for officers was so great that "we must visualize officers going directly from training to the field"; there was not time for internship--not even a week. The solution, he declared, lay in the establishment of model weather stations at the universities.[58]

The idea of a model weather station--where cadets might spend a certain period performing routine operations to learn how to apply the theoretical knowledge they were acquiring through their course work--had been bruited about in weather service circles for some months.[59] When the suggestion was first broached late in 1942, Lt. Col. W. O. Senter, Chief of the Operations Division, frowned upon it because sufficient personnel and equipment were not available. A standard weather station, he declared, would require 100 enlisted men and officers, besides certain teletype machines which had in December 1941 been declared in short supply. The use of model stations, Colonel Senter

added, was not desirable unless the stations resembled regular weather stations in every respect.[60]

One of Colonel Senter's objections was promptly challenged by another officer within the weather directorate. Lt.Col. W. H. Neal, executive of the directorate, held that 100 enlisted men and officers were not necessary for a satisfactory model weather station; the weather officer instructors normally assigned to the teaching staff of the university plus one enlisted weather observer waresufficient for a permanent detail. Actual manning of the station could be performed by the cadets themselves. Elaborating this plan further, Colonel Neal pointed out that the cadets might spend some part of each day in the station throughout the length of the course, and by using different shifts of students, "maps and charts could be plotted and drawn, and hourly and synoptic observations continued throughout the day." Anticipating an objection--the difficulties in safeguarding the weather information used in the operation of the station--Colonel Neal stated that security could be made the responsibility of the weather officer instructors and enlisted men.[61]

Late in December 1942 the Director of Weather decided that model stations should be set up at each of the universities. To accomplish this, priorities for equipment and supplies were to be obtained by the Equipment Division. Instruction in the station was to be given throughout the course, not just at the end; Training Manual 1-235 and AAF Regulation 105-8 were to be used as teaching aids; and "adequate instruction" was to be given in map-plotting. As far as possible,

instructors detailed to the station were to be officers who had had at least a month or two of experience at an AAF weather station. To teach the use of teletypes, tapes which had already been used for record purposes by AAF stations seven or more days before were to be run through a dummy transmitter. After the weather directorate issued a number of orders in January 1943 to put its program into effect,[62] something occurred which prevented them from being carried out. Possibly it was the reorganization of the weather service during the spring of 1943, bringing a further division of authority for weather training, which was responsible. At any rate, by March 1943 not a single model station had been established.

Once officers of AC/AS Training, which had newly become charged with responsibility for supervision of weather training, became acquainted with the problems of the meteorology course, they joined the fight for model stations. To win the approval of the various other new AAF Headquarters divisions they had to cover again much the same ground and meet anew the same old objections. They assured AC/AS MM&D that in a model station only one-third of the personnel of a regular weather station would be required,[63] and they had to work out arrangements with the Weather Wing and other divisions for the procurement of the necessary equipment and the maintenance of security precautions. As a result of their efforts, model stations were installed at the U. of Chicago and N.Y.U. in the summer of 1943, and at the other civilian institutions during the following autumn. Originally it was expected that radiosonde as well as standard station equipment would be installed,

but a shortage of the former necessitated the dropping of that part of the plan. Each station occupied a minimum of 1,000 square feet of space divided into three rooms: a display room, an analysis room, and an office. The security problem was solved by having the station considered a regular installation and operation of the Weather Wing of the Flight Control Command with the officer instructors and enlisted men responsible for the safeguarding of information.[64]

A certain amount of leeway was allowed each university in making use of its model station. At N.Y.U., for example, the station operated on three six-hour shifts each day, with each cadet spending three six-hour days in the station and having an interval of about two weeks between each visit; he was excused from as many hours of class work as he spent in the weather station. Each group assigned to the station was divided into two sections, one acting as forecasters, the other as observers. (No plotting was done.) At the end of the shift the group as a whole participated in a discussion of the day's activities, led by the weather officer on duty. Approximately the same system was employed at M.I.T., although there some attention was devoted to the problems of plotting. At U.C.L.A. cadets spent four days in the station, working their way through a routine that called for them to act as observers on the first day and forecasters on the last.[65] At the AAF technical school, the curriculum provided for 108 hours of instruction "in basic weather observer subjects and station procedures." Although the Grand Rapids authorities considered the model-weather-station project an impractical way of teaching station administration and

procedures, they believed the instruction they gave "more nearly satisfied the requirement for practical training than any other method adopted." This was possible because they had available the equipment necessary in order to teach their enlisted observers course, equipment which the universities lacked.[66]

It soon became generally appreciated that no matter how efficiently a model weather station was operated not enough time could be spared from a 33-week course to give a cadet adequate practical experience in the problems he would face in the field. In June 1943 when the demand for additional weather officers began to abate, the UMC appointed a subcommittee to impress AAF Headquarters with the desirability of adding a fourth 11-week term to the course, to be devoted to practical application of the theoretical aspects of meteorology. Presumably most of this training would be accomplished in model stations.[67] The plea was joined in by the Weather Wing and the Training Command. In urging the authorization of four quarters, the Training Command pointed out that the additional period would enable the schools to teach students how to use the "basic materials" they had learned during the first three terms, and to present new reference materials as well as the latest theories and methods not yet available to the service in the field. Unfortunately, about this time AC/AS Training had adopted the general policy that the length of no AAF technical course was to be extended, and it refused to make an exception in this instance.[68] There were subsequent appeals from this decision. One came from the commanding officer of the training detachment at U.C.L.A., who reported

that he had been told by regional weather officers and weather officers attending the U.C.L.A. course that an officer in charge of a weather station devoted approximately half of his time to administrative duties. Yet, the detachment commander continued, cadets at U.C.L.A. and C.I.T. got only a little such training, and that during their free time--which was "bad for their morale." But AC/AS Training remained adamant. "Deficiencies should be corrected by in-station training prior to shipment overseas."[69]

Specialization in Training

A perennial problem in the administration of the course was the determination of how much specialized instruction should be given. Ever since it established its meteorology course the U. of Chicago had slanted its instruction to give particular emphasis to tropical meteorology. Dr. Rossby of the UMC was anxious that specialization be practiced at other universities, with some over-all planning "to balance the needs of these specialized projects against each other."[70] Apparently some need for specialization was also felt in the field, for a number of the reports gathered by the Directorate of Weather late in 1942 spoke of the lack of ability among officers in "analyzing and forecasting upper air flow and other problems peculiar to the tropics."[71]

No action to extend specialized instruction was taken until the summer of 1943, when the Weather Wing request AC/AS Training to arrange for a special course in the weather of particular regions to be given on shipboard to weather personnel en route to that region. AC/AS Training

not only made arrangements for this kind of course but, impressed with the need for greater specialization, directed that as much as half of the laboratory time devoted to synoptic meteorology at the universities be spent on the study of weather problems in a particular area. In attempting to carry out the order, two principal difficulties were encountered: (1) it was necessary to have in advance some notion as to what proportion of each class was to be assigned to each area upon graduation; and (2) it was necessary to provide security for the distribution of weather information about particular areas. The latter problem was reduced somewhat by the agreement of AC/AS Intelligence that such data might be released if not too detailed and specific.[72] Although no system of predetermining the ultimate destination of cadets was ever worked out to solve the former problem, the universities, encouraged by the Weather Wing, tended to direct their attention to particular geographic areas during laboratory periods.

The trend toward specialization was halted abruptly as the result of a conference of weather officers at Weather Wing headquarters in October 1943. They maintained that the great need of the weather service was for men who were "well-grounded in basic knowledge applicable to the entire world." It would be well, they thought, if the universities dropped entirely their discussions of the problems of a particular area; if a need for more specialized training developed, it might be given to meteorology graduates in a special course conducted in the particular theater or at some specialized school such as the Institute of Tropical Meteorology in Puerto Rico.[73] This decision, which was promptly passed on to the university officials, brought some protest. Dr. Rossby pointed out that it was difficult to make a man a specialist in the weather

problems of the entire world within 33 weeks, but he might learn a great deal about one particular area within that time.[74] His protest, however, fell on deaf ears.

One other type of specialized instruction was introduced into the cadet course briefly during the summer of 1943 in response to a request from the Chemical Warfare Service for approximately 125 meteorology-trained officers. Names of cadets then taking the course at M.I.T., N.Y.U, U. of Chicago, and Grand Rapids were sorted to find holders of bachelor's and master's degrees in chemistry. Those considered best qualified were excused from the classes in theoretical meteorology so that they might attend lectures dealing with chemical warfare problems. At M.I.T., for example, the men substituted study of the turbulence of the ground layer for the lectures on long-range forecasting, and at Grand Rapids lectures on turbulence and diffusion and the use of chemical agents replaced the regular course material on single-station analysis.[75]

Instructors

The procurement, training, and utilization of instructors in the meteorology course presented other difficulties, some peculiar to this field of AAF training. When the training of cadets started at the five universities in 1940, the problem was practically nonexistent: teaching was done by the regular civilian instructors of the institutions; supervisory work and lectures were conducted by some of the foremost meteorologists in the world; and laboratory work and some classes were put in the charge of promising recent graduates of the course. As the

training program expanded--and particularly after the size and number of classes were greatly increased at the start of 1943--many new instructors had to be obtained: the majority of these were civilian employees from the Weather Bureau, and others were weather officers who had been graduated from a meteorology course. In addition, it became the practice to retain a few of the highest ranking students in each class to assist, as commissioned officers, in teaching succeeding classes. From time to time direct commissions in the Air Corps were granted to civilian instructors, who were then detailed to teaching duties at one of the universities. When the AAF school was established at Grand Rapids, the type and caliber of civilian and officer instructors employed were the same as at the universities--men who had formerly been on the teaching staffs of M.I.T., N.Y.U., U. of Chicago, U.C.L.A., and C.I.T., former Weather Bureau men, experienced weather officers, and recent graduates of the course at other schools. In every case junior instructors had completed a course on the level of the cadet course itself, while senior instructors had done considerable advanced work in meteorology.[76]

With the few men qualified to be instructors in demand by so many different agencies, the maintenance of a satisfactory ratio between instructors and students became a real problem. The experience of N.Y.U. is characteristic in this respect. At the outset a ratio of about 1 instructor for each 20 students was considered desirable, and the university authorities thought they were doing well if they could maintain that in the face of the growing size of the classes.*

*Instances are known where lectures were given at N.Y.U. and Chicago to classes of over 350.

Later, however, the situation got gradually better: 1 to 14 in July 1943, 1 to 11 in October 1943, 1 to 6 in March 1944, and 1 to 8 in May 1944.[77] The same general situation obtained at the AAF technical schools--a ratio of 1 to 20 while the course was conducted at Grand Rapids, of 1 to 12.1 while at Chanute late in 1943 and early 1944.[78] These figures are a little misleading, however, for the ratio varied greatly between lecture and laboratory work: at the University of Chicago, for example, a single professor, assisted by 1 or 2 assistants, might give lectures to a class of 150 or larger; in laboratory sessions, 2 or 3 instructors would teach 30 to 50 students; and field and observation work would be carried on in groups of 6 students.[79]

Officers in the field sometimes complained that the universities were skimming off the "cream" of their graduating classes to augment their teaching staffs. This was admitted by the universities, their contention being that it was important that the cadets have the benefit of instruction by the ablest young men in the service. They pointed out that some of the well-qualified young men in the field ought to be sent back to the institutions from time to time to replace those without field experience. This was done, however, only in a few instances.[80] The officers detailed to the universities had their grievance as well: although as a group they were regarded as the "cream" of the service, promotions for them came much more slowly than they did for their colleagues on service in the field. The UMC pleaded the cause of the young instructors with the Weather Wing, and during the latter part of 1943 a promotion policy was adopted which was generally considered more equitable.[81]

Despite the apparent mutual discomfiture on the part of field and university officers, it was still generally agreed that a weather officer was a more effective instructor if he had had experience in weather-station operation in the field. To give regularly assigned officer instructors the opportunity to obtain some field experience, the UMC in March 1943 broached a plan whereby two "relief" officers would be allotted each university so that each institution could always have two of its instructors detailed to two-month tours of duty in the field.[82] Personnel was so scarce at this time, however, that the plan could not be adopted. To meet increasing complaints from instructors that they were getting out of touch with the new developments in field operation more and more officer instructors were assigned to brief periods of temporary duty in the field, usually during the intermission periods between the terms of the course.[83]

To help standardize the instruction and to give each institution the benefit of the others' teaching techniques and research accomplishments, instructors—civilian as well as officer—were sometimes exchanged among the schools. It was generally agreed that this practice proved advantageous to instructors, students, and the weather service alike.[84] With this kind of cooperation and mutual respect the cadet meteorology course functioned satisfactorily for all concerned, until its official demise on 18 November 1944.

Chapter IV

THE PREMETEOROLOGY PROGRAM

A study made in November 1942 by Col. Don Z. Zimmerman, AAF Director of Weather, estimated that approximately 5,000 weather officers would be needed by January 1944, 10,000 by early 1945. There did not appear to be enough young men in the United States outside of the services with educational qualifications necessary for the cadet meteorology course to meet this quota. It was undesirable that the standards for weather officers be lowered, Colonel Zimmerman held; therefore it would be necessary to lower the educational prerequisites and lengthen the period of training. Inasmuch as the five universities already had their hands full teaching the cadet program, consideration was given to the idea of engaging the facilities of other colleges and universities to give premeteorology training--perhaps six months--that would prepare promising young men for the regular cadet meteorology course.[1] While this idea was being discussed, Dr. Gordon K. Chalmers, president of Kenyon College, approached General McClellland with the suggestion that his and a number of other small colleges with good mathematics and physics departments might assist in the proposed premeteorology program. The undergraduate bodies of these institutions were depleted by the draft, and for patriotic as well as financial reasons the college authorities were anxious to make their facilities available to the armed services. The use of this type of school would enable the AAF to tap another large source of able young men for meteorology work: high school graduates who might be qualified for the cadet course through 12 months of intensive study.[2]

The weather directorate, the Military Personnel Division, and the UMC all acclaimed the first of the proposed programs as highly desirable, indeed most necessary, but the Chalmers plan aroused considerable opposition. Dr. Rossby of the UMC expressed grave concern about it and advised the AAF to "proceed cautiously"; he had more confidence, he said, in the type of work done in the larger colleges and universities. Enough men would be found to take the six-month course at this type of institution, so that it would be unnecessary to resort to the small colleges. Dr. Joseph Kaplan, UCLA's representative on the UMC, also declared that he was "not enthusiastic" about the small college program, but was open to conviction. The Military Personnel Division disapproved it on the grounds that a 12-month training period would be "too expensive" and "excessively long," especially from the point of view of the student's morale. It also maintained that enough men could be found for the six-month program without resorting to a longer course.[3]

These doubts did not dissuade Colonel Zimmerman from approving the Chalmers plan. He gave three reasons for its "necessity" in strongly urging its adoption: (1) the operation of the draft was causing many students, potential meteorology cadets, to quit college; (2) the Navy and other government agencies were rapidly obtaining the services of the able young men; and (3) an "incomplete but probably representative" analysis of the members of the Enlisted Reserve indicated that less than 1 per cent would qualify for the six-month course.[4] The Military Personnel Division finally acquiesced in the proposal but pointed out that it was its "understanding" that 12-month premeteorology training

would be resorted to only when necessary to supplement the 6-month pre-meteorology course and the regular cadet meteorology programs.[5]

Steps were taken immediately to set up two premeteorology programs, both of them leading directly to the cadet meteorology course. To avoid confusion, the cadet meteorology course was to be called the "A" course, the 6-month premeteorology course the "B" course, and the 12-month premeteorology course the "C" course. For admission to the "B" course, a man had to be between the ages of 18 and 30, meet the same physical requirements as a reserve Army officer, have satisfactorily completed "in an accredited college or university . . . mathematics through college algebra, trigonometry and elementary analytic geometry, and physics through a one year course." A student's status was that of private until his admission to the "A" course, when he became an aviation cadet.[6] To be eligible for admission to the "C" course, men had to be between the ages of 18 and 21, pass the reserve Army officer physical examination, and be a high-school graduate with satisfactory completion of two years of high-school mathematics, including algebra and plane geometry, and one year of high-school science. While taking the course he was to have the rank of private.[7] It was planned that 3,000 "B" students were to start studying about 1 March 1943 so that they might be ready for the "A" course the following September; training for 2,500 "C" students would begin about 1 February 1943 so they could enter the "A" course in February 1944. Additional "C" classes, each with 3,000 students, would start early in May 1943 and every four months thereafter.[8]

ENGAGING FACILITIES AND RECRUITING STUDENTS

Considerable work had to be done to have contracts and other

arrangements made with the colleges and universities so that the two programs might start according to schedule. During October 1942 a series of conferences were held by Dr. Chalmers of Kenyon, Dr. Walter Bartky, dean of the physical sciences at the University of Chicago, Lt. Col. T. R. Gillenwaters of the Directorate of Weather, and Professors Rossby and Kaplan of the UMC. A list of small colleges with good mathematics and physics departments was drawn up as likely participants in the "C" program, and representatives of these institutions were invited to attend a conference at Philadelphia at which the objectives of the program were presented by Drs. Chalmers and Rossby, Colonel Gillenwaters, and Lt. Col. James F. Thompson, Jr., of the Technical Training Command.[9]

Although the college authorities were enthusiastic for the program at the outset, subsequently they grew a trifle cooler. This change of attitude was brought about by the establishment of other Army training programs at the colleges. Amherst College, for example, had facilities for 1,000 to 2,000 Army students, and the "C" program promised a maximum of only 200 at one time. The college authorities, negotiating with the Services of Supply for courses under the Army Specialized Training Program, feared that if they contracted to teach 200 premeteorology students, they would lose out on ASTP with a considerably larger number of students. When this situation was brought to the attention of AC/AS Training and AC/AS Personnel, the two offices proposed that all AAF college programs be turned over to the Services of Supply for administration in order to avoid such confusion. To this the weather directorate protested vigorously, maintaining that the "urgent need" for weather

officers made it imperative that the program be carried out as originally planned.[10] Ultimately the disturbed small colleges were reassured, and 12 of them were engaged to give the "C" course.[11] Less difficulty was encountered in lining up colleges for the "B" program. A conference of likely colleges and universities was held in Chicago on 11 November 1942, with Professors Rossby and Kaplan representing the UMC, and shortly afterwards 11 colleges and universities were granted contracts to give the course.[12]

Meanwhile UMC and AAF authorities conducted an energetic procurement campaign to fill the class quotas. At the outset primary responsibility for the campaign was assigned to the UMC, to be carried on simultaneously with its intensive recruiting in behalf of the "A" course.* Robert Kimball, assistant admissions officer at M.I.T. was loaned to the UMC to head the work. For the "B" and "C" programs, a series of circular letters and folders describing opportunities in meteorology in general and the AAF programs in particular were distributed to college and high school authorities and to science teachers. A number of college administrators were engaged to tour the country disseminating information about the programs in talks and interviews. Some of the participating colleges issued publicity and recruited students on their own behalf; the AAF encouraged this as long as the institutions made it clear that other colleges were also engaged in the programs. Youths already serving in the Army as enlisted men or on inactive status in the Enlisted Reserve Corps were encouraged to apply through their local aviation cadet examining boards.

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* See above, pp. 70ff.

The pressing need for men with this type of training and the changing regulations of Selective Service regarding inductions created a number of problems for AAF officials while the recruitment drive was under way. At the outset civilians were told to send their applications and transcripts of their academic records to "Weather, University of Chicago," where they were examined by a staff of experienced transcript evaluators engaged by the UMC. By special arrangement with The Adjutant General, men found acceptable for one of the programs were directed to enlist in the Enlisted Reserve Corps, where they were put in an inactive status until a place was found for them in one of the colleges.[13] Following the issuance of the executive order which forbade voluntary enlistments in the armed services after 15 December 1942, a new procedure had to be arranged. Applicants considered qualified by the UMC for premeteorology training now were notified by the AAF Directorate of Personnel that they must report to their local draft boards within a certain number of days and "volunteer for induction." Within a short period they were to be sent to an AAF basic training center earmarked for premeteorology training and later sent to a college. As meteorology and premeteorology were two of the few types of training for which "voluntary induction" was permitted, recruitment under this plan had to be conducted quietly through confidential canvassing by college authorities, none of it through newspaper publicity.*[14] Since there was a large backlog of men in the Air Corps Enlisted Reserve earmarked for communications training, these men were also invited to apply for premeteorology training.[15]

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* Late in January the War Department slightly relaxed its restriction on publicity. (Ltr., Dir. of Wea. to Hon. A. T. Treadway, 15 Mar. 1943, in AAG 353, Meteorology Training #4.)

In these ways more than 30,000 applications for the "A," "B," and "C" programs were received and screened by the UMC during the winter of 1942-43. Of these, approximately 10,000 were accepted, and by early March the procurement drive was closed.[16] From this pool the AAF made assignments to the "A," "B," and "C" courses during the months which followed. The caliber of the students thus obtained was very high: in six typical institutions the General Classification Test scores of the "B" students averaged 132, those of the "C" students 128, and some college authorities later reported that their premeteorological students were "of considerably higher intellectual level than normal college students."[17]

Curricula

More standardized curricula were used for the premeteorology courses than for the cadet course. The responsibility of drawing them up was assigned to the UMC, with supervision exercised by the weather directorate, but a considerable number of persons contributed to the actual work. Dr. Walter Bartky drew up tentative outlines and visited a number of eastern and midwestern "B" and "C" colleges to obtain advice; faculty members of the "A" universities offered suggestions on the basis of their experience; and conferences of representatives from "B" and "C" schools were held in January and March 1943 at the U. of Chicago and M.I.T. respectively. But the largest share of responsibility for the program was placed in the hands of the following special permanent subcommittee with headquarters in the UMC's offices in Chicago:

Professor W. L. Hart, University of Minnesota, chairman
Professor John I. S. Sokolnikoff, University of Wisconsin, mathematics
Professor William T. Reid, University of Chicago, mathematics
Professor Michael Ference, University of Chicago, physics
Professor Samuel N. Dicken, University of Minnesota, geography
Professor T. Morrison, Harvard University, English
Mr. Bernard De Voto, history

Besides drawing up the final curricula, this committee was to perform three functions: (1) make any changes in the course of study which became necessary after the program got into operation; (2) prepare uniform quizzes and examinations to be given in all colleges; and (3) determine broad policies for dropping students from the course. It was emphasized to the college authorities, however, that the course outlines need not be followed slavishly.[18]

The program ultimately adopted for the "B" course called for 26 weeks of study divided into two terms, the first 15 weeks in length, the second 11 weeks. Between the two terms students had a one-week vacation from classes, during which some were required to take military training. Of the 26 weeks allowed for the course, only about 22 were actually devoted to study, the balance being consumed by examinations, delays, etc. Like all AAF training in wartime, the course was conducted on a 6-day week, an average of 8-1/6 hours a day being devoted to academic work and approximately 1-1/2 hours a day to military drill and physical training. Of the 49 hours weekly devoted to academic work, approximately 25 per cent was spent on lectures, 25 per cent on recitations and quizzes, 5 per cent on laboratory work, 35 per cent on supervised study, and 10 per cent on "free study." Each college was expected to give its own quizzes and examinations on each course in addition to the standard UMC examinations.

Briefly, the subjects covered in the "B" course were, on a weekly basis, mathematics (three hours of lecture, four hours of recitation or quiz), mechanics and vector analysis (three hours of lecture, four hours of laboratory work), geography (three hours of lecture), and English (three hours of recitation).[19]

In general, the pattern of the "C" course resembled that of the "B" course. Because it was intended for high school graduates, however, rather than men who had had a year or two of college, it ran twice as long; the first half of the course was pitched on a more elementary level, while the second half was on the same level as the "B" course. The "C" course ran 48 weeks, divided into 4 equal terms. Between each term there was an intermission of one week; during two of these weeks students took military training, while they were granted a furlough during the third week. The number of hours spent on academic work and military training corresponded to that of the "B" program, as did the proportion of time allotted to lectures, recitations, examinations, quizzes, supervised study periods, and free study periods. In this course, too, the colleges gave frequent quizzes and examinations, while standard UMC examinations were given once a term in each course. The subjects covered in the "C" course and the time allotted per week to each were (1) mathematics, including college algebra, trigonometry, analytic geometry, differential and integral calculus, differential equations, and advanced calculus (three hours of lecture, three hours of recitation); (2) vector analysis and mechanics, including dynamics of particles and rigid bodies, vector algebra and vector calculus, line and surface integrals, the del operator, the divergence theorem, and

Stoke's theorem to provide a background for dynamic meteorology (three hours of lecture, two hours of recitation); (3) physics, including mechanics, heat and thermodynamics, wave motion, sound, light, magnetism, and electricity, with emphasis on the application of the basic principles to meteorology (two hours of lecture, two hours of quizzes and discussion, two hours of laboratory); (4) geography, including maps, land forms, elements of climate, climatic types, land masses of the world, location and interrelationship of world patterns of relief, drainage, and lines of communication (two hours of lecture, one hour of recitation); and (5) English and history, including composition, theme writing, lectures, discussion, and study periods (seven hours).[20]

At the last minute three main difficulties were encountered in getting the premeteorology program under way by the scheduled time--1 February 1943 for the "C" colleges, 1 March for the "B" colleges. One was the problem of processing men entering directly from civilian life: draft boards were finding it difficult to understand how "voluntary induction" was to be accomplished and operated slowly. On 9 January when 1,692 civilians had been accepted for the "B" course, only 40 had actually been inducted into the Army, and of the 1,346 civilians accepted for the "C" course, only 215 had been inducted. The second cause for delay was the difficulty experienced by the Technical Training Command in establishing new administrative detachments at 22 colleges. Many of the institutions were far removed from Army establishments, centers of population, and even adequate transportation facilities, creating special problems for detachment commanders and their staffs. Finally, a number of colleges

found that the conversion of their dormitories into barracks, and the organization of teaching staffs to handle the courses, required more time than they had anticipated. The consequence was that it became necessary to move back the starting date of the first class in each of the courses two weeks.

As arrangements were finally completed, 12 colleges started giving the "C" course on 15 February,* while on 15 March 4 additional institutions began giving the "C" course+ and 6 colleges and universities began giving the "B" course.++ Three of these universities were engaged in two weather-training programs at once--N.Y.U. and M.I.T. giving both the "A" and "B" courses, the U. of Chicago giving both the "A" and "C" courses.[21]

The Conflict over Administrative Control

The conflict over control of the "A" course which raged during late 1942

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* Amherst College, Amherst, Mass., 242 students; Bowdoin College, Brunswick, Maine, 222; Carleton College, Northfield, Minn., 215; Denison University, Granville, Ohio, 214; Hamilton College, Clinton, N.Y., 214, Haverford College, Haverford, Pa., 229; Kenyon College, Gambier, Ohio, 253; Pomona College, Pomona, Calif., 259; Reed College, Portland, Oreg., 258; University of Chicago, Ill., 226; University of Virginia, Charlottesville, Va., 222; and Vanderbilt University, Nashville, Tenn., 257.

\+ State University of Iowa, Iowa City, 213 students; University of California at Berkeley, 315; University of Minnesota, Minneapolis, 294; and Washington University, St. Louis, Mo., 262.

++ Brown University, Providence, R.I., 199 students; Massachusetts Institute of Technology, Cambridge, 242; New York University, New York City, 242; University of Michigan, Ann Arbor, 357; University of North Carolina, Chapel Hill, 243; and University of Wisconsin, Madison, 333.

and early 1943* was closely paralleled in the case of the "B" and "C" courses. If anything, the struggle was more complicated in the case of the premeteorology courses, for it involved not only the Directorate of Weather, the Technical Training Command, and the UMC, but a subcommittee of the UMC as a fourth party. The subcommittee, of which the most active member was Dr. W. L. Hart of the U. of Minnesota, came to believe that the problems of teaching on an undergraduate level were not sufficiently understood by the university men of the UMC, of whom Dr. Rossby was the most outspoken. Dr. Rossby had entertained doubts as to the soundness of the "C" project from the outset, and his misgivings continued after the premeteorology courses got under way. "There is a real danger," he wrote Dr. Edward Bowles, special assistant to the Secretary of War, in April 1943, "that these /premeteorology/ programs, because of the absence of strong meteorological leadership, may become a football for the benefit of the colleges rather than for the benefit of the Weather Service."[22] The attitude of some of the "B" and "C" men was well expressed by Dr. Carl B. Allendoerfer of Haverford College, serving as a consultant to the AAF, when he wrote:

> The B and C schools want to work with the Army, but resent being made appendages of the University of Chicago. The problems of the C schools are not understood by the University men, and they can not operate effectively under such supervision. . . . No one has been willing to look after details and make decisions except Dr. Hart./ Because he has seen his duty and done it, his position has been made untenable by Dr. Rossby.[23]

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* See above, pp. 9-14.

/ Dr. Hart resigned as chairman of the subcommittee in February 1943.

The critical attitude which some of the highest ranking TTC officials took toward the meteorology programs applied particularly to the "B" and "C" courses. Brig. Gen. Clinton W. Howard of the TTC told Dr. Allendoerfer that he was opposed (1) to having any "humanities" in the curriculum; (2) to having the responsible academic authority in Chicago, so far away from TTC headquarters; and (3) to training so many weather officers. The objections of General Weaver, commanding general of the TTC, were even more sweeping: he disliked, among other things, the "great length" of the "B" and "C" courses, the large number of men to be trained, and any external control being exercised over any course under his command.*[24]

The conflict was settled at a conference of officials of the weather directorate and the TTC early in February through the development of a formula applying to all the meteorology programs. Hereafter in training matters the UMC was to act only in an advisory capacity to the commanding general of the Technical Training Command. Real control of the "B" and "C" programs was to be vested in the commanding general of the TTC acting through the chain of command: commanding general of the district TTC's to the commanding officers of the training detachments at the colleges.[25] Thus the administration of the "B" and "C" courses became almost, if not entirely, a military function. Outside the classroom students were completely under military control; during classes instruction was provided and discipline maintained by civilian instructors. Periodically the students were subjected to examinations prepared by the UMC and by

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* See also above, pp. 11-12 for a similar reaction in slightly different circumstances.

The local teaching staff. Cases of academic failure and of cheating on examinations were reported by the school officials to the detachment commanders, and in practically all instances such cases were disposed of as recommended by the school authorities. Indeed, the lack of any serious incidents of friction between the academic and the military suggests that cooperation was close and relations friendly. The same can be said of the relations between academic and military authorities on higher echelons. Periodic inspections of all detachments for military and academic purposes were made by high-ranking officers of the TTC, and at the request of the TTC, representatives of the UMC occasionally visited the colleges. But the UMC possessed an even better means of monitoring the work done by the colleges: it could compare the scores made on its standard examinations by students at the various institutions.

Some of the problems which threatened to become large and troublesome when the program was being set up never materialized. One of these was the modification of the curriculum. The original courses of study appear to have been developed so thoughtfully and the degree of latitude allowed the colleges in using them was so great that no changes became immediately necessary. Furthermore, the life of the premeteorology programs was so short that long before its graduates could be tested by actual operational experience the "B" and "C" programs belonged to the limbo of forgotten AAF experiments.

Another problem which had threatened to become serious but never actually did was the retention of competent instructors. At the time the premeteorology programs were set up, it was not difficult to find capable

instructors: the draft was making serious inroads into the student bodies of the colleges and universities, leaving their faculties with light teaching schedules. But it seemed likely that some of the instructors, too, might be caught in the manpower dragnet. In virtually all the few instances where it was necessary, the UMC and the college concerned succeeded in saving imperiled instructors, but again the premeteorology program was concluded before the problem became very serious.[26]

Chapter V

LIQUIDATION OF THE METEOROLOGY AND PREMETEOROLOGY PROGRAMS

During the spring of 1943 AAF meteorology training maintained a fairly even keel. There existed, it was generally supposed, a very real need for large numbers of additional weather officers in stations and tactical organizations throughout the world, but the recruitment campaign for approximately 10,000 men qualified for training as weather officers had met signal success, and no more applications were accepted after early March. Approximately 2,750 cadets were pursuing the "A" meteorology course at 5 universities and the AAF school at Grand Rapids; approximately 1,600 students were taking the "B" premeteorology course at 6 colleges and universities; approximately 3,500 students were enrolled in the "C" meteorology course at 16 colleges.[1]

Then, suddenly, in early May the entire picture changed: at AAF Headquarters OC&R issued a revision of Manning Table 1-3628 which called for the removal of the weather officer from the table of organization of practically all tactical squadrons. In addition, considerable reduction in the number of weather officers assigned to stations, sections, and squadron headquarters was called for. It was estimated that by the end of 1943 approximately 800 fewer weather officers would be needed than had previously been supposed.[2] Indeed, reports subsequently received from the field indicated that even with this reduction, the number of weather officers authorized was well over twice as many as were actually required.[3]

The drastic change in the weather officer picture caught the training authorities unawares, and they spent some time considering means by which it might be corrected. At the meeting of the UMC at Pasadena early in June 1943, the types of training to which surplus "B" and "C" students might be diverted was discussed at length, but no definite decisions were reached.[4] At that time large numbers of recruits earmarked for "C" training were accumulating at basic training centers, and as there seemed little likelihood that these men would ever be needed as weather officers, in June AC/AS Training ordered that they be screened, and those with suitable qualifications be entered in the Army Specialized Training Program.[5] Despite this move, AC/AS Training still clung to the belief that the "exigencies of war" might within a year or two produce a situation where considerable numbers of additional weather officers would be needed. It won ASTP officials over to the idea that, if that occurred, a premeteorology course which would prepare men for the cadet meteorology course might be set up under the specialized training program. As it turned out, however, requirements for additional officers did not develop, and the ASTP was never called upon to give a premeteorology course.[6]

During the months of July, August, and September 1943 the increasing conviction that the surplus of weather officers was no figment of an OC&R planner's imagination led AAF training officials to take more positive steps toward the curtailment of the meteorology programs. In July AC/AS Training directed that no new classes were to be entered in either the "B" or "C" course, although the classes then undergoing instruction were

to continue through graduation as scheduled. Once these classes had finished, the facilities of the colleges and universities were to be made available to the ASTP--if it desired them.[7] Whether there were to be any additional "A" classes after the graduation of the one then in session remained undecided for some time. On 10 September Dr. Rossby, who was now acting as special consultant to the Office of the Secretary of War, proposed to the Chief of Air Staff that the "A" course be continued throughout the winter of 1943-1944. Graduates not needed for duty as weather officers could be assigned to navigation, flight control, pilot, and communications training, since it was generally agreed that a knowledge of meteorology was a desirable background for these types of officers. The Chief of Air Staff was inclined to approve of the suggestion, but AC/AS Training protested that it would produce a surplus of 2,350 weather officers--unwise when the manpower situation was so critical.[8]

A solution to this problem was found which incorporated one feature of Dr. Rossby's suggestion: approximately 200 men who had graduated from the "A" course on 6 September were assigned to navigator training.[9] But "A" training was not to continue indefinitely. On 17 September Maj. Gen. Barney M. Giles, Chief of Air Staff, approved OC&R's recommendation that the class of 1,700 "A" students entering the universities on 4 October 1943 be the last.[10] This meant, of course, that all of the "C" students then in school--and perhaps many of the "B" students as well--could not enter the "A" course. What should be done with them once they had completed the course they were now taking? The spirit in which the training officials approached that problem was well illustrated

by a remark Colonel Chavasse made at a UMC conference in late July: the AAF, he asserted, "had promised these boys a commission . . . . There was a possibility that not all of them would be weather officers; however, it was up to the Army Air Forces to see that the promise of a commission to these boys was kept if it was physically possible to do so."[11]

Inasmuch as the "B" classes would graduate before the "C" classes--one "B" class was scheduled to graduate on 18 September and another on 27 November--the disposition of "B" students became the first concern of AC/AS Training. This office directed the Technical Training Command to conduct a survey of the "B" students to see how many desired and were physically qualified for appointment as pilot, bombardier, or navigator (aircrew) cadets or as communications cadets. Training in communications, it added, would ultimately lead to work in the fast burgeoning field of radar, and graduation from the "B" course would constitute the educational qualifications for cadet appointment in any category.[12] By early August a complete survey by the 2d District TTC showed that 10 per cent of its "B" students were willing to volunteer and were physically qualified for some form of cadet training other than meteorology. Although it was handicapped in its attempt to formulate plans by the refusal of AC/AS Personnel to estimate future training requirements for weather officers, AC/AS Training notified the training command on 21 August that all "B" students graduating on 18 September who desired and were qualified for cadet aircrew training would be given it, while all the others would be entered in the cadet meteorology course. At the insistence of General Giles and

Dr. Rossby, it held to this policy in spite of a survey completed by OC&R in the middle of September which revealed the existence of a very large surplus of weather officers.[13]

This left the problem of disposing of "B" students in the 27 November 1943 class and "C" students in the 12 February, 11 March, and 28 May 1944 classes still unsolved. Although "A" meteorology training was now, of course, out of the question for these men, the possibility of appointing them cadets in aircrew and communications still remained for those who possessed the physical qualifications. In addition, a survey revealed other types of training that would not lead to a commission: courses under the ASTP and various types of AAF enlisted technical training, including aircraft maintenance, radio, armament, and weather observation. Weather service officers were anxious that men for whom places could not be found as aviation cadets would take the weather observers course. Graduates of the premeteorology course were men of unusually high intelligence; they had indicated their interest in meteorology as a profession by their voluntary enlistment for the program; and their training in the course gave them the type of background considered desirable for men in the weather field.

Appreciative of the fact that the pool of premeteorology students was one of the finest in the Army, and that the AAF owed certain obligations to the men who had been recruited for it, AAF Headquarters determined that the assignment of the men to other activities be accomplished on an individual basis with as much attention paid to the desires of each man as possible. Accordingly, in late September it directed the Training Command "immediately" to dispatch a "Meteorological Screening Board" to the premeteorology colleges to screen their students for other

types of training.[14] Because time was considered of the essence, the board of officers selected for this duty by the Training Command was divided into two groups, each group to spend several days at approximately 10 detachments. When the board arrived at a detachment, the entire premeteorology class was convened and addressed by one of the board members, who explained in general terms the reasons for the liquidation of the meteorology program, stressed the desire of the AAF to deal fairly with the men, and described the opportunities now open to them. As the greater number were not expected to be physically qualified for aircrew training, he gave special emphasis to the possibilities of communications cadet and weather-observer training as well as ASTP, armament, airplane maintenance, radio operator and mechanic, and administrative clerk training. Following the meeting, each student was interviewed individually by one or more of the board members, in the course of which the opportunities open were discussed as they applied to the man's individual case. The student then filled in and signed a form indicating his first, second, and third choices. Interviewers made notes on the student's academic achievement, military bearing, personality, and qualifications for officer candidacy, which were kept in an interview folder patterned roughly after that used at the Santa Ana Cadet Classification Center. During the screening, which was completed by early October, 6,119 men were interviewed.[15]

After the interviewing board had finished its tour, two members took the data it had collected to UMC headquarters in Chicago. There a tentative assignment was made for each student on the basis of his preference, the rating of the screening board, his educational background before entering the Army, his record in the premeteorology

course, and other records on file at UMC headquarters. So concerned was AAF Headquarters that the disposition of the students be made intelligently and fairly that it insisted that the recommendations drawn up at Chicago be forwarded to it for final decision.[16]

Inasmuch as the second and last class of "B" students was due to graduate on 27 November 1943, while the first class of "C" students was not scheduled to graduate until 12 February 1944, the training officials for the time being concentrated their attention on the former. Of the 609 "B" graduates, more than one half--358--were processed as communications cadets and assigned to classes starting in November and December.[17] Large numbers were assigned to weather-observer training, and a considerable number--in some instances against their wishes--were assigned to the Army Specialized Training Program.[18] By the time it became necessary to determine the final disposition of the "C" students, AAF Headquarters had grown less concerned about the liquidation of the meteorology program, and turned it over to the Training Command to handle on its own. In most cases the Training Command assigned the student to his first choice, except in the case of men who had elected ASTP training, which late in March was no longer accepting premeteorology graduates. The disposition made of the 606 graduates of the 11 March class may be considered characteristic: aircrew cadet, 266; communications cadet, 227; weather observer (EM), 75; aircraft mechanic (EM), 20; aircraft armorer (EM), 10; and radio operator-mechanic (EM), 8.[19]

The last "C" class, graduating 28 May 1944, presented problems slightly different from those of preceding classes. Late in March quotas for aircrew and communications cadet training had become so completely filled that no more "C" men could be accepted for them.

The Training Command, therefore, requested permission to send the "C" graduates to basic training centers and there assign them to flexible gunnery or some form of technical training.[20] Anxious to make the maximum possible use of its excellent meteorology material, AAF Headquarters refused permission and ordered the Training Command to conduct a new survey, following the same procedure that had been followed the preceding autumn. This time the traveling board of officers was to point out to the students two new types of training in the electronics field for which premeteorology graduates were believed to possess excellent qualifications. One was a 25-week course in radar, for which a knowledge of the basic principles of electricity, electronics, and radio was necessary as a prerequisite; the other was a course in direction-finding evaluation which would lead to service with the Army Airways Communications Service. There was still a strong demand for weather observers by the Weather Wing, so AAF Headquarters urged that the attractions of on-the-job training in this specialty at domestic stations be brought again to the attention of the students.[21] From 25 to 28 April inclusive a board of officers visited the colleges still giving "C" training and followed the same general interviewing practices they had six months earlier. As a result of this screening, the following disposition was made of 753 graduates of the 28 May class: special radar training (EM), 332; on-the-job weather observer training (EM), 216; direction-finding evaluator course (EM), 177; and combat crew assignments (EM), 28.[22]

This account of the liquidation of the meteorology programs has made the task seem far simpler than it actually was. During the year in which training was gradually being curtailed, the AAF found itself

faced with a difficult morale problem, one which affected the general public, the meteorology students, the instructors, and the administrators of the institutions giving the courses.

During late 1942 and early 1943, when the UMC was conducting its extensive recruitment campaign, the general public was informed through the press, over the radio, and from the lecture platform that a large and critical need for weather officers existed. But by September 1943 news of the liquidation of the program so agitated students at N.Y.U., and the members of the civilian public with whom they came into contact, that the public relations office, Headquarters New York Civilian Schools Area, felt it imperative that some official explanation of the drastic change of policy be released through the press. The headquarters of the Training Command told the New York public relations office to announce "that the assignments were being changed due to the acute need for certain other categories of specialists."[23] Within the next few days public discussion of the curtailment reached such proportions that representatives of the Office of the Chief of Staff and the War Department Bureau of Public Relations called upon AC/AS Training for additional clarification. The explanation the War Department issued early in October omitted the somewhat disingenuous explanation the Training Command had given but gave no clue as to the real factors behind the change. Instead, it stressed the excellent educational background the men had been given and the variety and attractiveness of the opportunities now open to them.[24]

The morale problem among students and instructors existed at "B" colleges which had classes graduating 27 November and at all "C"

colleges.* The rumor that the future of the meteorology program had grown dark began to sweep across the campuses of these colleges early in September--in many cases spread by students who had learned from friends enrolled in the 18 September class at "B" colleges that they were being encouraged to consider taking aircrew training instead of entering the "A" course. In an effort to clarify the situation, many of the detachment officers wrote or telegraphed higher military authority or the UMC. The answer they were all given was that all "B" and "C" classes would continue through to their scheduled completion. This was all that AAF training officials were certain of at the moment, but it was not the type of response to put the minds of jittery young men at ease. Hard on the heels of the rumor came the first visit of the Meteorological Screening Board. Through lectures and interviews the board officers were able to raise the morale of most of the men. Some students, however, inquired whether, if they were accepted as aircrew cadets, they might not immediately drop out of the premeteorology course and start on the long cadet course of study. The board members had to explain that a policy had been established some months earlier forbidding any premeteorology student from dropping out of the course to begin cadet training on the grounds that it was necessary that the weather service "maintain a highly trained small nucleus of pilot officers."[25] They confessed in a report to headquarters that they

* Good discussions of the morale problem as it affected typical premeterology detachments are given in the following: Histories, AFTD (Premeteorology) U. of Minnesota, 8 July to 31 Dec. 1943; AFTD Vanderbilt U., 22 Jan. 1943 to 28 Feb. 1944; AFTD U. of North Carolina, 16 Feb. to 1 Oct. 1943; AFTD Washington U., St. Louis, 7 July to 31 Dec. 1943; AFTD Kenyon College, 7 Dec. 1942 to 31 Dec. 1943; AFTD State U. of Iowa, 1 Sept. 1943 to 25 Mar. 1944; AFTD Denison U., 7 Dec. 1942 to 31 Dec. 1943. It is principally upon these that this account of the morale problem is based.

found it very difficult to give the young men a logical explanation for this ruling under the changed circumstances.

The efforts of the screening board officers and the realization that all members of the 18 September "B" class received assignments to their liking reestablished the morale of most of the students left in the colleges. Some, however, never recovered from their disappointment, declaring that they had nothing to look forward to now that their only goal--admission to the "A" course and ultimate commissioning as a weather officer--was gone. Some felt that the course they were studying had now become pointless, and a few deliberately tried to be eliminated. The majority of the detachments reported--and the results of the uniform UMC examinations bear them out--that the average standard of work dropped sharply, never to recover completely again. The feeling of some of the students was well illustrated by two sentences written on the blackboard of a classroom at Denison University. One was: "Days that will live in Infamy--7 December 1941 and 25 September 1943 [visit of the screening board to Denison]"; the other was: "Remember that you are still non-com material."[26] The screening board reported encountering some men with unfortunate attitudes while conducting their interviews, men who "had no desire to fight," men who "felt they were an intellectual elite who should be withheld from combat to be valuable after the war," men who felt "that they should be given only training leading directly to a commission," and some who "thought of the war as a golden opportunity to get a free education."[27]

The AAF and the UMC took strenuous steps to combat such feeling. Many detachment commanders held frequent meetings to appeal to their men

as soldiers, patriotic citizens, and intelligent young men who should be eager to make the most of the unusual educational and military opportunities offered them. Dr. Eldon R. Johnson of the UMC conducted a voluminous correspondence with college and university officials, throwing as much light as he could on a still confused situation. A conference of military and school officials was held at Chicago late in November 1943 under the auspices of the UMC to discuss morale problems and exchange notions as to ways in which they might be solved. The AAF and UMC, for example, discouraged academic authorities at some schools who were tending to make modifications in the course, to give it a more general cultural tone now that it was clear that the course would not necessarily lead to service in the weather field.[28]

The efforts of AAF officials to treat all students fairly made the liquidation of the meteorology and premeteorology programs a slow process: the last "B" class graduated on 27 November 1943, the last "C" class on 28 May 1944. Although it had been expected that the "A" classes graduating in June 1944 would be the last on the cadet level, an unexpected development prevented this from being the case. A number of men who had been eliminated from the course under what they protested as unusual circumstances pressed for another chance to complete the training. To grant them this opportunity, the AAF started a special class, numbering 32 men, at Chanute Field in February 1944. With the graduation of this group on 18 November 1944, the cadet program finally came to an end.[29]

The "A" meteorology course, as given at the five universities and the AAF technical school, received general commendation from civilian meteorologists and officers of the AAF Weather Service. One objective

test of the quality of its instruction in the highly important field of forecasting was provided in the spring of 1944. It was the practice of the weather service periodically to give all its forecasters in the continental United States a uniform short-range forecast-verification test.* In Febrary 1944 AC/AS Training, at the request of the OC&R Weather Division, directed the "A" schools to give all their students and instructors the same examination currently being given weather service forecasters.[30] The test was given at the six schools between early April and early June 1944, with each participant being called upon to submit at least three forecasts a week. Each forecast had five elements: pressure, temperature, ceiling height, visibility, and six-hourly precipitation. The validity of the examination was somewhat restricted by the fact that some of the schools--notably N.Y.U. and M.I.T.--did not have an adequate supply of forms to test all of their personnel. Although three of the schools made a better showing than did the average field station, probably the most striking result of the experiment was that the school whose students and instructors did best was the AAF school at Chanute.[31] In addition, the cadet meteorology course given at Grand Rapids is worthy of particular mention. The same curriculum was used as in the five civilian universities giving the course, and a strong faculty of officers and civilians, all of them university-trained in meteorology, was employed. In recognition of the quality of the training, the American Council on Education recommended that students who were graduated from the Grand Rapids course be given the same amount of academic credit towards postwar study as was given those completing

*See below, pp. 136-37.

the course at the five civilian universities. Incidentally, according to Colonel McNeal, this was the greatest amount of academic credit recommended by the American Council on Education for any course given in a U.S. Army school.[32]

In conclusion, the cadet meteorology program proved that a group of above-average students could successfully complete difficult technical courses at high speed if properly screened and trained. A distinguished American educator who sought to appraise the program after its completion, delineated four important respects in which college meteorological training differed from most military-sponsored programs. First, students were carefully selected on the basis of volunteer application rather than by arbitrary assignment, and recruitment rested heavily on civilian consultants, particularly college and university representatives. Second, the curriculum was genuinely integrated by means of careful planning and continuous coordination of instructional material by faculty committees at each college or university concerned. Third, administration was unique in that the academic part of the program was left exclusively to experienced academic personnel. The University Meteorological Committee, representing the five civilian institutions offering advanced weather officer training and the Army's own school at Chanute Field, advised on all meteorological and premeteorological training and dealt directly with the academic director and instructional staff at each college or university.* Fourth,

* It is also indicated, however, that the Army throughout had final authority and responsibility for the program. The military alone could determine assignment, transfer, or reclassification of men, termination of programs, granting of furloughs, and all other military questions, some of which had strong bearing on the success of the educational program. Even in these matters, however, the Army Air Forces willingly weighed suggestions from the UMC so long as such suggestions related to the educational repercussions of military decisions as indicated particularly in the establishment of appropriate times for academic furlough periods.

definite provision was made for maximum interchange of ideas and suggestions as the program progressed by means of national and regional conferences, which included academic directors and military detachment commanders, and also by means of academic visits which strengthened mutual understanding between the directing committee and the participating agencies.[33]

Chapter VI

TRAINING AFTER THE EXPANSION PERIOD

By the latter half of 1943 the AAF had built up the world-wide weather organization it believed necessary to prosecute a successful war against the Axis, and the number of graduates of weather courses from then on--that is from December 1943 to the end of the war--was only 5,578.[1] Some of these men were trained to provide replacements for the attrition that characterizes even such a non-hazardous assignment as weather service in wartime. Some of them were graduates of long-established courses operated primarily on a "token" basis so that the curriculum, equipment, and experienced instructor personnel might be readily available if new requirements for training should appear during the war or after. But the bulk of the training was distinctly new in character. With the emphasis no longer on numbers, men whose training had suffered from the consequences of haste would be given additional training to bring them up to the desired standards. As the war progressed, men who had been serving in one type of weather assignment or in one region of the world were reassigned to another type of assignment or other regions. This latter tendency was especially marked after the air war against Germany was well under control, and plans were made for the wholesale shifting of personnel from the European theater to the Pacific. In addition, need appeared for training in the use of tactics and devices which were developed while the war was being waged. An account of these "new" trends forms the substance of this chapter.

Aircrew Weather Course

As the liquidation of the meteorology course neared completion in the autumn of 1944, the AAF possessed such a large surplus of weather officers that there seemed to be no excuse for training more, even on a token basis. But about this time the AAF adopted the policy of training its rated pilots--of whom it also had a considerable surplus--in such technical specialites as aircraft maintenance, armament, photography, and communications. Two motives had prompted this step: it would keep a token course on the officer level in existence, ready for any exigency, and it would fit in with long-range plans for the postwar air force, when all rated pilots would be expected to possess at least one technical specialty. In October 1944 AC/AS Training proposed that this policy be extended to weather. As soon as the last cadet meteorology class graduated from Chanute in November, an "Aircrew Weather Course" was to be started, using the same curriculum, instructors, and facilities; the student body, however, was to be composed of rated pilots.[2] The Weather Division of OC&R heartily seconded the suggestion since it was desirable that as many weather officers serving in the postwar air force as possible be rated pilots. But there would be an immediate advantage to the course as well: an extensive weather reconnaissance program was being developed,* and graduates of this course could be assigned to

* See below, pp. 157-62.

units of that type.[3]

AAF Headquarters thereupon ordered the inauguration of such a course to start at Chanute in November 1944 and to last 33 weeks. Places in the class of 25 were to be allotted by AAF Headquarters from applicants in the continental air forces. To be eligible, an applicant had to be a commissioned aircrew member below field grade, and have a B.S. or higher degree with a major in mathematics or physics--a reversion to the very high standards of the pre-expansion period. A notable exception to the latter requirement was made for graduates of the "B" and "C" premeteorology courses who could be admitted without any additional academic qualifications if they held a commission as pilot, bombardier, or navigator.[4] It proved difficult, however, to find applicants with such qualifications, and as a result, at the last minute the start of the first class had to be postponed to 19 February 1945, by which time the full quota had been filled. The curriculum and teaching methods employed throughout the rest of the war were substantially unchanged from the old cadet course, with the exception of some rearrangement in the time schedule to permit a closer coordination between the lectures and laboratory work.[5]

Proficiency and Refresher Training

Now that AAF training and weather officials no longer were concerned primarily with the numbers of men trained, they could give some attention to the improvement of the quality of AAF weather observation and forecasting. In the rush to fill quotas, some men had been graduated from

TTC school courses who could scarcely be said to meet the desired standards of proficiency of the weather service, and a series of "outlaw" courses had been conducted by the Second Air Force,* the qualification of whose graduates remained to be determined.

Moreover, as the duration of the war lengthened from months into years, men began to grow stale in their jobs and lose touch with the latest developments in the meteorological field. One method adopted to buoy the morale of those who had been serving in remote stations overseas was a rotation plan designed to bring men back to the United States for reassignment after two years and replace them with men who had held administrative or teaching positions in the United States. Both the returnees and the replacements needed training that would reacquaint them with skills they had once learned but which had grown rusty from disuse, or that would familiarize them with conditions they would encounter in their new assignment.

To meet these needs for proficiency and refresher training, the AAF conducted five important programs between the middle of 1943 and the end of the war, only one which was a "course" in the formal sense of the word--an "Advanced and Refresher Course" for officers and enlisted forecasters returned from overseas, conducted at Chanute Field starting in May 1944. Brevity and improvisation characterized the refresher courses for observers and forecasters which the Weather Wing conducted at its redistribution center at Seymour Johnson Field from May to September 1945 for personnel just back from the ETO and MTO who were scheduled for

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* See above, pp. 11-13.

assignment in the United States. A program for testing the proficiency of personnel irregularly trained by the Second Air Force and the TTC was conducted by the TTC in conjunction with the Weather Wing at Chanute Field during the early spring of 1944, and about the same time the Weather Wing conducted a comparable program among all its personnel throughout the United States. Although the first of these projects was sometimes referred to as a "course," actually both were testing rather than teaching programs. More instructional in nature were two programs which the Weather Wing and the various regional control officers sponsored, also during the spring of 1944: one to give enlisted forecasters in domestic stations opportunity to learn more about meteorological conditions through actual flight experience, and another which brought visiting teams of civilian instructors to weather stations overseas as well as in the interior to lecture on forecasting problems.

Forecasters advanced and refresher course at Chanute. By the middle of 1943 AAF weather forecasters had been in combat theaters as long as 18 months with no prospect in sight of the time when their services could be spared. Naturally, since most of them were performing routine duties day after day in isolated spots, their morale was beginning to suffer. Even worse, they were unacquainted with the remarkable advances that the activities of war were bringing to the science of meteorology. When Col. W. O. Senter became commanding officer of the Weather Wing, he announced that he would like to see some kind of "specialized refresher" training conducted in the United States to correct this situation.[6]

It was Dr. Rossby of the University of Chicago who took the first step to convert Colonel Senter's wish into reality. In December 1943

he submitted to the AAF the prospectus of a course in "Advanced Meteorology" to be conducted at his institution as soon as the "A" course had ended there, and he proposed that the AAF send some of its experienced forecasters to the course.[7] The suggestion was not very warmly received by AAF Headquarters: the Weather Division regarded the proposed curriculum as "excellent" for a second-year graduate course in meteorology, but far "too academic for the purposes of the Weather Service in wartime."[8] Moreover, AC/AS Training had adopted the general policy that wherever possible "refresher" training was to be conducted at the AAF's own schools.[9]

Dr. Rossby's proposal, however, did spur AAF officials to take steps of their own for such a course. Early in March 1944 representatives of the Weather Wing and of AAF Headquarters held a series of conferences which produced a plan for a "refresher and advanced" course to be conducted at Chanute Field. They estimated that the weather service had at least 300 officers and enlisted men who could profit from such instruction. The officers were "top-grade" talent who might ultimately be expected to receive such responsible assignments as regional control officers, technical inspectors, and staff weather officers; the enlisted forecasters were of comparable caliber.[10]

After the usual delays, an "Advanced and Refresher Course" was started at Chanute on 1 May 1944 with a class of 32 officers and enlisted men in attendance, later increased to 40.[11] Quotas for officers and men were allotted to all overseas weather regions, which were assured

that the personnel they sent would be returned to them upon completion of the course. In certain instances quotas were also granted continental United States weather regions for officers who had been serving in an administrative capacity for a long period and were believed to need refresher training before being sent overseas for forecasting duty.[12]

At the outset the course lasted nine weeks* but once the course got into operation, it was found necessary to modify the curriculum constantly in order to meet the varying backgrounds and interests of the students who attended. Topics within the various subjects were rearranged for more effective presentation, and a great deal of experimentation was carried on to find the most effective method of conducting examinations. It was found that most of the students had had considerable flying experience and professed to be bored during the period devoted to practice reconnaissance flights. Moreover, it appeared desirable that a great deal of material ought to be added to the curriculum, covering such new topics as the forecasting of true altitude for high-level bombardment, the forecasting of ballistic winds, densities and temperature for artillery warfare, and the detailed application of meteorology to chemical warfare. After several months of experimentation, the Chanute authorities recommended that the length of the course be increased to 11 weeks to incorporate this new material, and to omit the weather reconnaissance flights.[13]

When the Weather Wing heard of the proposal late in December 1944 it entered a protest on the grounds that 11 weeks was too long a period

* For a detailed presentation of the curriculum, see Appendix G.

for personnel to be away from their duties and that the lengthening of the course would necessitate fewer classes a year with fewer officers and men benefiting from the training. AAF Headquarters, however, had already approved the lengthened course, effective 27 November 1944, so the Weather Wing protested in vain.[14]

The course continued on this basis to the end of the war. Its career was not placid, however, for a considerable amount of criticism was constantly being leveled against it by the students. During the first class the Weather Wing asked a number of officers who had returned from overseas to attend the course to offer comments. Few were enthusiastic. Of those reporting, all agreed that it was beneficial to men who, because of administrative assignments, had not done actual forecasting for some time. One suggested that men back from the tropics would find the course useful because it would refresh their knowledge of conditions in the temperate zones. These two comments, however, were in a definite minority. A more fundamental criticism was that the course was pitched on too low a level. The students complained that they had come in order to learn of the new advances made in meteorology while they were overseas. Instead, descriptions of these advances were tucked inconspicuously in the middle of extended discussions of meteorological theory that had been carried over from the old cadet course. The overseas returnees were likewise critical of the instructors--veterans of the old "A" course--because they lacked field experience and in many cases were of "poor calibre."[15] The curriculum itself was criticized

as covering too many highly specialized topics for which the forecaster would find no immediate use in his work in the field. Some of the students--particularly those who did not make high grades on the examinations--complained that too much time was being devoted to the weekly tests to permit them to get a "comprehensive view" of the subject. The school authorities, however, countered with the charge that many students who had been detailed to the school were not particularly interested in the course, but had obtained the assignment merely to return to the United States for several months.[16]

These points of dissatisfaction became the topics of a conference on weather training held at Chanute Field in June 1945. The recommendations of the conference, which were concurred in by AAF Headquarters, were as follows: (1) officers with overseas experience would be used as instructors as far as possible, but assignments would be made only through the normal operation of the rotation system, with Chanute authorities having the right to determine which men were acceptable as instructors; (2) instead of describing the course as one for "key personnel" of the weather service, and AAF hereafter would state more modestly that it was for "promising forecasters"; (3) no change was to be made in the length or essential content of the course; (4) examinations would continue to be used until "competent and interested" students could be provided; and (5) the name of the course was to be changed to the "Advanced Course" so that there would be no confusion with a refresher course which the weather service had recently begun to give at its redeployment center, Goldsboro, N. C.[17] This the "Advanced

Course" continued without important change until the surrender of Japan removed the need for it.[18] The last class graduated on 19 October 1945.

Refresher courses for observers and forecasters. As early as February 1944 the 25th Weather Region's master weather station at Lynbrook, N. Y., was giving refresher training to forecasters to prepare them for duties within the Zone of Interior. Generally, this was informal on-the-job training, but when the influx of returnees became greater, it was made more formal. Early in the winter of 1944 the 2d and 3d Weather Squadrons were also conducting refresher training, as was the 25th Weather Squadron at Mitchel Field from November 1944 to April 1945. Indeed, the latter served as a direct predecessor to the refresher course given at Seymour Johnson Field, N.C., at the end of the European war. At that time some 1,200 men were to be returned to man the greatly understaffed domestic weather stations. Of these, many could not meet the proficiency standards of the weather service, but had been allowed in the emergency to serve at stations in the ETO and MTO; thus with a nucleus of instructors from the 25th Weather Squadron course, refresher training was begun at Seymour Johnson Field, where the Weather Wing operated a redeployment and training unit.

Two such courses were conducted, one for observers and one for forecasters. The observers course, which began on 21 May 1945, included in its 10-day session courses in map plotting (28 hours), auxiliary charts (24 hours), surface observations (12 hours), teletype procedure (4 hours), and upper air data (4 hours). If a student failed to achieve the desired standards in the allotted time, he was required to continue with the course until he could meet them. As it turned out, the varying backgrounds of the students made this necessary in a good many cases.

For example, only half of the first class was able to complete the work in the 10-day period. On the other hand, in some subsequent classes there were students capable of completing the course in five days or less. For administrative purposes, the school authorities found it advisable to make use of the "phase system," whereby the course was divided into a number of parts or "phases," so that a man might move to the next phase as soon as he was able to master the material in the first one.[20]

To speed up the reassignment of personnel even further, beginning in August a screening test was given to returnees as soon as they arrived at Seymour Johnson. Thus men who met the standards of proficiency for observers could proceed to their new stations without taking the refresher course at all.[21]

The refresher course for forecasters, enlisted and commissioned, got under way on 28 May. It had two basic purposes: (1) to reacquaint with domestic weather conditions men who had been dealing with weather patterns outside the United States or who had recently had duties other than forecasting; and (2) to acquaint all returnees with forecasting techniques and procedures that had been developed since they went overseas. For 15 days students devoted their mornings to lectures and discussions,* their afternoons to laboratory work such as map analysis and forecasting. Later, because of the shortage of classroom space and of instructor personnel, the length of the course was reduced to 10 days, and although no changes were made in the material covered, one-

* For details of this phase, see Appendix H.

third less time was devoted to each of the topics.[22]

Important parts of both observers and forecasters courses were conducted in the school weather station, which was operated exactly like a Class B weather station. Observers learned teletype procedure and practiced observation, the elements of instrument repair and maintenance, as well as the other fundamentals of domestic station operation. Forecaster students practiced forecasting, aided by the current synoptic maps, hourly sequences, and radiosonde observations prepared in the station.[23]

The school authorities encountered two persistent administrative problems: shortage of classroom facilities and shortage of instructors. Both of these were produced by the rapidly mounting numbers of returnees who poured into the school: at the end of May there were 19 students, a month later 58, and by early September 75. In addition, even greater numbers were given the screening examination, and upon the basis of their success with it were assigned directly to stations. The school authorities solved the problem of space shortage to a slight extent by additional construction of classrooms, to a greater extent by the use of the screening examination. The opening of the school was delayed some weeks until men with teaching experience in domestic regional control officer schools could be rounded up to form an instructional staff. Ultimately an officer and 2 enlisted men were found for this assignment, and to man the school's weather station, 10 graduates of the refresher program were pressed into service.[24]

Forecasters proficiency testing program at Chanute. Late in 1943 the Second Air Force requested the Weather Wing and AAF Headquarters to "examine and instruct" some 62 officers and men who had graduated from

the forecasters course it had conducted in the autumn of 1942 and which had been held to be "sub-standard."* If these men passed, they might be rated as forecasters and be permitted to continue in or be given a forecaster assignment in the weather service. The Weather Wing seconded the idea, suggesting that an "abbreviated refresher course" be established for the purpose at Chanute, and the Chanute authorities complied by setting up a two-week "Weather Proficiency Course."[25]

Before the "course" actually got started, the Weather Wing broadened--and even confused--its purpose: regional control officers were invited to send to this "short laboratory course" enlisted men whom they considered to possess the necessary qualifications for a forecaster but who lacked such a rating, and rated forecasters who had been trained at AAF technical schools but did not seem "adequate" in the performance of their duties were also to be sent. If the latter passed the "qualification course and examination," they would continue as rated forecasters; if they did not, they would be disqualified and reassigned.[26]

Thus officers and men who had already had formal training in forecasting were dispatched to Chanute under the impression that they were going to take a refresher course. Being given little advanced notice, they took none of their old lecture notes with them; upon their arrival, they were furnished with some textbooks, but the program offered no lectures and little time for review. Indeed, the "course" was merely a series of examinations--in weather station operation and weather

* See above, pp. 11-13.

observer training (2 hours), synoptic meteorology (3 hours), climatology (2 hours), dynamic meteorology for commissioned personnel (2 hours), and surface and auxiliary charts and forecasting (62 hours).[27]

The mortality rate of the "course" was high: 17 officers passed and 51 failed; 17 enlisted men passed and 87 failed.[28] There were, quite naturally, complaints from men who had come to Chanute under the impression that the program was a course rather than a series of examinations. But, as a precautionary measure, the Weather Wing had assigned two recent Chanute graduates to each of the classes to take the examinations and report on them; they declared that the "course was fairly designed for the purposes intended. . . . The program is accomplishing the purposes for which it was inaugurated and a high degree of training is required to achieve a good standing." They observed, however, that the tests were too difficult for men who had been away from active forecasting as long as five years unless they had had more preparation than the program allowed.[29]

Weather Wing's "Short-Range Verification Program." About the same time the Weather Wing undertook to test and improve the proficiency of observers and forecasters serving in the continental United States. This seemed especially desirable because, as Maj. George F. Taylor, Director of the Department of Weather at Chanute pointed out, his school and the one at Grand Rapids had graduated a considerable number of men who had not made passing grades in all subjects of the observers and forecasters courses. This had been necessary because of a TTC directive, imposed about two years earlier, requiring that 85 per cent of each class be

graduated. Up to that time an average of about 50 per cent had been graduated.[30]

Between April and June 1944 an extensive program of testing the proficiency of observers and forecasters was conducted. In the case of forecasters, each man was called upon to submit at least three forecasts a week, each forecast consisting of five elements: pressure, temperature, ceiling height, visibility, and six-hourly precipitation.[31] The tabulated results from the various regions were sent to all the regional control officers so that they might see how their personnel compared with those in the country as a whole. The findings led at least one regional control officer to inaugurate a new program of "supplementary and remedial training" for his observers. The 24th Regional Control Officer dispatched to each of his stations a course outline and a study guide with tests, bibliographies, and training films available upon request. Within each station, administrative responsibility for the program was placed upon the station weather officer or noncommissioned officer in charge.[32]

The Weather Wing did not allow the matter of forecaster proficiency to rest. Early in 1945 it prepared a course outline of its own and distributed it to all regional control officers under its jurisdiction. These outlines, it suggested, were to be used "as circumstances permit" to correct any deficiencies or needs for refresher training which appeared throughout the rest of the war.[33]

Visiting instructors teams. Another medium which the Weather Wing used to improve the proficiency of forecasters in regions under its direct control was the sending of teams of instructors on a tour of

stations to give lectures on approved techniques. In the case of regions overseas, over which the wing provided technical supervision, it facilitated the dispatch of teams and offered advice.

The first suggestion for the adoption of this as a regular practice appears to have come from Lt. Col. T. S. Moorman of the 21st Weather Squadron in June 1943. Victor S. Oliver of the University of Chicago had just completed a series of lectures on single-station forecasting before members of this squadron, at the conclusion of which he had remarked on the lack of knowledge of some of the basic principles of analysis and forecasting shown by the forecasters, particularly enlisted forecasters, during his classes. "I believe," Colonel Moorman reported later, "that technical inspectors for each region should travel from base to base conducting classes in forecasting and related subjects."[34] Although it expressed cordial agreement with the proposal, the Weather Wing was content to rely on in-station training for more than a year.[35]

Early in July 1944, however, it dispatched seven teams on a tour of the 1st, 2d, 3d, 4th, 23d, 24th, and 25th regions. The typical team consisted of an "eminent" civilian meteorologist, one weather officer who was a specialist in briefing practice and procedure, and one or more "highly qualified" weather officers who had had experience as instructors. These teams paid three-day visits to the key weather stations or to other places "where groups could be conveniently assembled" for seminars on subjects of vital interest. In the following autumn teams were sent to the 6th, 9th, 16th, and 22d regions. Because part of the 9th Weather Region lay in tropical areas, officers from that region familiar with

tropical weather conditions were sent on a tour of stations concerned with those problems.[36]

Flight experience for forecasters. The typical forecaster, earth-bound in his weather station, worked under a considerable handicap in not being able to observe weather conditions at first hand. The chances were that he had never had the opportunity to step inside a plane while in school, or if he had, it was a fleeting experience at best. If he only could board a plane once in a while and see conditions from the vantage point of the sky, he could perform his task of forecasting with more assurance and could discuss his forecasts more persuasively with pilots. This was the theory which lay behind a program backed by the Weather Wing during early 1944 for giving flight experience to forecasters. Which organization in the weather service deserves credit for being the first to do something of this sort is not clear. The regional control officer of the 7th Weather Region declared that his organization put into effect a program to give its forecasters flight experience in 1942.[37] It is clear, however, that in June 1943 the 6th region notified the Weather Wing that it was inaugurating such a program, while in the following November the Western Technical Training Command took a similar step.[38]

By February 1944 the Weather Wing had decided to throw its full support behind the idea. At that time it induced AAF Headquarters to direct the Training Command to provide an opportunity for all its forecasters, except those serving as instructors at technical schools, to gain flight experience.[39] It prepared and sent out to each weather region copies of a program designed (1) to familiarize forecasters with the

problems of the pilot and navigator; (2) to familiarize forecasters with the terrain of the area whose weather they regularly forecast; and (3) to enable forecasters to verify their own predictions. Flights were to be made during poor as well as good weather, and before taking the air, the forecaster was to prepare a written report forecasting conditions 24 hours in advance. He was to prepare a weather cross-section, draw the course on aeronautical charts, make recommendations as to the flight altitude, and forecast the winds. During the flight he was to sketch the actual weather conditions to be encountered.[40]

Seven months later the 6th and 22d Weather Regions reported that "all" their forecasters were making flights regularly, and the 9th, 23d, and 24th Weather Regions reported that substantial numbers were participating in the program. The frequency with which the forecasters took the flights varied from once a month to once every three months.[41]

Training in New Devices and Techniques

While fighting World War II, the AAF developed a number of new instruments and techniques useful to weather forecasting, as well as a number of new methods for applying those in use for some time. To train its personnel to utilize these new devices and techniques, the AAF conducted eight important courses between the middle of 1943 and V-J Day:

(1) A course for staff weather officers--men who advised commanding officers of a tactical group or higher headquarters on weather problems--was conducted at the AAF School of Applied Tactics at Orlando, Fla. from

September 1943 to September 1945.

(2) A course in tropical meteorology was conducted to acquaint AAF weather officers with a field about which not a great deal was known until relatively recently. Need for this training increased as the aerial war was stepped up in the Pacific. At first AAF training in this field was conducted by the University of Chicago's Institute of Tropical Meteorology at the University of Puerto Rico from October 1943 to November 1944. Later, from April 1945 to after V-J Day, the AAF conducted its own school at Howard Field, Canal Zone.

(3) A new course in micrometeorology, prompted by the realization that weather conditions were closely connected with the effective use of various types of chemicals in warfare, was conducted in conjunction with the Navy at Dugway Proving Ground, Utah between September 1944 and the end of the war.

(4) A weather reconnaissance course at Chanute Field in February 1945, which was supplemented by a small amount of training accomplished through short-lived courses operated by the weather squadrons themselves.

(5) A weather-equipment-technicians course, established at the Signal Corps' Toms River Signal Laboratory, N. J. early in 1943, for the training of officers and enlisted men in the installation and minor maintenance of new types of weather equipment.

(6) "Rawinsonde" operations and maintenance was given at Harvard University, the Ground Signal Agency of the Signal Corps at Spring Lake, N. J., and Chanute Field from October 1944 to the summer of 1945. In July 1945 a single course combining the material offered in the three courses was started at Chanute.

(7) A variety of courses starting in the summer of 1944 and given at such places as the Royal Canadian Air Force school, Clinton, Ont.; the AAF radar school, Boca Raton, Fla.; the Signal Corps' Ground Signal Agency, Spring Lake, N. J.; Harvard University; Massachusetts Institute of Technology; and Chanute Field, trained officers and enlisted men in the operation and minor maintenance of electronic and radar equipment other than rawinsonde.

(8) A Sferics operation and maintenance course at Scott Field from October 1944 to train enlisted men in these new devices. Enlisted men whose duty was simply to operate the sets were trained by the Signal Corps in a Sferics operation course given at the Eatontown Signal Laboratory, Spring Lake, N. J., from October 1944 to May 1945.

Staff weather officers course. During the first year of World War II the Army began the practice of assigning weather officers to positions on the staff of commanding generals of tactical groups and higher headquarters before the departure of the combat units for overseas theaters. Recognizing, however, that weather was a factor in tactics, and that to be a good staff officer a forecaster required a solid foundation in tactical problems, AC/AS Personnel recommended that the tables of organization of combat units be revised so that prospective staff weather officers would be eligible to attend the courses for "all key personnel" conducted at the AAF School of Applied Tactics (AFSAT). The commandant of AFSAT liked the idea, but proposed that staff officers be given not the general course in combat aviation tactics, but a course designed expressly for staff weather officers.[42]

Although these recommendations were first made in December 1942,

and reiterated several times during the months following, it was not until July 1943 that AAF Headquarters ordered the activation of such a course. The first class was started at Orlando the next month in a course only two weeks long, of which but nine days were devoted to school work.[43]

It was inevitable that a course which started from scratch and whose instructors and administrators had had no previous experience giving training of this type should experience some growing pains at the outset. Students complained that the time allotted was too brief to cover the subject matter adequately, and there were criticisms that too much of the course was devoted to the theoretical aspects of administration, not enough to the practical duties of the staff weather officer. It was charged, furthermore, that too gr at a period elapsed between the time a "lesson" was learned in the theater of operations and the time it was inserted into the course. Many important reports on combat experience never even reached the school because other AAF organizations were unaware that the school desired them.

Some of these criticisms were offset by a reorganization of the course effective June 1945 which doubled its length.* Although much of the instruction was still carried on through the medium of lectures, notable "practical" features were introduced. The personnel and facilities of the 26th Weather Region, which happened to be located at the school, were pressed into service to demonstrate the operations and equipment of a

* For details of the course work, see Appendix I.

regional control office, a weather central, and a weather equipment area.

Normally each student was required to prepare five briefings, including command, planning, and operational types. These he would present before his fellow students, who assumed the roles of members of a planning staff or of a group of aircrews about to engage in an operational air mission. Approximately 12 hours were devoted to a special "Staff Weather Officers problem," in which students were called upon to prepare all the plans necessary for the organization, logistics, and operation of a region. The remarkable facilities available at Orlando permitted the students as part of the course, to attend a tactical air force demonstration, where offensive tactical air force operations, air-to-ground communications, and air-to-ground liaison could be observed under conditions simulating the real thing. Especially pertinent were the demonstrations of the effect upon tactical operations of weather conditions, including the hindering of bombing operations by a low cloud deck, the delay of parachute operations by gusty winds, and the delay of all types of operations by sudden showers.[44]

Besides the usual curriculum difficulties, the most troublesome problem was that of personnel. Ideally, it was felt, instructors assigned to the course should be thoroughly versed in the latest meteorological developments; they should have had considerable foreign service as weather officers; and they should possess all the attributes necessary for a good teacher. Such men were difficult to find, but the school authorities believed that most of their instructors met the specifications.

The student personnel problem was not solved so easily. At the

outset, the size of the classes was about 12 students, but as time went on it was found more economical to admit as many as 40. These quotas were filled by the AAF Weather Wing, usually from recent graduates of the "A" meteorology course who were of company grade. In June 1944 authorities at the school recommended that students be screened more carefully before being admitted to the course. In addition to meteorological training and the ability and capacity to learn readily, the ability to speak well, and the possession of a thorough knowledge of basic weather station procedure, a knowledge of Army policies and procedures and certain intangible "potentialities to be in a key position" were urged as factors to be considered. Though such criteria may have guided the Weather Wing in making its selections thereafter, no formal screening process was adopted. This problem was largely vitiated however, when, during the spring of 1945 after the European war was over and the emphasis swung to postwar requirements, the size of the classes was reduced to 15 officers, and senior AAF officers were admitted with the expectation that they would assume staff and command positions in the postwar air force.[45]

Tropical weather course. When the war broke out, not a great deal was known about tropical meteorology, particularly about the behavior of the tropical front and upper-air circulation in the lower latitudes. Nevertheless, for the first year and a quarter of the war AAF officials did not feel this lack of knowledge acutely enough to do anything about it. In February 1942, for example, AAF representatives attended a conference in Washington with Weather Bureau and Navy men to discuss

the question, but no positive steps were taken. Later in the autumn of that year representatives of the universities which were giving meteorology training discussed the subject at a conference in New York. Following the session, Professor Athelstan Spilhaus of N.Y.U. and Dr. C. G. Rossby of the U. of Chicago submitted a recommendation to the armed services that an institute of tropical meteorology be organized to conduct specialized research and give advanced training in the unexplored field. The general attitude in Washington to this proposal was that it would be better to wait until the war was over before undertaking such a long-term program.[46]

By early 1943, however, the difficulties of operating the weather service in the South Pacific had become abundantly clear. In March Col. H. H. Bassett, Director of Weather admitted in a letter to Dr. Rossby that "few weather officers have been found who are able to utilize available data in analyzing and forecasting the upper air flow," and that there was a "lack of understanding of the problem of forecasting in tropical regions."[47]

A month later Brig. Gen. R. W. Harper told Dr. Rossby that members of the weather service agreed that tropical problems were "difficult" and that present AAF training was not adequate to fit officers for service in the tropics. He suggested that the UMC investigate the possibility of setting up an institute of tropical meteorology.[48]

With this encouragement, the U. of Chicago Department of Meteorology established an Institute of Tropical Meteorology and made arrangements with the University of Puerto Rico to house it on the campus at San Juan.

Preparations for a tropical weather course for AAF personnel proceeded through the spring and summer of 1943, hampered considerably by the fact that so many commands and organizations had to be consulted, always through channels. Dr. Clarence E. Palmer of the New Zealand Weather Service, engaged by the U. of Chicago to direct the institute, found the officers of the headquarters Antilles Department and the 9th Weather Squadron at first willing to cooperate with him "just out of their good nature." But as numbers of instructors and administrators began descending upon them, they began to insist that the newcomers present some sort of credentials and statement of authority. Supplies were slow in arriving and Palmer began to suspect that his first shipment of equipment was stalemated on a wharf in New Orleans.[49]

The confusion was compounded when the Technical Training Command, informed by AAF Headquarters that it was to be responsible for seeing that the first class entered on 12 September,[50] dispatched a board of officers from Chanute Field to survey the facilities available at the U. of Puerto Rico. They reported that the college was "not ready" to offer the course and would not be until 1 November at the earliest. The only facilities available, they asserted, were one teletype machine, six or seven vacant classrooms, and a staff of five civilians and one officer, and the commanding general of the Antilles Department had told them that the messing, housing, and transportation situation in San Juan was "extremely critical." If it were essential that the course be conducted in the tropics, the board recommended that it be located

at Borinquen Field, Puerto Rico; if it were not, the ideal location would be the AAF technical school at Chanute.[51]

Luckily Lt. Col. William W. Jones, chief of the Weather Research Bureau, was already in Puerto Rico as a representative of AAF Headquarters, and he was able to bring some order out of the chaos. Colonel Jones conferred with Maj. Gen. Conger Pratt, commander of the Antilles Department, and members of his staff, explaining the urgency of the project. They declared that some of their subordinates in the lower echelons had not understood the real purpose and nature of the school; complete cooperation was now to be given. Ultimately General Pratt agreed to assume administrative responsibility for housing, messing, and transporting students at the school.[52] From the acting regional control officer of the 9th Weather Region, Colonel Jones obtained a promise for the personnel necessary to man the weather station that would be established at the school. It was Colonel Jones' considered opinion that the school was adequately staffed and would have adequate facilities to begin its first class at the designated time, although he admitted that Puerto Rico was quite congested and the school was likely to experience difficulty in obtaining certain weather data. Colonel Jones had a talk with the Training Command board of officers which had submitted the unfavorable report and found that none of them were weather officers and all of them appeared confused as to "the purpose, scope, and objectives of the school." Discussions about weather with Army officers stationed in the area increased Colonel Jones' conviction of the absolute necessity for the establishment of the course. During a conference with Lt. Gen.

George H. Brett, commander of the Caribbean Defense Command, he had learned that the location of the intertropical weather front was such that under certain conditions an alert enemy could make it very difficult to defend the Panama Canal from the western approaches. "It follows," Colonel Jones concluded, in his report to Washington "that a knowledge of tropical weather and competent forecasting is [sic] absolutely essential for that region."[53]

Thanks to the insistence of AAF Headquarters that the school begin operations without delay, as well as to the work Colonel Jones rendered in cutting through administrative red tape, the first class started about 1 October, only about three weeks late. Forty-nine second lieutenants, recent graduates of the "A" course at the U. of Chicago and N.Y.U., made up the student body. Students were "adequately, perhaps even luxuriously, housed and fed" at the Hotel Normandy, a resort hotel four miles southeast of the university, and transportation between the school and the hotel was taken care of by bus. These details, like the administration of the detachment, were under the direction of an officer of the Antilles Department. True to its promise, the 9th Weather Region assisted in establishing a Class B weather station at the university.[54]

The course at the Institute of Tropical Meteorology ran eight weeks. Lectures occupied two hours daily, Monday through Saturday, and these were supplemented by four hours of laboratory work daily, Monday through Friday. On Saturday one hour was devoted to an examination covering the work of the week, followed by another hour devoted to making local forecasts. Field trips to the interior of the island were conducted

during weekends.*

The AAF continued to send students to the Institute of Tropical Meteorology during the next 11 months, some of them officers of the Navy and civilian employees of the Weather Bureau. AAF quotas varied between 40 and 50 men per class, and were usually filled by the Weather Wing, Air Transport Command, and theater commanders with personnel destined for service in areas where tropical weather conditions were a problem.[55]

As the Institute proceeded with its work, it was discovered that some of the AAF officers assigned to operate its weather station by the 9th Weather Region were actually better acquainted with tropical weather conditions than a number of the civilians who had been hired to teach in the classrooms and laboratory. At the suggestion of Dr. Horace R. Byers of the U. of Chicago, civilian and military personnel were exchanged between instructional and research assignments whenever it seemed advantageous.[56]

Soon after the course started, Dr. Palmer proposed that a phase be added which would give the students some actual experience in the observation of tropical weather from an airplane. Only in such a manner, he maintained, could a weather officer come to appreciate the problems of the pilot, as well as to see what cloud and weather formations look like from the air. Such experience was especially valuable in the tropics because in that part of the world "it is almost impossible . . . to obtain any consistent view of the weather distribution by analysis of

* For a detailed list of the syllabus, see Appendix J.

surface land reports. Orographical effects are extremely marked; observations from mountainous islands like Puerto Rico are often positively misleading if an attempt is made to apply the analytical results of the surrounding oceanic areas." This suggestion was accorded general approval by command upon command as it progressed upward, through channels to AAF Headquarters. When it reached the AC/AS Training in February 1944, he agreed that the idea had merit, but as it was expected that no more AAF students would be sent to the institute, he declared it was "too late to do anything."[58]

This decision to discontinue use by the AAF of the institute's facilities had been reached upon the basis of a report made by Maj. R. A. Bourke and Capt. C. A. Gagliardi. The two officers pointed out that although the institute was a civilian enterprise, "housing, messing, local transportation, weather service and communication facilities are now provided by the Army . . . . All of the facilities needed for the conduct of such training are more conveniently available at any one of the well established AAF installations in tropical regions." They proposed that the AAF establish its own tropical weather school at one of it's own air bases, and engage two or three civilian instructors to supplement a teaching staff of three or four weather officers. At an AAF base the course could offer what the institute had never been able to provide--flights through tropical weather to supplement laboratory exercises and lectures. The authors of the report added that while they thought it "advantageous" that the course be conducted in the tropics, this was not "necessary." On the basis of this report, AAF Headquarters directed that no more of its officers be sent to the institute to succeed

those who graduated on 3 November 1944; the training detachment there was to be inactivated.[59] In the 13 months since the start of the institute it had been attended by 171 weather officers.

Discontinuing the use of the Institute of Tropical Meteorology in no wise signified that the AAF did not consider training in tropical meteorology highly desirable. Lt. Gen. Millard F. Harmon, commander of the AAF in the Pacific Ocean Areas, told AAF Headquarters that

> weather officers shipped to this area should in all cases where practicable be graduates of a school in tropical meteorology. The practical application as well as the theoretical knowledge gained at the Institute of Tropical Meteorology has been of inestimable value in this region. . . . Maximum benefit is derived from training in a location where students actually watch the day to day changes in tropical phenomena.[60]

Dr. Byers, returning from a tour of weather stations in Central and South America, reported to the commanding officer of the Weather Wing in December that "there is still need for training additional officers in tropical meteorology in order to insure uniformity of approach to the forecasting problem, and in order to encourage additional studies of forecasting problems in the various regions."[61] Drawing up plans for the acceleration of the aerial war against Japan, Brig. Gen. Patrick W. Timberlake, Acting Chief of Air Staff, in January 1945 directed that steps be taken to improve weather forecasting in the Pacific so that it would compare favorably with that conducted in the European Theater of Operations. A survey conducted in December 1944 indicated that there were requirements for 209 additional officers with tropical weather training for assignments outside the continental United States.[62]

The problem now was to decide where the AAF should locate its own

tropical weather school. Late in 1944 a group of four officers who had been closely identified with weather training was dispatched to survey military installations in the Panama Canal Zone. They paid particular attention to Albrook Field and Howard Field and recommended that the latter site be selected.[63] After Howard was chosen, establishment of the school there proved to be as difficult to accomplish in this case as it had been in that of the Institute of Tropical Meteorology. Upon orders from AAF Headquarters, the Training Command activated the 3540th AAF Base Unit (Tropical Weather School) at Chanute Field on 15 February 1945 and alerted it to move to Howard Field on 1 March.[64] At the last moment, however, it was learned that a new policy of the War Department General Staff forbade the sending of personnel charged to the Zone of Interior on extended foreign duty. Therefore, the 3540th AAFBU was disbanded, and a complicated division of administrative powers and responsibilities between various Army authorities worked out. Under a War Department letter, the commanding general of the Caribbean Defense Command was asked to activate an AAF tropical weather unit with an instructional and administrative staff of 70 charged to his manpower allotment. Personnel, however, was to be furnished by the Eastern Technical Training Command, and the unit, "assigned" to the Training Command, was in turn "reassigned" it to the Eastern Technical Training Command for "technical supervision and operation." For administrative and disciplinary purposes, the unit was to be under the control of the Caribbean Defense Command (through Howard Field). Direct communication

between the ETTC and the unit was authorized.[65]

These administrative difficulties were straightened out in time for the tropical weather unit to start its first class, 50 officers on temporary duty from the Weather Wing, on 9 April 1945.[66] Although the eight-week course covered virtually the same material which had been taught at the Institute of Tropical Meteorology, the arrangement of material and the allotment of time differed in many respects.* The course continued without interruption through the summer of 1945. Indeed, the expected increase of activities in the Pacific led to the formulation of plans for an increase in the size of classes to 100 officers, but this development was precluded by the surrender of Japan and the inactivation of the school on 6 October.[67]

In retrospect, AAF officials and civilian instructors concluded that the location of the school outside of the Zone of Interior had been unfortunate from both administrative and pedagogical points of view. Some of the problems which grew out of the division of administrative functions have already been described, but there were many others which were never satisfactorily solved, as the ETTC complained to the Training Command in mid-summer 1945. These included the proper procedure for processing promotions of the School's officer personnel, for amending the unit's exact manning table, for submission of the unit's history, and for the supply of a multilith, two aircraft, and other equipment.[68] Furthermore, although the AAF had gone to considerable pains to locate the school in an area where tropical weather conditions would obtain,

* For a detailed outline of the syllabus and comparison with that of the Institute of Tropical Meteorology, see Appendix J.

this goal was not achieved at Howard Field. Near Howard the atmosphere was too much affected by South American continental and local mountainous conditions to give the students a fair notion of the conditions typical of overseas tropical areas. (If long-range four-engine planes had been available, however, this shortcoming might have been overcome.) One Howard instructor suggested that a better location for the school would have been the vicinity of Miami, Florida. Miami was the site of an important weather information collection center, and school located there would have been independent of any regional control officer. Moreover it would not have been subject to the divided and confusing administrative control that was necessary anywhere outside the Zone of Interior.[69]

Micrometeorology course. One of the services, the weather service had agreed to provide the service and ground forces, as Dr. Rossby pointed out in the middle of 1943, was the supply to theater commanders of staff weather officers acquainted with the interrelation of weather conditions and chemical warfare.[70] Not for a full year, however, was any action taken by AAF Headquarters to initiate such a service. In June 1944 Brig. Gen. Mervin E. Gross of the OC&R Requirements Division declared that up to that time the AAF's attitude toward chemical warfare had been "entirely defensive" and that in preparation for increased activity in the Pacific, it might be advisable to establish a "retaliatory" course similar to that given at the Navy Chemical Warfare School, Dugway Proving Ground, Utah.[71] In the need for a site where the "behavior of various chemical agents and the means for their projection or release may be observed by students in field exercises," AC/AS Training

came to the conclusion that Dugway was the best place for AAF purposes. Accordingly, it made arrangements with the Navy and the Army's Chemical Warfare Service (to which Dugway was assigned) for the AAF to share the facilities of the Navy Chemical Warfare School.[72]

The retaliatory chemical warfare course got under way late in the summer of 1944 with 12 student officers from the continental United States in attendance. The domestic regions, however, denied that their men needed this type of training; theater commanders and commanders of tactical air forces on the other hand believed that it would be useful for their personnel. Therefore, subsequent classes, begun in October and December 1944 and in February 1945, were filled as far as possible by quotas allotted to overseas commanders. To emphasize that the course was intended for men of staff caliber, AAF Headquarters asserted that "field grade officers were preferred" as students.[73] The course, four weeks in length, consisted of lectures and field work including practical demonstrations of the use of chemical agents by the ground and air forces.[74]

In the spring of 1945 the AAF decided to move the course from Dugway to some other installation. Capt. Boyd E. Quaite, AAF director of training at Dugway, recommended that a site--like Albrook Field, Canal Zone--be selected which possessed three features: (1) extensive vegetative cover, including grass, low shrubs, or forest; (2) large mountainous and valley areas; and (3) coastal area. Near Albrook was San Jose Island, a Chemical Warfare Service proving ground, where field tests were regularly conducted under varying terrain, jungle, and

vegetation conditions.[75] Captain Quaite's suggestion was brushed aside by AAF Headquarters on the ground that the future status of San Jose Island was too shrouded in uncertainty to make any plans involving its use. Instead, the AAF chose Buckley Field, Colo. as the new site. The desired features were not all present at Buckley, but inasmuch as the AAF was concentrating all its chemical warfare training there, it was deemed "adequate" for the present.[76]

With the transfer, which was consummated in time to begin a class at the new location in the middle of July, the title and length of the course was changed. Officially the name became the "Applied Micrometeorology Course," which was considered more exact than the previous appellation, and on the recommendation of Captain Quaite, the length was reduced to three weeks because it had tended to drag when four weeks were allotted to it.[77] The course continued in this status until, in September with the changed military situation, steps were taken to discontinue it.[78]

Weather reconnaissance training. One of the most important techniques of weather observation developed during World War II was the use of reconnaissance planes over enemy territory. As far as the AAF was concerned, this method was developed relatively late in the war and was used most effectively against Japan. The importance with which this activity came to be regarded was well illustrated in the course of a memorandum which Adm. Ernest J. King submitted to Gen. George C. Marshall in March 1945:

> The report of the Commander, Fifth Fleet, after the recent operations by the fast carrier task forces against Tokyo and other cities of the island of Honshu, draws attention to the adverse weather encountered and stresses the lack of information on weather conditions

> in the Honshu area with the resultant inability to make reasonably accurate predictions concerning this area. An analysis of the operations of the 20th Air Force also reveals a lack of weather information to be expected over targets on the island of Honshu.

Admiral King recommended additional weather reconnaissance units "to provide as continuous reports as practicable from the area around Japan for several days before and during Pacific Fleet operations against Honshu targets."[79]

Although the AAF activated its first reconnaissance squadron for testing purposes in August 1942,[80] the first squadron for operational purposes, consisting of nine planes, was not set up until the spring of 1944. By September of that year six squadrons were in operation and a seventh in training, of which three were activated in the theaters of operation from whatever personnel and equipment were available to the theater commander.[81] As plans were projected for organizing two additional reconnaissance units and for meeting expected attrition during 1945, AAF Headquarters came to realize that this haphazard manner of activation and training would have to be abandoned. Several possibilities were considered. One was to use the "Aircrew Weather Course"* for pilots and other rated aircrew members at Chanute as a source for reconnaissance personnel, but this was rejected because the course ran nine months--too long to meet the pressing need for reconnaissance units. Thereupon, the Weather Division of OC&R proposed that the Training Command establish a new course which would train weather officers in the techniques of reconnaissance operations, upon the completion of which they might be given the rating of Aircraft Observer (Weather Reconnaissance).[82]

This suggestion, too, was sidetracked when early in 1945 the AAF

* See above, pp. 124-25.

began the activation of several very-long-range reconnaissance squadrons to provide both photographic and weather reconnaissance. On 26 January AAF Headquarters directed the Training Command to start a new 15-week course at Chanute which would acquaint rated pilots already trained in photo-reconnaissance with the "fundamentals of meteorology" so that they might assume assignments for "accurate observation, interpretation, and reporting of weather phenomena from the air."[83] An officer was dispatched to select 40 pilots for this training from the February graduating class of a course in photo-reconnaissance at Will Rogers Field. The criteria employed in the selection were the pilot's desire for the training and his educational background as it related to meteorology.[84]

Most of the courses* were taught through the lecture method, although "Surface Weather Charts and Forecasting" was given to small groups in laboratory fashion. The school authorities faced a constant problem in determining the rate at which material should be presented, for the educational background of the students varied far more greatly than those taking the average weather course. Very few of the students for example, had had any college training, and none had majored in mathematics or physics. To make up for these deficiencies, an eight-week review course in "meteorological mathematics" was established.[85]

The greatest difficulty, however, lay in providing one very important feature of the course--practice in making in-flight observations. The B-17 plane they procured for this purpose was late in arriving, and when

* For an outline of the curriculum, see Appendix K.

it finally came, it lacked an important valve. As a makeshift, a C-47 plane, which was ill-suited to observational and instructional purposes, had to be used. Even then, there was constant friction between the operating crew of the plane and the instructional staff of the school as to what sort of flight program should be followed. The ultimate arrival of the B-17 did not alleviate to any great extent these difficulties.[86]

In May 1945 it was estimated that 2,400 officers would have to be trained during the year to meet the requirements of the rapidly expanding reconnaissance program.[87] A wide variety of personnel was therefore pressed into service, and the Chanute course had to be modified to fit the peculiar and variegated needs of these students. In June and July two large classes composed almost entirely of navigators were entered, for whom the problem of instruction was considerably smaller: the curriculum previously used in training pilots was employed with only minor changes. During the same period two classes in a new "sub-course" were offered for non-rated weather officers. By omitting subjects with which these men were familiar through previous weather training it was possible to limit this sub-course to five weeks.[88] After a tour of weather reconnaissance bases at Grenier Field (N. H.), Gander (Newfoundland), Lagens (Azores), and Watton (England) during the summer of 1945, representatives of the Chanute school reported the course good enough to prepare a student to "adapt himself" to any of the various specialized methods which we observed in the field."[89]

Partly because of the lack of facilities available at Chanute and

partly as an experiment, a small amount of on-the-job reconnaissance training was conducted by the 53d Reconnaissance Squadron (Long-Range Weather) based at Grenier Field. Two classes comprising 19 rated-pilot weather officers were held starting in April and July respectively. The course lasted seven weeks, the first two being spent at Grenier Field, the last five in flying missions in South America and over the North Atlantic. During the first two weeks lectures were presented dealing with the theory behind weather reconnaissance, problem sessions were held, and practice was gained in Morse code. During the next five weeks, besides the flights, students spent part of their time in the base weather station drawing cross-sections and plotting weather reports as they were transmitted from a plane. On the flights each student was accompanied by a qualified weather observer who acted as his instructor and assistant. Instruction in weather theory and navigation, as well as practice in Morse code was continued during the field period.

Students asked to submit reports on the course were enthusiastic about it: "very complete," "well planned," "characterized by practical training," "one of the most instructive courses I ever took," were some of the comments. The suggestion was made, however, that the course might have been easier to comprehend if all the procedures were standardized "because almost every operation has a choice of at least two procedures"; but this was a commentary on the embryonic condition of weather reconnaissance rather than on the course itself. The 53d Reconnaissance Squadron authorities took considerable pride in the course although, as they pointed out, the work was not the primary function of their organization and it interfered with the performance of their regular duties. They

urged that if more extensive use of this kind of training were made in the future, there ought not to be more than 10 students in a class and no more than one class ought to be assigned in an organization at one time.[90]

Weather equipment technician course. During the first two years of war new types of weather station equipment were made available in large quantities to the AAF Weather Service by the Signal Corps, the agency which still retained responsibility for its development and procurement. To train AAF personnel in the installation and minor maintenance of this equipment, early in 1943 a school was established at the Signal Corps' Toms River Signal Laboratory, Seagirt, N. J. This, it was expected, would be only a temporary expedient; ultimately the facilities would be moved to form a part of the weather training center which the AAF was setting up at Grand Rapids. But, the AAF changed its mind and decided to allow the school to remain at Seagirt, where developments in the equipment field were occurring rapidly and constantly.[91]

During the spring and summer of 1943 the regional control officers in the United States were granted quotas so that their personnel might attend the course. Officers and enlisted men were trained separately, the average officer class numbering about 12, the average enlisted class about 40. In both cases the course lasted eight weeks, and there was little difference in the curriculum used.[92] During the summer the practice was adopted of selecting the enlisted students from among the graduates of the observer course at Chanute--a change made because the men being sent were not always of the "highest caliber." It was

considered desirable, though not imperative that a man be an observer to make a good equipment technician, but it was believed highly important that he possess a radio and mechanical background and have made good grades in high school or college science.[93]

Although certain regional control officers requested that they be allowed to send their observers to the school,[94] no change in the method of selection was made until February 1944, about the time the observers course at Chanute was discontinued. At that time, the domestic regional control officers were invited to nominate their "best enlisted men" for the course; the Weather Wing, which allotted the class quotas, specified that candidates be qualified observers, have at least two years of college training with a scientific slant, preferably have some familiarity with electronics, and possess good character, personality, and appearance. In addition, since it was expected that all graduates would be assigned overseas, candidates had to be qualified for that service.[95]

The demand for additional enlisted technicians did not abate with the end of the war, and the school was removed to the Signal Corps' permanent installation at Fort Monmouth, with the prospect that the course would continue indefinitely on the same scale.[96]

Radar and weather training. Weather observation and forecasting, like so many other fields of military activity, were drastically affected by the increasing use of radar during the latter stages of the war. In the summer of 1944 the first supply of SCR-584, SCR-717B, and AN/APQ-13 sets, radar equipment useful to detect storms and to obtain other weather data, became available to the weather service. It

estimated that there would be an immediate need for 400 enlisted men familiar with the operation and minor maintenance of such devices. In July the Weather Wing directed each regional control officer in the continental United States to make available for such training a proportionate number of its observers who were graduates of the "C" pre-meteorology course. These men were sent to the RCAF school at Clinton, Ont. for training on the SCR-584 set.* After completing this course, about 24 men--who were destined for service with a weather reconnaissance squadron which would use the AN/APQ-13 and SCR-717B--were sent on to the AAF's own radar school at Boca Raton, where a course in those two devices was regularly given.[97]

For weather officers, three courses were offered. Thirty-two officers who were to supervise the installation and maintenance of the SCR-584 set were sent for training to Spring Lake in the summer of 1944.[98] Starting the following autumn, officers requiring this kind of training were sent to a four-month "Pre-Radar Course" conducted by the Army Electronics Training Center at Harvard University. The average class, numbering about 10 officers, was filled through quotas granted to the continental regional control officers. Upon completing this course, the students normally proceeded to a three-month course in "Airborne and Ground Radar," covering the SCR-717B and AN/APQ-13 sets, at M.I.T. Of an average class of 10 men, 8 were normally assigned to the installation and maintenance of ground equipment, and 2 to airborne equipment. This ratio was changed, however, whenever the quantity of equipment of each type used by the AAF made it advisable.[99]

*Following British usage, the Canadians described this school as a radio-locator school.

Yet another set of courses grew out of discoveries about the nature of radar which had been made during operations in the Southwest Pacific. These showed that certain weather conditions produce a phenomenon known as "guided propagation" which seriously affect radar reception; if these weather conditions could be anticipated, the degree of propagation could be forecast. In October 1944 a "Radar Coverage Forecaster Course" was established for officers who were interested in receiving an assignment as a staff officer on a research project. The first four weeks, intended to cover the theoretical aspects of the subject, were given at Chanute: physical background, theory of radar propagation, qualitative forecasting of radar equipment, basic principles of radar equipment, and techniques in forecast verification.

To increase the practical qualities of the training, upon completing the work at Chanute, students proceeded to the AAF Tactical Center and School of Applied Tactics at Orlando for an additional 10-day period. Here they heard lectures on tactical employment of ground radar, airborne radar, radar countermeasures, and forecasting procedures for low level soundings.

The more practical aspects of radar propagation forecasting were treated in lectures and laboratory periods, and an opportunity was provided to practice forecasting radar coverage using data from current soundings over land and water and to make low-level soundings with two different types of ground equipment and with the airborne psychrometer ML-313.

It was inevitable from the pioneering nature of the radar coverage forecaster course that the curriculum should be in a constant state of

flux, and that the instructors sometimes should find themselves knowing little more about the subject than the students. Efforts were made to improve this situation by having key instructor personnel attend the periodic conferences on wave propagation sponsored by the National Defense Research Council. The school authorities believed that their teaching might have been more effective if more rigorous standards had been applied to the selection of students. Recent graduates of the "A" meteorology course who had volunteered for the training were eligible, but because of the importance of mathematics and physics in radar work, it was specified that candidates must have ranked in the top 10 per cent of their class in dynamic meteorology. The requirement that they be volunteers was adopted because it was desirable that graduates be enthusiastic about the subject so that they might "sell" the new and untried technique in the field. Unfortunately, as it turned out, many officers detailed to the course had not actually volunteered, and of those who had, few knew what the course covered, being under the misapprehension that it dealt with radar rather than weather.[100]

Sferics training. The last devices useful for weather observation to be introduced during the war was the Static Direction Finder, known for short as Sferic. Developed by the Signal Corps and the AAF at Red Bank, N. J., Bermuda, and Gainesville, Fla., the sferic employed a radar-like directional antenna (two mutually perpendicular receiving loops) and a cathode-ray tube. The revolving antenna sought out the static signals which accompany certain types of storms and relayed them to the weatherman as straight-line flashes on the face of the cathode-ray tube. The angle at which the flashes appeared indicated the direction which the storm was taking. A network of stations simultaneously taking

observations of the same flashes could locate their source and the position of a storm within a 2,000-mile radius.[101]

In August 1944 the Weather Wing obtained from the Signal Corps a promise of 24 sferics sets--enough to operate 6 networks--for operational purposes by the following April, and it requested AAF Headquarters to initiate training for 48 enlisted men to operate and maintain them.[102] Headquarters responded by setting up at Scott Field--long-time home of AAF radio and electronics training--a 12-week course in Sferics maintenance and operation starting on 16 October. For admission a man had to be an observer with some capacity for electrical work.

Basically the course was one in radio mechanics, dealing with the theory and elements of electricity, alternating and direct current, vacuum tubes, radio, radio circuits, transmitters, and receivers; shop practice and maintenance on all parts of the radio set SCR-399--transmitters, receivers, power supplies, power units (engine-driven); and radio operating procedures and operating signals. Additional classes, each composed of 12 students, were begun in November and December 1944 and January and February 1945, till the 49 required enlisted men had been trained.[103]

To meet the need for enlisted men whose duties would be merely the operation of sferics networks, the Signal Corps on 16 October 1944 began a three-week course in sferics operation for AAF enlisted men at Eatontown Signal Laboratories, Spring Lake. There were approximately 30 men in each of these classes, the course composed of one week of formal lectures and two weeks of practice performed under actual operating conditions. The lecture period covered general theory and

construction of sferics equipment, its uses and alignment, and radio procedure. During the practice period, attention was devoted to the reading of azimuths, plotting and encoding of fixes, and encoding and decoding of exchanged messages. The school authorities believed that more time should be devoted to the course, but conceded the fact that since a high quality of student was provided them, they were able to turn out good operators nonetheless. The course was ended after the graduation of a class which had entered on 28 April 1945.[104]

Chapter VII

PLANS FOR A PEACETIME WEATHER SERVICE

By the end of World War II the AAF had built up an efficiently operating, worldwide weather service of nearly 20,000 officers and men, virtually all of whom had received some of the training described in the foregoing pages. According to official records, 18,513 enlisted men and 5,924 officers had been graduated from the regularly conducted school courses between the middle of 1939 and V-J Day.[1]

The manner in which the weather service conducted its mission during the war years offers clear evidence as to the quality of this training. It is significant that when AAF officials began during the spring and summer of 1945 to consider what training ought to be conducted in the peacetime weather service, although they planned to incorporate into the curricula many of the techniques and devices which had been developed during the war, they contemplated no fundamental changes in the training structure. All planning for peacetime training hinged, of course, on the question as to what the role of the weather service in the postwar Army was to be. Each of these questions was shrouded in the thickest kind of obscurity, which meant that any plans which might be made for post-war weather training would have to be highly speculative.

As plans were drawn and redrawn, a number of assumptions were accepted as premises. One was that the peacetime armed services would be considerably larger than they had been in 1937. Another was that whether the AAF, the Navy, or some other unit of the Army were given primary responsibility for military weather service, the AAF would continue to be one of the principal users of it. Moreover, if the AAF were to continue to have prima-

ry responsibility for weather service, or if it were to have responsibility only for servicing its own operations, most of its work would be performed by rated pilot-officers who were also trained forecasters, assisted by a corps of highly qualified enlisted forecasters and observers. As this situation applied to training, it appeared likely that the newly created AAF Weather Service, now a command operating on a world-wide basis, would make an attempt to take the initiative in determining weather training policies at the expense of the training division of AAF Headquarters. The material which had been offered in the numerous highly specialized courses which came into existence since the middle of 1943 would have to be incorporated into relatively few standard courses which would be given regularly at permanent AAF installations or at such institutions as civilian universities.

The sudden surrender of Japan in August brought the AAF planners to the realization that they could no longer toy with possibilities; the post-war era was already upon them. The impact of demobilization on the weather service can be readily seen by comparing the 19,000 personnel available on V-E Day with the 17,800 on V-J Day, the 8,656 on 31 December 1945, and the 4,198 on 30 June 1946. In May 1945, and throughout the rest of the year, the AAF Weather Service, which had become the operating and disseminating agency of all weather information throughout the Army, was committed to a plan of preserving the world network of meteorological facilities in the support of occupational troops and extensive ATC routes. To meet this requirement weather service planners visualized their personnel needs for the Interim Air Force as 11,639 military personnel, more than twice the number available at the end of 1946. This critical shortage was to be met

by various means: (1) to have the weather service declared a career service so that officers could be assigned to it permanently; (2) to secure a proportionate share of the AUS officers being given Regular Army commissions; (3) to attempt to regain some of the weather-trained officers who had been diverted to other commands in 1943-45; (4) to recall meteorology specialists to active duty assignments; and (5) to reinstitute a vigorous weather training program.

Although some personnel was secured through the first four means outlined here, the majority of them, the weather service realized, would have to come through the training program. In view of this the AAF ordered five of its war courses* continued without interruption in order to facilitate the rebuilding of the decimated weather service.[2]

(1) Enlisted Observers Course was reinstituted at Chanute Field on 23 August 1945,[3] without much change from its wartime status. With the establishment of the Army's two-year service plan, a complete turnover of observer personnel every year or so was expected to constitute a heavy demand on this basic weather course and indeed the first few classes were composed almost entirely of draftees who had just completed basic training.[4] Soon after initiating postwar operations the course experienced great difficulty in securing student personnel in sufficient numbers to meet the established quota for enlisted observers. The first few classes, which were entered every two weeks, ranged from about 125 to 233 students, whereas

* The description of the courses to follow are based for the most part on plans adopted by V-J Day, and no attempt is made to recount all of their subsequent modifications.

452 was the desired figure.[5] The reason for this was quickly diagnosed as the relatively high academic requirements, a review of which subsequently revealed that the AAF Manual 35-0-1 established only "desirable minimum qualifications" with a GCT score of 100 and a weather aptitude test score of 90.[6] Consequently, early in February 1946 the Training Command was informed that it could use as absolute minimum qualifications for entry into the observers course a GCT score of 90 and a weather aptitude test score of 85. This, however, was to be only an emergency expedient, and the next two classes were to be carefully checked to ascertain if the men were qualified for the course, which was to retain high standards.

(2) Enlisted Forecasters Course was to be given at Chanute, also with little change from its wartime status. Early in December the Training Division of the AAF informed the Training Command that requirements had been established for the training of 791 forecasters,[7] but on 18 January the weather service suddenly requested that the weather forecasters class scheduled to begin on 4 February be canceled.[8] The reason given was the critical need for weather observers when the majority of reenlistments up to that time had been weather forecasters. The diversion of weather observers waiting training at Chanute would be of more value to the weather service, it was believed, even though the forecasters were also needed. The class of forecasters was therefore suspended by the Training Command on 31 January, only to be reinstituted on 18 February for 20 students.[9] The weather service requested that the student personnel for this class be selected from experienced enlisted personnel in the service rather than newly enlisted personnel. This would be an inducement for reenlistment in the weather service: to know that training leading

to higher job classifications was being made available. Experience had shown that weather observers with field experience were more cognizant of the problems and requirements of the weather service, and made better weather forecasters. And it was undesirable that enlisted personnel in the field should see newly trained personnel placed directly into advanced training solely because of their physical availability.

(3) Rawinsonde Operators Course for enlisted men was to be given at Chanute. On 3 December 1945 the training requirements for this specialty were set at 161, all men to be qualified weather observers and to have demonstrated an aptitude for electronics training. The students received for this course--as well as the course below--were of low caliber and many of the instructors had to be subsequently discharged as well before the course achieved some stability early in 1946.[10]

(4) Rawinsonde Technicians Course for enlisted men was also to be given at Chanute for men who had graduated from a basic course in electronics. Although reinstitution was suddenly postponed indefinitely after being scheduled to start on 16 July 1945,[11] the course did get under way on 18 February 1946, but with the same general difficulties experienced in the Rawinsonde Operators Course.[12]

(5) Weather Officers Course was to be given at Chanute using the curriculum developed during the war for the cadet meteorology course, the aircrew weather course, and some of the material from the micro-meteorology and staff weather officers courses. The length of the course was to be 39 weeks (the first class started on 22 October 1945) and the eligibility requirements of officers up to and including the rank of major

were: graduate of U.S. Military Academy, Regular Army officers, officers recommended for and desirous of a commission in the Regular Army who were graduates of an "B" or "C" premeteorology course, or who had completed at least three years of college work with major study in mathematics, including integral calculus, or physics, including at least one full college year of physics.[13] It was anticipated that the graduates of this course would be assigned to the AAF Weather Service. The AAF desired that the standard of training in this course be comparable to, if not better than, the meteorological instruction conducted at civilian universities.[14] To accomplish this it was necessary to amplify and expand the course curriculum and procure highly qualified meteorology instructors. The AAF directed the Training Command to prepare a proposed course outline on a level with the universities', determine the required standards for civilian instructors, and prepare job descriptions for the civilian instructors.

As could be expected there was great difficulty in getting either instructors or students with the desired qualifications, especially on the basis of a volunteer system. On 6 November 1945 the weather service had submitted an estimated officer requirement of 1,203 as of 1 July 1946. It was assured by the Military Personnel Division that every effort would be made to fill weather officer training classes with volunteers who met qualifications as established in AAF Letter 50-76. Surveys were conducted by the AAF commands to determine those officers qualified and interested in meteorology training and the net result was that 19 officers entered training at Chanute Field. The total number of volunteers then in training

was 41. Various sources of personnel were canvassed and considered, recruitment even approached a wartime basis, and much of the old advertising was used, but all proved inadequate.[15]

On 9 September 1946 the weather service submitted a staff study to the AAF that outlined the requirements for trained weather officers, what the service had done to meet these requirements, the lack of success experienced, and the recommendations for improving the weather officer training program.[16] The weather service did not concur in lowering the eligibility requirements for weather officer training as it would not be consistent with the general AAF policy to produce and maintain high educational standards in its officers (meteorology training was considered to be on professional or graduate level by the universities). The staff study concluded that there existed within the AAF an insufficient number of officers qualified for and desiring weather officer training to meet the needs of the weather service.[17] Even if quotas for the weather officer classes were filled in the future the training output would not meet authorized strength until November 1948. The instructor staff at Chanute Field lacked the experience and professional competence necessary to maintain weather officer training at a graduate and professional level. Therefore, it was recommended that there be a return to a subsidized cadet meteorology program similar to that conducted during the war, using college and Air ROTC graduates thoroughly schooled in physics and mathematics as students. The bulk of weather officer training should be transferred to the civilian universities, it was thought, where highly competent instructors were available and meteorology training was conducted at a graduate level. A

small, continuous weather training program should be retained in the AAF, however, preferably in the Air Institute of Technology, to serve as a standard for comparison and for training research personnel in meteorology.

After the establishment of the above five courses was authorized, the omission of one of the wartime courses--the staff weather officers course--was protested by the authorities in charge of it. The course had just attained its peak of efficiency, Col. L. A. Walker, Staff Weather Officer of the AAF Tactical Center pointed out, and might now be considered a "General Staff Course for the AAF Weather Service." If it were discontinued, it would take a long time to reestablish it to its present standards. He pointed out that other comparable AAF schools--for inspectors, communications officers, and senior staff officers--were to be operated regularly at the tactical center, and Colonel Walker held that the school's location and facilities were better suited for a weather officers course than those at Chanute. The weather service and AAF Headquarters refused these suggestions on the ground that for economy's sake weather training ought to be concentrated at one school. Since the acute shortage of forecaster personnel in the Zone of Interior made it inadvisable to conduct more than one weather course for officers at present, the important features of the tactical center course--and perhaps some of its instructors--could be used in the weather officers course at Chanute.[18]

Finally, in addition to these basic courses outlined above, in February 1946 the AAF announced that a committee had been established to make recommendations on an AAF "Post-Graduate Civilian Education Program." The weather service recommended that a quota of 40 officers be allocated

to the service for this kind of training--5 to be selected yearly to enroll in one or more of the executive and administrative branches, 30 to be enrolled yearly in the professional fields, and 5 officers to be enrolled in the research field to attain advanced post-graduate education. Accordingly for the autumn of 1946 a total of 24 officers throughout the weather service had applied for graduate training in meteorology.[19] Twenty of these officers were selected by the Air Materiel Command to enter training, and seven had been selected for this training and had entered the spring semester 1946. The weather service strongly urged all officers expecting to make the weather service a career to take advantage of the program to obtain an advanced degree in meteorology--and in so doing help maintain the Air Weather Service in the execution of its global mission.

G L O S S A R Y

AAFWS	Army Air Force Weather Service
AAF WTC	Army Air Force Weather Training Center
AFAAP	Assistant Chief of Air Staff, Personnel
AFACT	Assistant Chief of Air Staff, Training
AFCAS	Chief of Air Staff
AFDAS	Deputy Chief of Air Staff
AFDMC	Directorate of Management Control
AFDMR	Directorate of Military Requirements
AFDCP	Directorate of Personnel
AFDTS	Directorate of Technical Services
AFMP	Military Personnel Division
AFRIT	Directorate of Individual Training
AFSAT	Air Force School of Applied Tactics
AFTD	Air Force Training Detachment
AFTSW	Directorate of Weather
ASTP	Army Specialized Training Program
AWS	Air Weather Service
C.I.T.	California Institute of Technology
CSigO	Chief Signal Officer
CTTC	Central Technical Training Command
ETTC	Eastern Technical Training Command
GCT	General Classification Test (Army)
GHQAF	General Headquarters Air Force
M.I.T.	Massachusetts Institute of Technology
MMD	Material, Maintenance, & Distribution
OC/AC	Office of the Chief of Air Corps
OCAT	Operations, Commitments, & Requirements
RCAF	Royal Canadian Air Force
RCO	Regional Control Officer
S/W	Secretary of War
TnG	Training Command
TTC	Technical Training Command
U.C.L.A.	University of California at Los Angeles
UMC	University Meteorological Committee
WR	Weather Region
WTTC	Western Technical Training Command

NOTES

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1. History of the AAF Weather Service, I, 1-7 (hereinafter cited as Hist. AAFWS).

2. T.O. 00-75-27, pp. 15, 66.

3. Ibid., pp. 15, 72.

4. Ibid., p. 15.

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2. See the condemnation of Edgar B. Calvert, "The Weather Bureau and the War" in Monthly Weather Review, XLV (1917), 411-12.

3. Ltr., Lt. Col. J. M. Andrews to CO, Aviation Mobilization Camp, Waco, Texas, 4 Apr. 1918; memo for Maj. Moulthrop, Training Div. from Air Div., 8 Apr. 1918, in 353.9A, Meteorological Training.

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6. Homer W. Hall, "Meteorological Course Given in the Signal Corps School at Camp Alfred Vail, N. J. during 1920," Monthly Weather Review, XLIX (1921), 85.

7. Interview with Col. Don McNeal, 2 Nov. 1944.

8. Memo for C/AC from Col. R. P. Lincoln, Chief, Plans Sec., Exec. Div., 8 Dec. 1936, in Hist. AAFTS, II, App. 16.

9. Hist. AAFTS, I, 4.

10. [illegible], Chief, Mgt. Sec. to Chief, Training Sec., 15 May 1939, in Hist. AAFTS, II, App. 24.

11. AAF Reg. 50-12, 16 Jan. 1943; CGTTC (Classification Div.) to [illegible], 27 June 1943, in AC/AS Training files.

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14. Ltr., PCO 2d AF to CO, Richmond, Va. MB, 24 July 1942; 1st and 2d ind's. thereto, in Hist. AAFTS, IV, App. 51.

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17. Lt. Col. I. I. Mundell, Acting RCO 3d AR to CG 2d AF, 15 Oct. 1942, in Hist. AAFWS, IV, App. 49.

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19. C.-G. Rossby to Edward Powles, 18 May 1943, in min., WMC mtg.,3-6 June 1943, in AFACT files.

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Appendix A

WEATHER OBSERVERS COURSE, 1941-42

		Hours
I	Meteorology A course in elementary meteorology covering a study of properties of the atmosphere, weather elements and their interrelation, atmospheric circulation, and climate.....	60
II	Surface Observations Practical exercises in taking surface weather observations.....	22.5
III	Upper Air Observations Practical exercises in making pilot balloon observations of wind direction and wind speed at various levels.....	15
IV	Plotting Map Signals Practical exercises in decoding weather reports and entering data on base weather maps.....	120
V	Plotting Wind-Aloft Charts Practical exercises in decoding wind-aloft reports and preparing wind-aloft charts.....	15
VI	Plotting Atmospheric Soundings Practical exercises in decoding, checking, and plotting atmospheric radiosonde reports on adiabatic and Rossby charts.....	45
VII	Plotting Isentropic Charts Practical exercises in plotting basic data for isentropic charts and drawing the isentropic pressure field.....	7.5
VIII	Plotting Atmospheric Vertical Cross-Sections Practical exercises in plotting basic data for atmospheric cross-sections and drawing potential temperature isotherms.....	7.5
IX	Weather Instruments Laboratory exercises in the care and repair of weather instruments.....	60
X	Weather Forms Practical exercises in the preparation of all weather forms.....	22.5

RESTRICTED

Appendix A (Cont'd)

		Hours
XI	Teletype Perforators Practical exercises in the preparation of teletype perforated tape and the transmission of it over local circuits.....	22.5
XII	Teletype Procedure A course designed to qualify the student in Q-signals and all phases of teletype procedure.....	22.5
	TOTAL HOURS	420

Appendix B

WEATHER OBSERVERS COURSE, 1942-43

		Hours
I	Meteorology A course in elementary meteorology covering a study of properties of the atmosphere, weather elements and their interrelation, atmospheric circulation, and climate.....	60
II	Surface Observations and Weather Forms Practical exercises in the conduct of surface weather observations and the recording of same on prescribed weather forms.....	66
III	Upper Air Observations Practical exercises in the conduct of pilot balloon observations and the reduction of upper air wind direction and wind speed values at various levels.....	36
IV	Plotting Surface Synoptic Maps and Snow Charts Practical exercises in decoding weather reports, entering the data on base weather maps and snow charts, and the drawing of snow charts.....	84
V	Plotting Wind-Aloft Charts Practical exercises in decoding wind-aloft reports and preparing wind-aloft charts.....	12
VI	Plotting Atmospheric Soundings, Isentropic Charts and Vertical Cross Sections Practical exercises in the decoding of radiosonde reports, plotting adiabatic charts, Rossby charts, isentropic charts, and vertical cross sections.....	36
VII	Weather Instruments Laboratory exercises in the study of the operating principle, care and minor maintenance of weather instruments.....	54
VIII	Teletype Procedure Practical exercises in the composition of teletype messages and the proper transmission procedure involved.....	39

Appendix B (Cont'd)

		Hours
IX	Teletype Operation Practical exercises in the operation of teletype perforators and printers, as required in the handling of meteorological messages at field weather stations.....	33
	TOTAL HOURS	420

Appendix C

SUGGESTED CURRICULUM FOR IN-STATION TRAINING FOR AAF WEATHER OBSERVERS*

		Textbooks	Approx. Hours
I	Elementary Meteorology A course in elementary meteorology covering a study of properties of the atmosphere, weather elements and their interrelation, atmospheric circulation, and climate.	Weather Elements by Blair or Introduction to Meteorology by Petterssen	60
II	Surface Observations and Weather Forms Practical exercises in the conduct of surface weather observations and the recording of same on prescribed weather forms.	TM 1-235 and 1943 Supp.; AAF Reg. 105-7; W.B. Circular N	64
III	Upper Air Observations Practical exercises in the conduct of pilot balloon observations and the deduction of upper wind direction and wind speed values at various levels.	TM 1-235	56
IV	Plotting Surface Synoptic Maps and Snow Charts Practical exercises in decoding and encoding weather reports, entering the data on base weather maps and snow charts, and the drawing of snow charts.	TM 1-235 and 1943 Supp.; W.B. Circular N.; Weather Code (Numerical System), 1 June 1942	80
V	Plotting Wind-Aloft Charts Practical exercises in decoding and encoding wind-aloft reports and preparing wind-aloft charts.	TM 1-235 and 1943 Supp.; W.B. Circular N	12
VI	Plotting Atmospheric Soundings, Isentropic Charts, and Vertical Cross-Sections Practical exercises in the decoding and encoding of radiosonde reports, plotting adiabatic charts, Rossby charts, isentropic charts, and vertical cross-sections.	TM 1-235 and 1943 Supp.; W.B. Circular N	36
VII	Weather Cryotography Practical exercises in the use of weather codes and ciphers.	Practical Weather Ciphers; Weather Code (Numerical System), 1 June 1942	6

* AAF T.O. 00-25-27

		Textbooks	Approx. Hours
VIII	Weather Instruments Laboratory exercises in the study of the operating principle, care, and minor maintenance of weather instruments.	TM 1-235	54
IX	Teletype Procedure Practical exercises in the composition of teletype messages and the proper transmission procedure involved.	TM 1-235	39
X	Teletype Operation Practical exercises in the operation of teletype perforators and printers as required in the handling of meteorological messages at field weather stations.	TM 1-235	33
		TOTAL HOURS	429

Appendix D

WEATHER FORECASTERS COURSE, 1941-42

		Approx. Hours
I.	Meteorology A course in the physical properties and processes of the atmosphere including a study of radiation, pressure and temperature distribution, circulation, the origin and development of atmospheric waves, atmospheric stability, and air mass and frontal analysis. This course is designed to prepare the student for his work in weather forecasting and is arranged to follow the progress in the laboratory work in that subject as closely as possible.	140
II.	Air Mass Analysis A study of the atmospheric processes as they modify air masses, the relative conservation of air mass properties, laboratory exercises in the identification of air masses and the application of such analysis to the study of synoptic weather charts and forecasting.	122
III.	Atmospheric Vertical Cross-Sections A study of the analysis of vertical cross-sections and their use in the study of synoptic weather charts and forecasting.	94
IV.	Isentropic Analysis A study of the analysis of daily isentropic charts and their use in connection with the study of synoptic weather charts and forecasting.	94
V.	Upper Atmosphere Weather Maps A study of the pressure and temperature distribution at several levels above the earth's surface as associated with surface synoptic weather charts and the preparation of forecasts.	86
VI.	Surface Weather Maps and Forecasting Laboratory exercises in the analysis of surface weather maps and the preparation of weather forecasts.	340
VII.	Dynamic Meteorological Laboratory Laboratory exercises in the employment of principles developed in the lecture course in meteorology.	34
	TOTAL HOURS	910

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SECURITY INFORMATION

Appendix E

RADIOSONDE OPERATORS COURSE, JANUARY 1944

I. TEXT REFERENCES

1) J. P. Friez and Sons, Baltimore, Md., "Instructions for Friez Raysonde."
2) Circular P, "Instructions for Modulated Audio Frequency Radiosonde Observations," 3d ed. (1941), reprinted by U.S. Dept. of Commerce, Weather Bureau, March 1945.
3) U.S. Dept. of Commerce, Weather Bureau, "1943 Radiosonde Code," 1 February 1943.
4) AAFTTC, Guide for Radiosonde Operators.
5) AAFTTC, Maintenance Guide for the Radiosonde Ground Set.

II. OUTLINE OF INSTRUCTION

1) Introduction
   a. Indoctrination lecture, explaining regulations, formations, class discipline, safety rules, grading and demerit system.
   b. Issue of supplies.
2) Radiosonde Observation Procedure
   a. Evaluation of the recorder record.
   b. Construction of curves on Adiabatic Chart.
   c. Determination of fixed level and isentropic data.
   d. Selection of levels to be included in coded message.
3) Field Operation Procedure
   a. Preparation of equipment for the observation.
   b. Releasing the radiosonde transmitter assembly.
   c. Operation of radiosonde ground set during observation.
   d. Evaluation of received data and preparation of coded message.
4) Radiosonde Code
   a. First transmission and elements contained therein.
   b. Second transmission and elements contained therein.
5) Theory, Operation, and Maintenance of Equipment
   a. Radiosonde transmitter.
   b. Radiosonde ground set.
   c. ML-185 hydrogen generator
   d. PE-75 power unit.

III. DAILY CURRICULUM (6 HOURS PER DAY)

1st day:
   a. Evaluation of pressure, temperature, and humidity of the recorder record.
   b. Description of code structure, symbols, and elements.
   c. Electrical action of component parts of ML-141-A and ML-141-B.

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III. DAILY CURRICULUM (contd.)

2d day:
- a. Recorder record evaluation.
- b. Encoding first transmission.
- c. Examination of ML-141 by students.

3d day:
- a. Recorder record evaluation.
- b. Encoding second transmission.
- c. Discussion of meteorological section of ML-141.

4th day:
- a. Recorder record evaluation.
- b. Means of encoding supplementary data.
- c. Locating defects in ML-141.

5th day:
- a. Recorder record evaluation.
- b. Reference frequency drift correction.
- c. Repairing defects in ML-141.

6th day:
- a. Reference frequency drift correction.
- b. Code and ML-141 examination.

7th day:
- a. Reference frequency shift correction.
- b. Reference frequency correction for shift and drift in combination.
- c. Encoding missing data.
- d. Visual inspection and performance test procedure.

8th day:
- a. Reference frequency shift or drift correction.
- b. Recorder record evaluation.
- c. Encoding doubtful data.
- d. Visual inspection and performance test procedure.

9th day:
- a. Conversion (of temperature frequencies) and plotting the adiabatic diagrams.
- b. Encoding corrective data.
- c. Storing and conditioning of radiosondes.

10th day:
- a. Conversion and plotting.
- b. Calculation of mean virtual temperatures.
- c. Termination of flight reporting.
- d. Preparation of radiosondes for release.

III DAILY CURRICULUM (contd.)

11th day:
- a. Pressure-height computation.
- b. Code review.
- c. Base-line check.

12th day:
- a. Pressure-height computation.
- b. Fixed-level pressure computation.
- c. Examination on code and radiosonde preparation, care, and minor repair.

13th day:
- a. Fixed-level pressure computation.
- b. Isentropic surface data computation
- c. Selection of levels for transmission.
- d. Base-line check and preparation of radiosonde for release.

14th day:
- a. Isentropic data computation.
- b. Adiabatic chart computation.
- c. Methods of release and method of making temperature-pressure correction on ML-141-B.

15th day:
- a. Adiabatic chart computation.
- b. Computing the vertical temperature gradient factor.
- c. Terms, units, and symbols used in electricity.

16th day:
- a. Wind-shear factor computation.
- b. Isentropic isobar data computation.
- c. Discussion of inductance, capacitance, reactance, impedance.

17th day:
- a. Isentropic isobar data computation.
- b. Electron tube discussion.

18th day:
- a. Entry of monthly summary data.
- b. Examination.

19th day:
- a. Flight #1: computation of a complete radiosonde observation.
- b. Discussion of components of radiosonde ground set.

20th day:
- a. Same as 19th day.
- b. Discussion of National 110 radiosonde circuit.

21st day:
- a. Examination.
- b. Discussion of frequency meter circuit.

III. DAILY CURRICULUM (contd.)

22d day:
a. Flight # 2: computation of radiosonde observation.
b. Discussion of recorder and recorder amplifier.

23d day:
a. Flight #3: computation of radiosonde observation.
b. Trouble-shooting in the radiosonde ground set.

24th day:
a. Same as 23d day plus examination.

25th day:
a. Field problem of taking a radiosonde observation. This includes hydrogen gas generation, taking a pilot balloon observation, and preparation of the radiosonde for release, releasing the radiosonde balloon and assembly, evaluating the collected data, and encoding the teletype messages.

26th day through 29th day:
a. Same as 25th day.

30th day:
a. Disassembly and reassembly of ground set.

31st day through 35th day:
a. Same as 25th day.

36th day:
a. Trouble-shooting procedure on all components of radiosonde ground set.
b. Servicing and operation of PE-75 power unit and ML-185 hydrogen generator.

37th day through 47th day:
a. Same as 25th day.

48th day:
a. Final instructions and graduation.

Appendix F

AVIATION METEOROLOGICAL CADET COURSE

		Hours
I	Surface Weather Charts and Forecasting Laboratory exercises in the decoding and plotting of surface synoptic weather charts and their complete physical, kinematic, and dynamic analysis, their coordinate interpretation with air mass analysis and various auxiliary charts and diagrams, and the preparation of daily weather forecasts. The analysis of selected synoptic weather situations from the various theaters of war throughout the world. The preparation of detailed route forecasts for a variety of tactical flight-planning problems.	511
II	Auxiliary Charts and Diagrams Classroom instruction and laboratory exercises on the preparation and use of constant-level charts, isentropic charts, vertical cross-sections, energy diagrams, and other similar charts and diagrams; the determination of air particle trajectories; and the use of various related forecasting techniques.	174
III	Air Mass Analysis Classroom instruction and laboratory exercises on various atmospheric properties; the properties, modification, and identification of air masses; and the correlation of such study with surface weather chart analysis.	132
IV	Weather Observer Subjects 1) Surface weather observations--classroom and laboratory instruction in the taking of regular surface weather observation, and the use of various related forms; 2) Weather instruments--laboratory exercises in the care, maintenance, repair, installation, and shipping of meteorological instruments; 3) Teletype operation and procedure--classroom and laboratory instruction in the use of teletype transmitting and receiving equipment, and in the proper procedure to be employed in transmitting weather and other operational material on standard teletype circuits; 4) Wind-aloft observations--laboratory exercises in making pilot balloon soundings, in obtaining upper wind information from them, and in constructing wind-aloft charts.	108
V	Dyamic Meteorology Classroom instruction in the hydrodynamical and thermodynamical aspects of meteorology, including such subjects as turbulence, wave motion, and atmospheric stability.	99

Hours

VI Single Station Weather Analysis
Laboratory studies on the interpretation of surface, wind-aloft and radiosonde data from a single station, with a view to the construction of surface and three-kilometer weather maps for an extended area, based upon this single station analysis; also the preparation of weather forecasts based upon such analysis. . . . 90

VII World Geography and Climatology
Classroom instruction on those features of the physiography of regions which influence their weather; a study of the climate of various regions of the world, particularly those which are in the theater of war. 75

VIII Synoptic Meteorology
Classroom instruction on those aspects of general meteorology which are especially applicable to an understanding of the synoptic weather situation, including particularly the subjects of radiation, pressure, and temperature distribution, and a description of the synoptic aspects of such meteorological phenomena as precipitation, fog, thunderstorms, and frontal characteristics. 66

IX- In-flight Weather Observation
The observing, reporting, and forecasting of weather conditions based on actual airplane flights; the techniques employed in weather reconnaissance missions; and the problems of coordination between air crews and the weather officer. 35

X Extended and Long-Range Forecasting
A critical survey, both in the classroom and laboratory of present-day forecasting techniques for periods of more than 48 hours 24

XI Oceanography
Classroom and laboratory instruction in the practical application of oceanography to meteorology in the forecasting of sea swells. . . . 24

XII Radiosonde Operation
Classroom and laboratory instruction in the operation of radiosonde equipment.. 24

XIII Weather Station Operation
1) Background of the weather service--founding of the service; the weather bureau, and the navy aerological section;
2) Organization of the AAF Weather Service, origin of the Air Corps weather service, the Air Corps weather school, origin of the mobile weather service, reorganization of the weather service, present organization of the AAF Weather Service, weather regions, stations and sections, weather service in the field, weather training system and facilities;

		Hours
XIII	Weather Station Operation (contd.)	
	3) Weather station administration--weather squadrons and detachments, administrative duties of non-commissioned officers, personnel, activation of a new weather station, meteorological codes and ciphers, weather equipment and supplies, authorized allowance, accountability, security, requisitions, work orders, repair of meteorological instruments;	
	4) Weather station operation--general station arrangement, typical weather stations, display and dissemination of weather information, weather station lighting facilities, meteorological instruments, teletypewriter operation and procedure, duty schedules, the station chief, operational functions of weather technicians, AAF methods of constructing weather maps, charts, and diagrams, preparation of weather forecasts for the AAF, entry of weather trends of aircraft clearance forms No. 23 and 23A, AAF air traffic rules, flight planning problems for military aircraft, preparation of weather station reports, preparation of weather records;	
	5) Duties of weather officers--station weather officers, staff weather officers.	24
	TOTAL HOURS	1,386

Appendix G

ADVANCED AND REFRESHER COURSE, 1944*

		Hours
I.	Weather Forecasting and Briefing Laboratory Conference laboratory exercises in analysis of given weather situations; station and route forecasts; simulated briefing presentations; special attention to upper air data.	180
II.	Auxiliary Charts Laboratory exercises in preparation of miscellaneous charts.	30
III.	Meteorology Classroom instruction in recent developments in theoretical meteorology and its military application.	45
IV.	Special Topics Classroom instruction in basic principles of electronics and radar operation, radar measurement of winds aloft, radar storm detection, radar range forecasting, RDF winds aloft measurement, flood forecasting, techniques of weather reconnaissance flight.	24
V.	Radiosonde and RDF Winds Aloft Operation Laboratory exercises in conduct of radiosonde flights.	27
VI.	Aerial Navigation Classroom and laboratory exercises in solving navigational problems.	25
VII.	Limited Data Weather Analysis Classroom and laboratory exercises in analysis and forecasting when data are limited to one or a few stations.	20
VIII.	Weather Seminar Weekly meetings in which a student leads discussion of problems peculiar to the area in which he has served.	18
IX.	Weather Reconnaissance Flights.	27
	TOTAL HOURS	396

* Training and Opns. memo 50-101, Chanute Field, 24 July 1944, in AFACT files; Brig. Gen. R. E. O'Neill to CG ETTC, 13 Oct. 1944, in WSHQ files.

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Appendix H

REFRESHER COURSE FOR FORECASTERS, SEYMOUR JOHNSON FIELD*

	Subject	Hours
1)	Use of upper air charts in forecasting	7
2)	Raob code	1
3)	Winds-aloft code, rawins, etc.	1
4)	Surface synoptic code.	1
5)	Icing and turbulence.	2
6)	Communications.	1
7)	Air masses and long-range forecasting.	4
8)	Analogues and analysis code.	1
9)	The adiabatic chart, Rossby diagrams, and raob analysis.	7
10)	Organization of War Department, AAF, and Weather Service.	1
11)	AAF regulations, preparation of route forecasts, analysis of surface maps.	2
12)	Sferics.	1
13)	Thunderstorms, stability diagrams, and tornadoes.	3
14)	Administration.	1
15)	Fog.	2
16)	Methods of prognostication.	1
17)	Teletype procedure.	1
18)	Observing (WABAN 10A).	2

* Hist. 66th AAFBU Seymour Johnson Field, 1 July to 2 Sept. 1945, App.

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Appendix I

STAFF WEATHER OFFICERS COURSE, JUNE 1945*

1st day:
- a. Orientation.
- b. Organization of War Department, AAF, and AAF Weather Service.
- c. Training aids demonstration.

2d day:
- a. Staff principles and duties of group staff officer.
- b. Aircraft recognition, accident investigation and reports.
- c. Photo interpretation.

3d day:
- a. Functions and duties of staff weather officer.
- b. World weather communications.
- c. Night fighter operations.
- d. Capabilities and limitations of fighter aircraft.
- e. Air defense.

4th day:
- a. Reconnaissance aviation.
- b. Mission, organization, and equipment of troop carrier.
- c. Mission of air inspection.
- d. Mission and organization of tactical air force.

5th day:
- a. Organization, operations, and employment of strategic air force.
- b. Theory of bombing and very heavy bombing operations.
- c. Employment and capabilities of tactical bombardment.
- d. Weather problems in combat bombing operations.
- e. Bombing altitude computation for bombardiers.

6th day:
- a. Principles of weather briefing and mission briefing.
- b. Effects of weather and desired weather requirements for bombardment, troop carrier, ATC, fighter, and reconnaissance aviation.

7th day:
- a. Micrometeorology.
- b. Air-sea rescue operations.
- c. Wind-wave analysis.
- d. Africa and Middle East weather service requirements.

8th day:
- a. Weather briefing to commanding officers of air forces and commands.
- b. Special briefing on contrails.

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* Curriculum AFTAC course for 3 Aug. to 25 Aug. 1945, dtd. 31 July 1945, in WSHQ files.

9th day:
- a. Effects of weather on VHF, UHF, and SHF propagation.
- b. Weather intelligence, security, and ciphers.
- c. Capabilities and limitations of antiaircraft artillery.
- d. Weather organization of AAA and effects of weather on AA fire.

10th day:
- a. Weather and soil trafficability.
- b. AGF, techniques and tactics.
- c. Weather requirements for ground and amphibious operations.
- d. Ballistic wind computations for bombardiers.
- e. Synthetic weather briefing to air crews.

11th day:
- a. Elements of navigation.
- b. Weather officers' functions in flight plan analysis.
- c. Special staff weather officers' problems.
- d. Application of "D" system for drift determination.

12th day:
- a. Objective folders and target charts.
- b. Field orders.
- c. Technical intelligence.
- d. Intelligence in tactical air force operations.
- e. Selection of strategic targets.
- f. Briefing, interrogation, and reporting.

13th day:
- a. Synthetic briefing for air crews.
- b. Organization and operations of ATC.
- c. AAF engineers.
- d. Preparation and planning the use of climatic studies.

14th day:
- a. Weather interrogation: aircraft weather forms.
- b. Staff requirements on weather pertaining to enemy operations.
- c. Climatic briefing problems.

15th day:
- a. Air logistics.
- b. Plan of supply and maintenance in Z/I and theater of operations.
- c. POA weather service and requirements.
- d. AAF medical problems.

16th day:
- a. Demonstration of latest weather equipment.
- b. Synthetic briefing of climatic studies.
- c. Weather problems in survival.

17th day:
- a. Tactical air force demonstration.

18th day:

a. Preparation and discussion of solution to weather problem.
b. Weather briefing problem assignment.
c. Synthetic briefing of air crews.

19th day:

a. Personal law and affairs in preparation for overseas assignment.
b. General critique.
c. Summarization and graduation.

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Appendix J

[redacted]

TROPICAL WEATHER ANALYSIS AND FORECASTING, 1944*

		Hours
I.	Elements of Tropical Analysis	
	1) Surface analysis.	6
	2) Upper Air analysis.	2
	3) Analytical models.	15
II.	Elements of Tropical Prognosis	
	1) Single station forecasting.	2
	2) Terminal forecasting.	1
	3) Route and operational forecasting.	1
	4) Special purpose forecasting.	1
	5) Hurricane forecasting.	6
III.	Tropical Dynamic Meteorology	10
IV.	General Circulation in the Tropics	5
V.	Miscellaneous: technical devices, diurnal variation of pressure, etc.	4
VI.	Regional Meteorology	
	1) South America, Southwest Pacific, India and Indo-China, Equatorial Africa, West Africa, and South Atlantic.	23
VII.	Daily Schedule for Laboratory Work	
	1) Morning session: local single-station analysis and forecast; postmortem on previous day's forecast; analysis of current weather, two surface maps, and all available auxiliary charts.	
	2) Afternoon session: complete analysis of current weather charts; map discussion and postmortem on previous day's maps and forecasts; route and other forecasts.	

* Syllabus of "University of Chicago Institute of Meteorology Courses in Tropical Weather Analysis and Forecasting," incl. in ltr., H. R. Byers to Maj. Gen. R. W. Harper, 7 Aug. 1944, in AFACT files.

[redacted]

AAF TROPICAL WEATHER COURSE, HOWARD FIELD, 1945*

		Hours
I.	Synoptic Meteorology	
	1) Classroom instruction in general principles as applied to tropical weather forecasting.	40
II.	Dynamic Meteorology	
	1) Classroom instruction with emphasis on recent developments.	30
III.	Climatology	
	1) Classroom and laboratory exercises on special problems in tropical theaters.	30
IV.	Special Topics	
	1) Classroom instruction in the application of radar to meteorology, micrometeorology, etc.	10
V.	Weather Forecasting Laboratory	
	1) Practical application of theoretical principles of meteorology to tropical weather analysis and forecasting; 2) Use of time cross-sections, space cross-sections, and various types of charts.	128
VI.	Weather Reconnaissance and In-Flight Weather Observation	
	1) Classroom and in-flight instruction in weather reconnaissance; 2) Forecast verification, cross-section construction, flight weather reporting.	58
VII.	Weather Seminar	
	1) Weekly meetings to which all students contribute from their field experience.	16

* Course outline for Tropical Weather Course, Howard Field, 24 Feb. 1945, in AFACT files.

Appendix K

PHOTO-RECONNAISSANCE PILOT WEATHER COURSE, 1945*

		Hours
I.	Surface Weather Charts and Forecasting.	258
II.	Auxiliary Charts and Diagrams.	48
III.	Air Mass Analysis.	42
IV.	Synoptic Meteorology.	90
V.	Weather Observer Subjects	
	1) Surface Weather Observations.	30
	2) Weather Instruments.	30
	3) Wind-Aloft Observation.	5
VI.	In-Flight Weather Observation.	60
VII.	Radiosonde Operation.	12
VIII.	Altimetry and Determination of Winds in Flight.	12
IX.	Weather Reporting: Codes and Forms.	18
X.	Weather Analysis from Visual Observation.	24

* Syllabus, Photo Reconnaissance Pilot Weather Course, 15 Feb. 1945, in Hist. Chanute Field, Mar.-Apr. 1945, II, 184.

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