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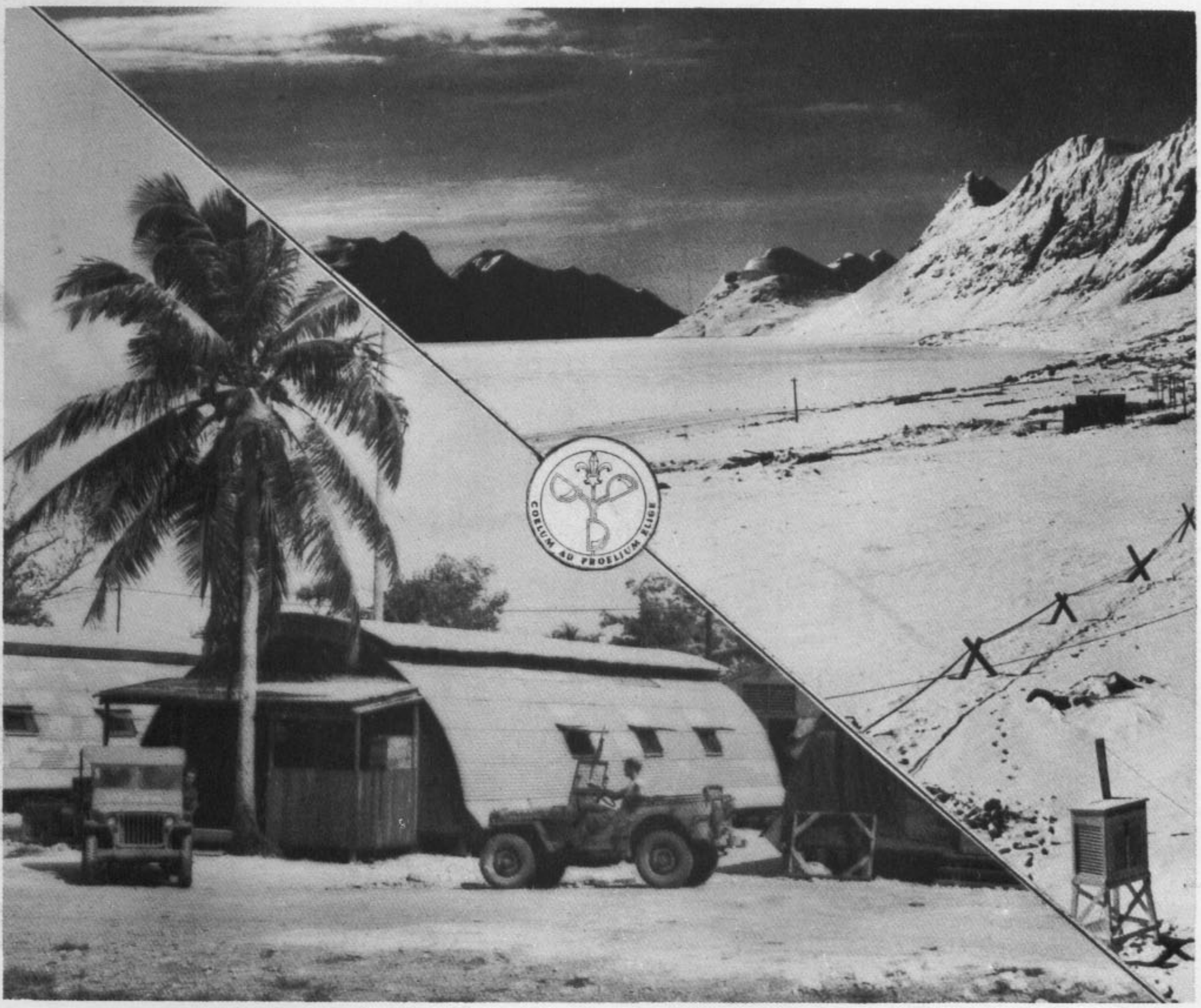
WEATHER SERVICE BULLETIN

No. 8, 1949



MILITARY AIR TRANSPORT SERVICE

HEADQUARTERS, AIR WEATHER SERVICE

WASHINGTON, D. C.

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HEADQUARTERS, AIR WEATHER SERVICE
ANDREWS AIR FORCE BASE
WASHINGTON 25, D. C.
20 September 1949

TO ALL CONCERNED:

The Weather Service Bulletin No. 8, 1949, is published for dissemination of important information to all echelons of the Air Weather Service.

It is believed that much of the material in the Weather Service Bulletin is of enduring value, and therefore each USAF weather installation should maintain a permanent file of this publication for reference.

BY COMMAND OF BRIGADIER GENERAL YATES:

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WEATHER SERVICE BULLETIN No. 8, 20 September 1949

WEATHER SERVICE MESSAGE

MAXIMUM EFFICIENCY, MINIMUM COST (U)

My message for this issue of the Bulletin deserves, I believe, the attention of every officer and airman in the Air Weather Service. It has to do with obtaining maximum efficiency at the minimum cost.

In general, the budget of the Air Weather Service is fixed. It is the responsibility of every one of us, then, to make the most efficient use of personnel, facilities, and funds. By proper planning, training, and whole-hearted acceptance of additional responsibilities, we can expand our present service under existing budget appropriations, or continue the present service in the event of reduced appropriations.

Congress charges the services with the proper discharge of assigned responsibilities, but Congress expects, and rightly so, that we give continuing and exhaustive study for the reduction of cost.

The Chief of Staff, United States Air Force, has recognized the importance of economy in management in the new Effectiveness Report which is rendered periodically on all officers. The first mandatory comment on an officer concerns his judgment in the economical management of personnel and resources under his supervision. Therefore, each officer's efficiency will be judged in the future, at least in part, on his ability to discharge responsibilities efficiently with the minimum of personnel, facilities, and funds.

Economy in personnel management can be accomplished by continued training of officers and airmen in their specialties and by expanding their training. Each officer and airman must then be taught to accept the additional responsibilities in new but related technical and administrative fields. Economy will dictate that such training be done at the unit level to the greatest degree possible rather than resorting to assignments to various formal schools. Such a program will result in better utilization of our personnel.

Economy in the use of facilities can be accomplished through the conservation and effective utilization of available facilities. This is a prime obligation of every organization and individual of the Service from the most senior officer to the newest airman recruit. Complete familiarity and compliance with appropriate technical publications will accomplish the best utilization of equipment and supplies, and good preventative maintenance will reduce the added costs of higher echelon maintenance. All personnel must exercise initiative and resourcefulness to exploit all possibilities of repair and reclamation of equipment and supplies. Costs can be reduced or held to a minimum by prompt return of reparable equipment and by prompt submission of completely accomplished UR's through the proper channels. Elimination of waste, full utilization of available facilities, and preventative maintenance will enable us to achieve the most economical use of our weather facilities.

Economy in the control of funds can best be accomplished by careful programming of inspection trips and command and staff visits, by exercising good judgment in the selection of the means of communications used for official messages, and by the method of travel used.

To reflect improvement in the utilization of manpower, facilities, and funds, the greater portion of the effort must come from the operating units. It behooves every one of us to examine our everyday duties and to start now in helping to prevent wasted effort, to conserve equipment, and to limit expenditures. The suggestions of all concerned are solicited, both at working level and officially through established channels.

D. N. YATES
Brigadier General, USAF
Chief, Air Weather Service

RESEARCH and DEVELOPMENT REPORTS

"STEERING" IN THE PROPAGATION OF HURRICANES (U)

This report represents a phase of the work done by the Pacific Tropical Meteorology Project of the Institute of Geophysics at the University of California,Los Angeles; the project is conducted for the Geophysical Directorate of the Cambridge Field Station under an Air Materiel Command Contract (ref. WSB No. 6, item 11). The summary which follows is based on a paper by Mr. Leon Sherman which was presented at the meeting of the American Geophysical Union held at U.C.L.A., 4-5 February 1949.

INTRODUCTION

The steering current has been described as the dominating factor in the control of hurricane paths, including periods of potential or actual recurvature (Ref. 1, 2, 3, 6). Steering wind and steering level are concepts receiving serious attention from working meteorologists faced with the actual forecast (ref. AWS Tech. Reports 105-37, 105-40, 105-42). However, it is clear, from the lack of agreement between meteorologists as to just what constitutes the steering wind and the steering level, that the steering concept is a hazy one. Even so it ought not to be dismissed from consideration, for it is important that we clarify our thinking about it.

Generally, steering implies some method of obtaining the flow pattern that would exist in the area were the hurricane not present and

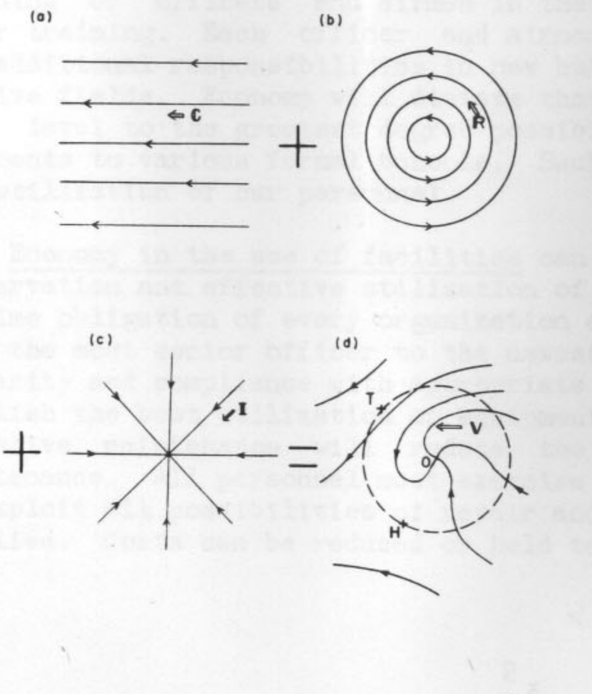

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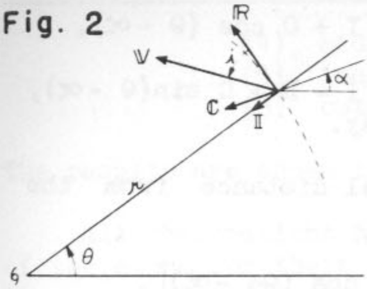
Fig. I

The Model. -- We assume Field (d) [the sum of Fields (a), (b), and (c)] to approximate that of a hurricane. (It is of interest to note that with our model, the alignment of the field (a) coincides with that of the bisector of the angle HOT between the ray from the storm center O to the hyperbolic point and the ray to the point of tangency of the streamlines and the circle about O through H.)

Fig. 2



also the assumption that the hurricane is moving in the direction of flow or at some fixed angle relative to it. To obtain the undisturbed flow pattern, the forecaster may go to an area beyond the storm's influence. Observations made so far from the storm, however, probably are not representative of the basic current in which the storm is embedded. This is true also in the case of any wind measurements from "above" the storm.

PROPAGATION OF DISTURBANCES IN FLUIDS

The velocity of propagation of a fluid disturbance may be considered to consist of a convective part and a dynamic part (Ref. 7). For example, if we observe such a disturbance in a river, the convective part is the current of the river. This portion of the velocity would be present in the absence of any asymmetric distribution of the horizontal divergence field. The dynamic portion of the velocity of propagation is that part which would appear should the stream velocity be zero; it depends on the asymmetry of the (horizontal) divergence field.

We will next show that the convective velocity (and hence its approximation, the steering current) does not dominate the control of the direction of storm propagation. To do this we shall assume that it does, and set up the consequent model. We will then test this model against observations from the Pacific hurricanes of 1947 and find it necessary to reject the model, thus establishing our thesis.

THE MODEL

If we add a constant field of translation (C), a radially symmetric field of rotation (R), and a radially symmetric field of convergence(I), we obtain a velocity field which may be taken as a first approximation to that of a hurricane (Fig. 1). It has a "dangerous semicircle" to the right of the direction of the field of translation; it also has greater angles of indraft in the rear quadrants than in the others. These properties conform rather well to those of an actual hurricane. However, this model is definitely but a first approximation, since it fails, for example, to show the spiraling lines of convergence found as squall lines on the radar screen (Ref. 8). Finally, we re-emphasize that it clearly has a symmetric field of convergence; thus, it should show no dynamic field of propagation.

If the hypothesis is valid that the dominant control in the propagation of storms is the convective velocity, then the orientation of the field of translation as calculated from the model should correlate highly with the actual direction of propagation of the storm.

Given an observation of wind speed, V, and the angle of indraft, i, at a point (r, Θ), where r and Θ are polar coordinates measured with respect to an origin at the storm center and a reference ray directed east, we have the following relations (Fig. 2):

(1) Radial component of the wind = $V \sin i = I + C \cos(\theta - \alpha)$,

(2) Tangential component of the wind = $V \cos i = R + C \sin(\theta - \alpha)$, where α is the angle between C and the reference ray.

Hence, with two observations at the same radial distance from the center, (V_1, i_1, r_1 and V_2, i_2, r_2), we have:

$$(3) \quad V_1 \sin i_1 - V_2 \sin i_2 = C\left[\cos(\theta_1 - \alpha) - \cos(\theta_2 - \alpha)\right],$$

$$(4) \quad V_1 \cos i_1 - V_2 \cos i_2 = C\left[\sin(\theta_1 - \alpha) - \sin(\theta_2 - \alpha)\right].$$

Now the right member of equation (3) is identical to:

$$-2C \sin\left(\frac{\theta_1 + \theta_2}{2} - \alpha\right) \sin\left(\frac{\theta_1 - \theta_2}{2}\right),$$

and that of equation (4) is identical to:

$$2C \sin\left(\frac{\theta_1 - \theta_2}{2}\right) \cos\left(\frac{\theta_1 + \theta_2}{2} - \alpha\right).$$

Hence, if we divide (3) by (4) we obtain:

$$-\tan\left(\frac{\theta_1 + \theta_2}{2} - \alpha\right) = \frac{V_1 \sin i_1 - V_2 \sin i_2}{V_1 \cos i_1 - V_2 \cos i_2},$$

whence

$$(5) \quad \alpha = \frac{\theta_1 + \theta_2}{2} + \arctan \frac{V_1 \sin i_1 - V_2 \sin i_2}{V_1 \cos i_1 - V_2 \sin i_2}.$$

THE TEST OF THE HYPOTHESIS

The values of α were determined from equation (5) for all possible cases from the Navy report on the 1947 typhoons (Ref. 5). They were then converted to angles (A) measured in the usual meteorological sense and compared to the angles (B), the direction of propagation of the hurricane as taken from the actual storm tracks given in the source publication (Ref. 5).

There were 84 usable observations grouped in 33 rings about the various storm centers. The 33 rings were then classified as being in the inner, middle, or outer third of the storm circulation. The angles A and B(the computed orientation of the field of translation and the observed orientation of the instantaneous velocity of propagation) were correlated into the following groupings:

(1) all the data weighted equally;
(2) all rings of data weighted equally;
(3) best ring for a given time chosen by the rule of priority: middle, outer, inner;

(4) middle rings;
(5) inner rings, and
(6) outer rings.

The results are shown in Table I.

All observations have been adjusted by means of the observed motion of the storm for their lack of simultaneity (due to the finite speeds of the reconnaissance aircraft). Also, "filtering" tests were applied to eliminate faulty observations through a cross-checking process with no significant effect on the results, indicating the data to be homogeneous in quality. It is seen, too, that if data from only the middle region of the storm (possibly a priori more representative than outer data and less sensitive to observational error than inner data) are used exclusively in determining the convective current, we obtain essentially the same results as when all of the data are used.

TABLE I

Correlations between A and B

All 84 obs . . .	0.744
All 33 rings . .	0.496
Best	0.723
Middle only . .	0.746
Outer only . . .	0.265
Inner only . . .	0.250

CONCLUSIONS

It is clear from the first line of Table I that not more than 55 percent* of the variation in the direction of propagation is predictable from the convective velocity (and hence, by implication, to even a lesser extent from steering). So we must reject steering as a sufficient tool for forecasting and should instead consider both the convective and the dynamic parts of the velocity of propagation. There remains the possibility that the lowering of the predictability due to observational errors is large enough to account for about half the control of the estimated storm direction. Should this be so, it might be that the dynamic velocity is unimportant, but in any event it is clear that the calculated convective velocity in itself is not a sufficient basis for prediction. (Review of Mr. Leon Sherman's paper, "On 'Steering' in the Propagation of Hurricanes," by H. S. Appleman, Hq., AWS.)

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*The square of the correlation may be interpreted as the fraction of the variation of one of the variables predictable from knowledge of the other (Ref. 4).

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MICROSEISMIC 'OBS' AID IN LOCATING STORMS (U)

Progress continues to be made by the U. S. Navy in adapting seismic instruments to storm detection at Miami, Swan Island (Cuba), and Roosevelt Roads (P.R.) in addition to a small network of stations in the western North Pacific.

The instruments used are very sensitive detectors hinged to allow either vertical or horizontal movement of a free end and thus record vibrations of the earth. Disturbances by slight earth movements, wave action, and storms cause typical vibrations called microseisms which can be identified on the recording sheet.* It is not yet definitely known how the energy from a storm produces a microseismic trace of rather regular amplitude and period, but research continues in that direction.

Each of the three observing stations consists of three detectors spaced 2000 feet apart in a triangle, the fractional time difference between arrival of selected microseisms at each detector allowing calculation of the storm's bearing. With bearings from two or more positions, the location of a storm up to 1000 miles away -- and in certain cases up to 15,000 miles -- may be determined. The great value of microseismic stations is in determining the location and intensity of storms, at the present time mainly hurricanes, over areas not covered by regular weather observations. It is believed, but not yet proved, that centers of extratropical cyclones can also be located. St. Louis University is investigating this theory, and seismic stations are being established by the Navy at Bermuda and at Cherry Point, N. C., to test it.

Work is also being done on this rather new aid to meteorologists by the California Institute of Technology which is erecting an observing station at Mt.Palomar observatory for the purpose of investigating, from observations at a single location, microseisms associated with meteorological phenomena other than hurricanes. A group at Columbia University is concentrating on determining the methods by which disturbance energy is transformed into recordable microseisms.

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*The tidal-wave warning system in operation in the Pacific (ref. WSB No. 7, item 51) uses seismic observations for detection of tidal waves.

At present, the Air Force (or AWS) has no plans for setting up its own observational net, but its requirements are reflected in the projects at C.I.T. and Columbia through the Air Materiel Command. In addition, the work of the Navy will be followed with interest and their observations of microseisms utilized through the Joint WB-AF-Navy Hurricane Center at Miami and the AWS Typhoon Warning Center at Guam. (Hq., AWS)

NEW STORM DETECTION RADAR DEVELOPED (U)

An instrument markedly improved over the AN/APQ-13 for detecting storms by radar has been developed by the Signal Corps Engineering Laboratories. Known as the AN/CPS-9, it is the first radar system to be designed solely for weather purposes, contrasted to the adaptation of existing equipment for storm detection in the past.

The main console of the AN/CPS-9 (see Fig. 1) houses four cathode-ray-tube indicators and a range counter: a plan-position indicator, an R-scope, a B-scope, a range-height indicator, and a counter to read accurate range. The standard PPI-scope is the main presentation of the system. The B-scope, with the horizontal scale indicating azimuth and the vertical scale delayed range, presents detailed information of a small region of the plan-position display. Similar to an A-scope presentation, except that it displays the delayed range information, is

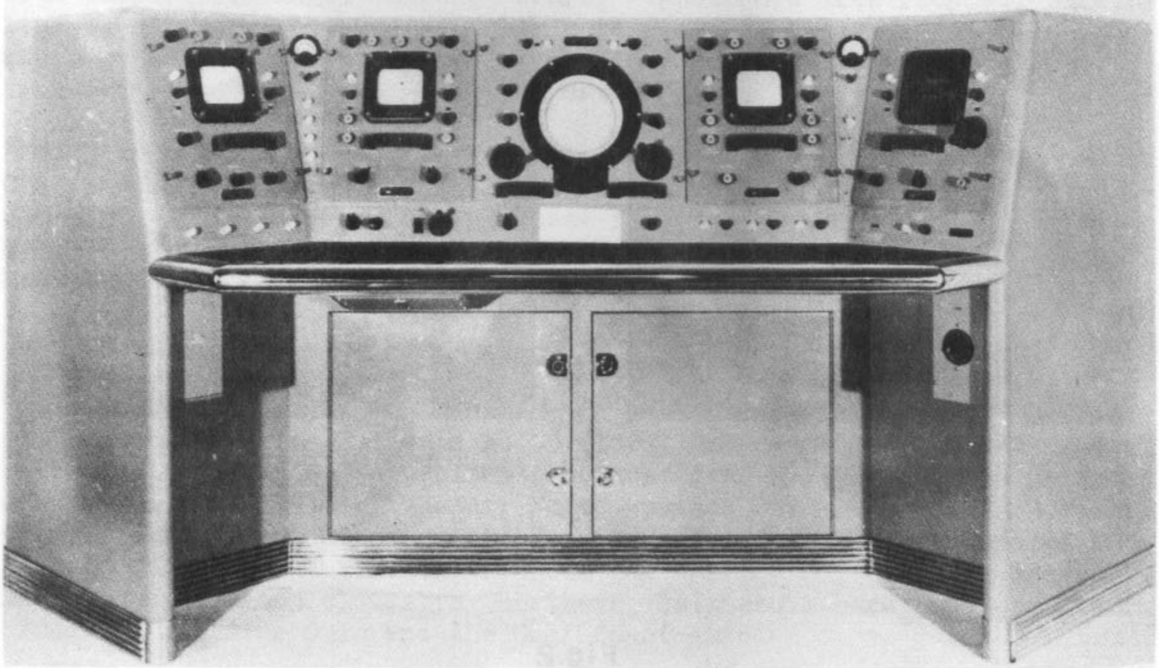
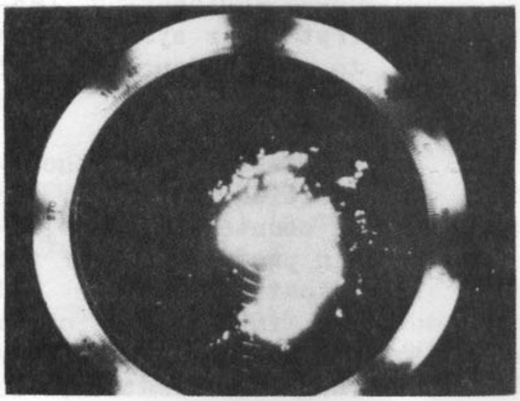


Fig. 1

SWEEP RANGE — 200 MILES

RANGE CIRCLES IN LOWEST PICTURES 138 MILES

NOTE: NEW STORM DEVELOPMENT TO THE WEST AT 130 MILES — 1130 EDT



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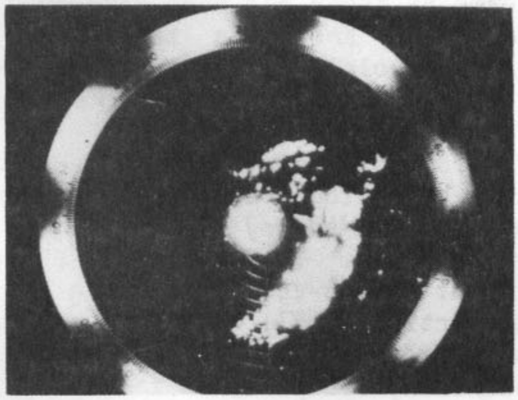
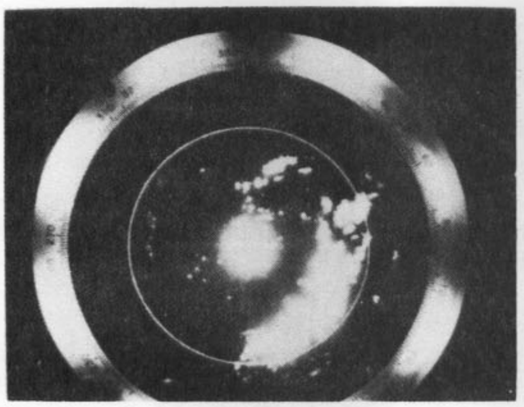


1100 EDT



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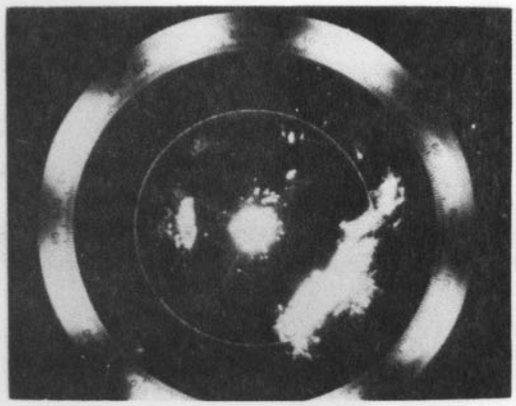


1310 EDT

Fig.2

that of the R-scope on which signal amplitude is given on the vertical scale and delayed range on the horizontal scale. The range-height indicator is used to obtain the vertical structure of storm areas, giving the height along the ordinate and the horizontal range along the abscissa. The fifth indicator is a counter for accurately ranging on the limits of storm areas. Also provided is a remote indicator consisting of a single PPI-scope which may be located up to one-half mile from the main console. A telephone connects the operator controlling the equipment at the main console with the observer at the remote plan-position indicator.

The set provides over 200 kilowatts peak power at a wavelength in the three-centimeter region in a very narrow beam and has a much greater range than the AN/APQ-13. (See Fig. 2.) A long pulse is employed for long-range storm detection, while the pulse width is decreased ten times for close, detailed investigations. Flexibility in installation is provided by using special circuits between major components. The antenna, which can be sector-scanned, rotated continuously in azimuth, or manually positioned, may be placed at a location up to one-half mile from the weather station in order to clear local obstructions. The main console is placed in the weather station.

A very useful function of the R-scope is to determine whether a very small signal on the plan-position indicator is from a precipitation area, a plane, ship, or fixed target -- a precipitation area will give a lacy signal on the R-scope, compared with a bobbing signal from radar targets other than precipitation. An additional feature of the equipment is a sensitivity-time control which automatically increases the receiver gain with respect to range. Strong, nearby signals are thus reduced, permitting direct comparison with weaker more distant echoes. Basically, normal gain permits observing the storm limits, while sensitivity-time control permits seeing internal storm detail.

The AN/CPS-9 is now being service-tested by the USAF Proving Ground Command at Eglin Air Force Base, Florida, and if it is found suitable for field use of AWS units, a request for procurement will be initiated by this headquarters. (Hq., AWS; based on a report by L. A. Zurcher, Evans Signal Laboratory.)

RECENT RESULTS OF CLOUD-SEEDING EXPERIMENTS (U)

Weather Service Bulletin No. 5 (item 128) contained a brief report of the "cloud-seeding" experiments conducted in Ohio during the period 5 January to 1 May 1948 by the Air Force-Weather Bureau-National Advisory Committee for Aeronautics joint operation termed "The Cloud Physics Project." Since that time the Project has carried out additional experiments on stratiform clouds in northern California and on cumuliform clouds in southern Ohio and the Gulf Coast area.

The cumuliform cloud experiments in Ohio were operated with the same aircraft and equipment used in the previous Ohio experiments. In California and the Gulf States, however, only three aircraft were used:

one B-17 for seeding and observation, another (containing an APS-20 radar) for controlling the procedures and for determination of rain echoes, and a C-47 for observing the area just beneath the seeded cloud. Observers and photographers were aboard the aircraft to obtain necessary data, including extent of the cloud, temperature inside and out, relative humidity, presence of supercooled water and ice crystals, optical effects, and the results: precipitation from and/or dissipation of the seeded cloud and other cloud formations in the vicinity. A ground-controlled APS-20 radar was especially helpful in determining whether echoes were produced by natural or artificial means.

EXPERIMENTS ON STRATUS CLOUDS

Operations in the California area took place during February, March, and April of this year; results are listed in Table I. Plans called for seeding orographic, stratus-type clouds along and over the mountains, but since it was very difficult to locate clouds of that type which were also supercooled, only 15 seeding missions were actually accomplished. Of these, 6 resulted in a "trough" or "valley" being formed in the cloud, hereafter referred to as "partial dissipation." On only one mission was there complete dissipation of the seeded portion, i.e. a hole completely through the cloud.

The seeding of stratiform clouds was usually carried out in an "L"-shaped pattern at rates of 1 to 3 pounds of 3/8" dry-ice pellets per mile. In some cases when the cloud deck was thin and dissipating naturally, the unseeded portion would dissipate while the seeded portion turned to ice crystals and persisted longer than other naturally dissipated clouds in the area. It appears that results are dependent on some correlation between the amount of dry ice used and the moisture content and droplet distribution of the cloud. Single pellets were occasionally dropped into clouds, but no effects were noted.

In no way did the California results contradict those obtained in Ohio during 1948. The only time significant modification was produced in a stratiform cloud deck, natural conditions and the synoptic situation indicated dissipation or horizontal divergence. Only very small amounts of rain, if any, have been produced by seeding stratus-type clouds. From a practical point of view, then, seeding stratiform clouds with dry ice does not appear to be effective for producing significant precipitation. Experiments on supercooled fog have not been undertaken by this Project, but it is doubtful, judging from results on stratus clouds, whether any significant effects could be obtained.

EXPERIMENTS ON CUMULUS CLOUDS

During the summer and fall of 1948 there were 79 cumulus-type clouds seeded in the Ohio area; in May and June of this year 39 such clouds were seeded in the Gulf Coast area. Results in the two locations were very similar and so are not listed separately in Table II.

Seeding traverses were usually made through the top of the cloud to obtain temperature readings and to determine whether supercooled water

TABLE I. RESULTS OF SEEDING STRATUS CLOUDS

Date	Sdg Run	Frontal or Non-Frontal	Convergence, Divergence, Neutral	Height & Temperature of Top	Height & Temperature of Base	Rate of Sdg lbs per mile	Were clouds supercooled?	Results
Feb. 15	1	F	D	10650; -7.0°C.	9800; -6.0°C.	3	Yes	Hole opened[a]
Feb. 22	1	F	C	13000; -8.0	9000; -1.0	3	Yes	Possibly slight building[b]
Feb. 24	1	F	C	10000; -7.0	8500; -5.0	3	Yes (?)	None[b]
	2	F	C	10000; -7.0	8500; -5.0	3	Yes (?)	None[b]
Mar. 1	1	F	D	13100; -11.0	12600; -12.0	3	Yes	Hole opened[a]
	Single pellet drop also with no results observed.							
Mar. 2	1	F	D	18500; -27.0	10600; -10.0	3	Yes*	Change in texture[c]
	Single pellet drop also with no results observed.							
Mar. 9	1	F	C	12200; -10.0	2200; +8.0	3	Yes*	Narrow seeding line obsvd for short period only
Mar. 23	1	NF	N	9600; -11.0	4000; -2.0	3	Yes	None
	Single pellet drop also with no results observed.							
	2	NF	N	8450; -8.0	4000; -2.0	2	Yes	Hole opened[d]
	3	NF	N	7800; -5.0	4000; -2.0	1	Yes	None
Mar. 24	1	NF	D	12800; -15.0	12300; -14.0	3	Yes	Hole opened[e]
	Single pellet drop also with no results observed; possibly dropped in natural hole.							
	2	NF	D	13300; -15.0	12300; -14.0	3	Yes	Hole opened[a]
	Single pellet drop also with no results observed.							
	3	NF	D	15900; -21.0	12300; -14.0	10 lb drop	Yes	Hole opened[a]
Apr. 7	1	NF	N	14000; -10.0	13500; -8.0	3	Yes	Pattern made[d]
	2	NF	N	14000; -10.0	13700; -8.0	No. of single pellets	No (?)	None

*Also ice crystals.
[a]Natural holes nearby.
[b]Chaotic sky interfered with obs.
[c]Also built up about 500 feet.
[d]Natural dissipation nearby.
[e]Natural hole along seeded path.

TABLE II.

RESULTS OF SEEDING CUMULIFORM CLOUDS[a]

	Clouds Seeded with No Previous Rain Echo	Clouds Seeded with Previous Rain Echo
Total Number	81[b]	27[c]
Echoes Resulted from Seeding	18	-
Natural Echoes within 30 Miles	76	-
Rain Produced[d]	30	-
Cloud Building at Time of Seeding	74	26
Cloud Building only after Seeding	9	0
Partial Dissipation of Building Cloud[e]	58	24
Complete Dissipation of Building Cloud	4	2

[a] A total of 118 cumuliform clouds were seeded, but those dissipating at time of seeding are not included here.
[b] Results of 3 cases unknown.
[c] Results of 2 cases unknown.
[d] Rain produced means small showers and in some cases only virga.
[e] Includes up to approximately 90% of the cloud.

and/or ice crystals were present. The temperature of the portion of the clouds which were seeded was always below freezing. Usually 5-6 pounds of dry ice per mile were sown, but in some cases a mass of 20 pounds was instantaneously released.

The usual aftermath of these seedings was immediate dissipation, either partial or complete. Some clouds which were in the building stage when seeded continued to grow, but in no case was the rate of growth noticeably increased. In many cases showers were produced, although in general the rain was either very light or only as virga. The amount of artificially precipitated moisture appears to be entirely limited to the moisture content of the cloud <u>at time of seeding</u>. It appears, too, that seeding usually suppresses the further growth of the cloud so that less rain may actually fall from it than from neighboring unseeded ones. Thus, by seeding, it may be possible to prevent the development of clouds into thunderstorms; however, this might be rather ineffective when atmospheric conditions are really very favorable for thunderstorms. (Hq., AWS: based on report by Maj. I. Fischer, AWS Liaison Officer, Cloud Physics Project.)

ON ELECTRICAL CHARGES AND THUNDERSTORMS (R)

Just released and reprinted below is the final technical report of the Atmospheric Electricity Project, "Airplane Measurements of Charge Carried to Ground by Thunderstorms,"* by G. R. Wait and O. H. Gish of the Carnegie Institution. As mentioned previously (ref. WSB No. 3, item 67; No. 6, item 9; No. 7, item 42), the Project was a joint endeavor of the USAF and the Carnegie Institution of Washington to measure the vertical electrical currents above the tops of thunderstorms. For both years' operations (1947-48), the AWS furnished the B-29 and its complete flight crew, while AMC provided the operating base and maintenance.

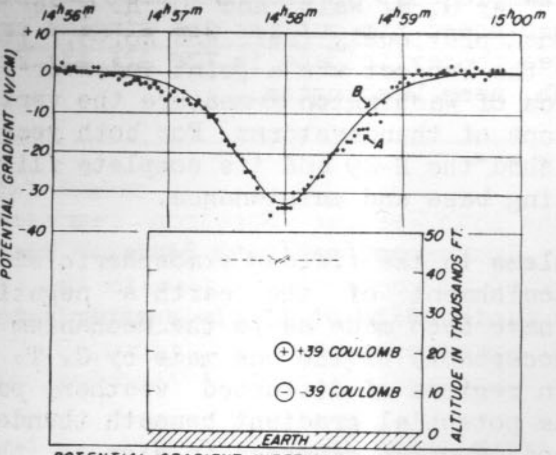
One of the most important problems in the field of atmospheric electricity is concerned with the replenishment of the earth's negative charge. A number of suggestions have been made as to the mechanism of replenishment. Probably the most acceptable is the one made by C. T. R. Wilson, that replenishment occurs in regions of disturbed weather, particularly through thunderstorms. The potential gradient beneath thunderclouds is usually relatively high and is often reversed in sign to that found during fair weather. Consequently, large currents can occur, especially from pointed conductors as point discharges. Currents also occur as lightning flashes from cloud to ground (which for the most part carry negative charge to ground, and as space charges are blown by the wind), and as charged rain and ordinary conduction currents from plane areas. Only rough estimates are thus far available on the magnitude and sign of the charge transferred to ground in this manner.

The number of thunderstorms in progress at any moment, throughout the world, has been estimated by Brooks (Brit. Met. Office, Geophys. Memoir No. 24, 1924) as about 1800. This number is nearly the same as the number of amperes of current (1500) which flows as the air-earth current during fair weather for the earth as a whole. Consequently the average thunderstorm must contribute around one ampere if only negative charges are brought to the ground. If positive charges are at times also brought down, or if they are always brought down in particular portions of the thunderstorm, then the total current carried by the average storm must exceed 1 ampere.

If the thunderstorm is the main source of negative charge to ground, and if it is to supply positive electricity to the conducting layer of the atmosphere above, thus maintaining it at a constant potential of about 300 kv with respect to ground, then the potential gradient must show a maximum at the time of day when the number of thunderstorms of the globe is a maximum. This has actually been found to occur by Whipple (Q. J. R. Met. Soc., Vol. 55, pp. 1-17, 1929) by employing potential gradient data from the ocean areas, taken aboard the S. S. Carnegie which were found by Mauchly (Terr. Mag., Vol. 28, pp. 61-81, 1923) to follow a universal time in its diurnal variation. Such indirect evidence

*Presented at the Geophysics Conference held at Bernard Price Institute, Johannesburg, So. Africa, on 27 July 1949.

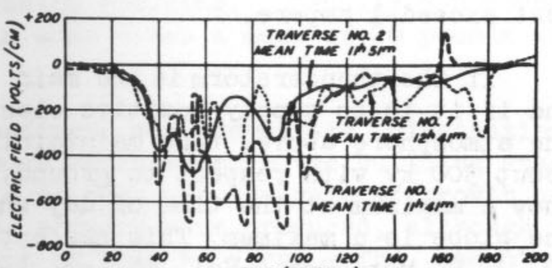
justifies the consideration of the thunderstorm as a possible source of replenishing charge to ground. In view of this, the Department of Terrestrial Magnetism of the Carnegie Institution in 1947 made plans to obtain more direct evidence concerning the magnitude and direction of the current carried by thunderstorms to ground.



POTENTIAL GRADIENT (VERTICAL COMPONENT) OVER THUNDERSTORM, OCTOBER 28, 1948, STORM NO. 1, TRAVERSE NO. 8; (A) OBSERVED, (B) CALCULATED FOR MODEL SHOWN

Fig. 1

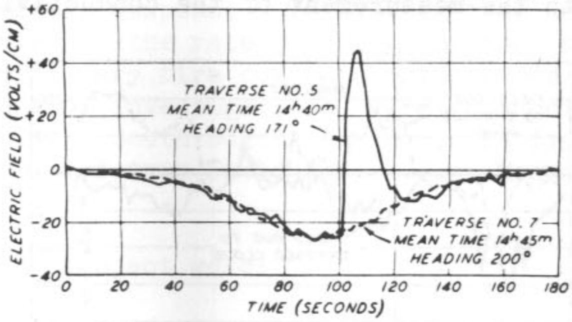
The electrical conditions are much simpler above a thundercloud than they are below. Above the cloud practically no current is carried by lightning flashes to the upper conducting layer by charged rain or by convection currents. The charges are transferred almost entirely as a pure conduction current which is subject to measurement with suitable instruments mounted on high-flying aircraft. It seemed possible by the close of the war that the B-29 airplane would be capable of attaining and maintaining sufficient altitudes to fly traverse patterns over the tops of many thunder storms. The cooperative project of the U. S. Air Forces and the Carnegie Institution of Washington, started during the summer of 1947, had for its purpose the measurement of the vertical electric currents passing through thunderclouds, using a B-29 airplane for carrying the measuring equipment over the tops of the storms. The measuring equipment consisted of two field meters, one mounted above and one below a wing in order to differentiate between the effect of a charge on the wing and a charge on a cloud below the plane, two instruments for the measurement of the electrical conductivity of the air, one for positive and one for negative, and equipment for measuring the electric current to an insulated plate. Auxiliary data were taken on all flights, such as free air temperature, altitude, speed of plane, heading of plane, and pictures of clouds from above.



ELECTRIC FIELD OVER THUNDERSTORM ON AUGUST 17, 1948

Fig. 2

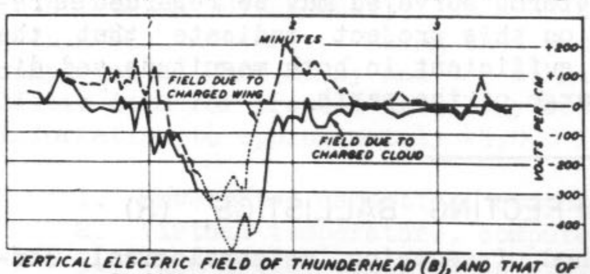
Measurements could not be undertaken in 1947 until the first of October owing to the late start and the time required to install the measuring equipment. During the month of October, however, three thunderstorms were successfully surveyed. Field work for the summer of 1948 was started the latter part of June and during the four succeeding months successful measurements were made on a total of 65 traverses over the tops of 21 different thunderstorms. All surveys were made at altitudes greater than 40,000 feet, and the highest altitude attained was over 48,000 feet above sea level. An occasional thunderstorm was found to be too high to top, exceeding 50,000 feet, and some probably extended to about 60,000 feet. The airplane was vectored to a thunderstorm, and back and forth over the center of the storm by means of radar. The airplane radar, after suitable modification, was found to be very satisfactory for the purpose. During the early part of the summer, chief reliance was placed in the V-beam radar installed at Jamestown, Ohio, some 15 miles from the air base where the plane was maintained.



ELECTRIC FIELD OVER THUNDERSTORMS ON OCTOBER 28, 1948

Fig. 3

The electric field over the centers of the thunderstorms surveyed on this project was found to be as large as 600 volts per cm with an occasional instantaneous value three times as large. The manner in which the field varies from the center outward over the thunderhead, particularly for the less intense storms and for those of simple structure, indicates that such clouds are bipolar in nature with positive charge above conforming to the Wilson model. An example of this type of field is shown in Fig.1; the field is accounted for on the basis of a positive charge of 39 coulombs at 20,000 feet altitude and a negative charge of similar magnitude at 10,000 feet, with the measurements having been made at an altitude of 43,000 feet. For the more intense storms the structure appears considerably more complicated. This is illustrated by Fig. 2 which shows the field as measured over a storm on August 17, on the first, the second, and the last traverse. The latter was made one hour later than the first traverse. The curves for the fields against time of measurement have been superimposed, that measured on the second traverse being turned about 180°. The general outlines of the fields are similar on all three traverses, but the details do not agree. Lightning flashes are probably the cause of the more rapid field changes. This is further illustrated in Fig. 3 where the top charge appears to have been largely destroyed, thus only the lower and greater charge remained effective.

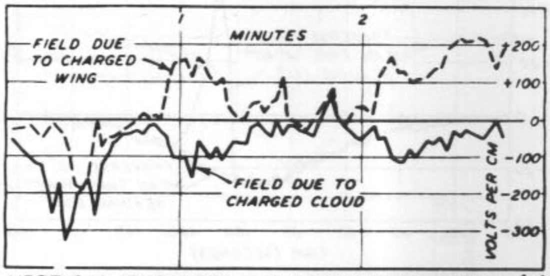


VERTICAL ELECTRIC FIELD OF THUNDERHEAD (B), AND THAT OF CHARGED AIRPLANE WING, OCTOBER 22, 1947

Fig. 4

Flying over a charged cloud induces a charge on the wings of the plane. The charge induced on the wing was often sufficient to considerably alter the vertical field as measured. A comparison of the vertical field due to a charged cloud and to the charge on the wing of the plane may be made from the curves of Figs. 4 and 5.

The conductivity of the atmosphere above a thunderhead appears to be very little influenced by the strong electric fields present. This finding is of considerable interest in view of Wilson's expressed belief that, through the influence of the strong fields, electrons might be brought into the region from the conducting layer above. The rather intense fields due to the charge on the wing of the plane interfered with the measurement of the conductivity. A negative charge on the wing was found to reduce the measured value of the negative conductivity but allowed the positive conductivity to be correctly measured. Similarly, a positive charge on the wing reduced the measured value of the positive conductivity but permitted the negative conductivity to be correctly measured. A field of about 250 volts per cm was found to be saturation potential for the ions when the plane was flying 200m.p.h. The fair weather conductivity increased with altitude, being a linear function of the altitude squared, in agreement with earlier results obtained on the Explorer II balloon ascension. The variation was in accordance with the equation $\lambda = \lambda_o + Ah^2$, where λ_o is the value of conductivity near the ground, h is the altitude, and λ is the value of the conductivity at height h. A mean value for λ_o is about 1.0×10^{-4} esu, and for A, when h is expressed in feet, 1.9×10^{-8}.



VERTICAL ELECTRIC FIELD OF THUNDERHEAD (A), AND THAT OF CHARGED AIRPLANE WING, OCTOBER 22, 1947

Fig. 5

Values of total current through each thunderstorm have been deduced as the integrated values of current densities, the values of which were obtained from the product of the electric fields and the sum of positive and negative conductivities. The direction of the resulting current was, in all cases, such as to return a negative current to ground. No exception was found to this general rule for any of the storms or on any of the traverses. The magnitude of the currents varied from around 0.1 to about 6 amperes. An arithmetical mean of the total currents through the thunderheads was 1 ampere, almost precisely that required to maintain the negative charge of the earth by thunderstorms.

To the extent that the thunderstorms surveyed may be regarded as representative, the measurements made on this project indicate that the currents carried by such storms are sufficient in both magnitude and direction to maintain the negative charge of the earth.

ON ATMOSPHERIC VARIATIONS AFFECTING BALLISTICS (R)

Prior to World War II, the method of securing meteorological corrections to field artillery firing data was based upon a series of empirical approximations involving an arbitrary altitude-zone structure of the atmosphere and ballistic weighting factors for applying the effects of atmospheric variations to specific artillery trajectories. Measurements of the meteorological variables were obtained with optical wind-finding equipment and by extrapolation of temperature and density data from surface observations.

During the period 1940 - 1944, extensive joint research by the Signal Corps and the Ordnance Department resulted in improved electronic meteorological equipment and new ballistic weighting factors applicable to modern high-velocity, high-trajectory weapons. To exploit this new-type equipment and to obtain estimates of the rate of change of the atmospheric elements pertinent to artillery fire during short periods of time and over short distances, extensive investigations were conducted near Fort Riley, Kansas, and Rapid City, South Dakota in 1946. The final report was recently released by the Chief,Army Field Forces,Fort Monroe, Virginia.

The objectives considered in the project were:

1. Density of meteorological stations required to serve adequately any given combat area or organization.
2. Type,frequency,and distribution of meteorological observations.
3. A standard method of evaluating meteorological observations.
4. Amount of wind turbulence occurring during a frontal passage.
5. The degree of interference, if any, between closely spaced stations.
6. The requirements for accuracy of:
   a. Forecasts where no observing stations are available.
   b. Dropsondes released in enemy or inaccessible territory.

To attain these objectives, a radiosonde network consisting of nine stations at an average distance of 18 miles apart was set up at Fort Riley, Kansas, and another network of 6 stations arranged at intervals of approximately 50 miles around an irregular hexagon was established at Rapid City, South Dakota. Dropsonde facilities were also made available.

Since one of the principal purposes of the investigation was to observe meteorological behavior during periods of variable weather conditions, observations were made only for selected periods during which frontal passages occurred. These periods were to begin 12 hours before the frontal passage at the surface and to end 24 hours after the front had passed. During these selected periods, rawinsonde flights were to be started simultaneously, on a bi-hourly schedule, by all stations within each network. Using this procedure, 400 acceptable flights were completed at Fort Riley and 425 at Rapid City. The computation of ballistic data for present artillery weapons made it necessary to obtain information to approximately 45,000 feet, including:

1. Unweighted densities, computed in percent of density,
2. Virtual temperature, computed in degrees centigrade,
3. Wind speed, computed in m.p.h., and
4. Wind direction, computed to hundreds of mils of azimuth.

The data obtained during the tests were treated statistically, resulting in these main conclusions:

1. The changes observed in atmospheric conditions over distances of 23 miles or less were probably largely the result of small sampling

effects of random errors. There was a slight indication of average change in wind direction over these distances.

2. During frontal passages in the localities considered, significant changes in atmospheric conditions occurred during periods as short as two hours, indicating that new artillery meteorological messages should be prepared at least every two hours.

3. A determination of atmospheric turbulence from rawinsonde data secured with present standard equipment is meaningless because of the many inaccuracies involved. Since the turbulence effect on ballistics is generally small, very changeable, and unpredictable, it is believed to be unnecessary and impractical to consider it in artillery fire.

4. Rawinsonde flights which terminated because of interference from a neighboring instrument were compared. There is a definite increase in cross interference between the instruments with an increase in density of stations. With a station separation of approximately 30 miles, approximately 5% of the flights will probably be terminated at or below 30,000 feet because of interference between radiosondes. However, if the frequencies of the raob transmitter released from closely sited stations were different, decreased interference should result.

5. Neither forecasts nor information obtained by dropsondes can be expected to possess the precision necessary to adequately denote atmospheric changes for artillery firing.

6. There is an immediate need for a means of decreasing the time lapse between release of the balloon and receipt of the finished message at the artillery unit utilizing the data.

7. The present meteorological sounding equipment is not precise enough to meet the accuracy requirements of field artillery. (This report is an extract from Final Report, Project FA346, Army Field Forces Board No. 1, Fort Bragg, N. C. and does not necessarily represent the opinion of Hq, AWS.)

● Lest newcomers in the ranks of AWS personnel be not fully aware of the meaning of AWS insignia: The first participation of a US Army Weather Service in combat in France during World War I is commemorated by the fleur-de-lis; performance of meteorological duties both day and night is indicated by the blue and black background; the anemometer cups, an important source of data for weather forecasting, is symbolic of the service. "Coelum ad Proelium Elige" or "Choose the Weather for Action" heralds meteorology as a vital consideration in modern strategy and tactics.

CLOUD BASE AND TOP INDICATOR DEVELOPED (R)

In the early part of 1945, personnel of Evans Signal Laboratory became interested in the possibility of detecting clouds by radar. Of course, radar storm detectors were available and in operation at that time, but such equipment received echoes only from precipitation areas and clouds composed of large water-droplets, not ordinary clouds.

Ten-centimeter and three-centimeter wavelength sets were found to be unsatisfactory for consistently detecting ordinary clouds, probably because the particle-size of droplets in ordinary clouds is too small (about 1/100 the size of raindrops). Theoretical investigation at Evans

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Fig. I

An A-scope presentation is given, showing a sweep length of 40,000 feet with 5000-foot markers. The main pulse is at the bottom of the picture, occupying approximately 800 feet. The first cloud layer has a base of 11,000 feet with a top of 12,500 feet. The higher deck gives a saturated signal with a base of about 14,000 feet, extending to 17,000 ft. Above this is a layer with a base at 20,500 feet and a top measuring 23,000 feet. A thin layer exists at 25,000 feet.

For accurate measurement of altitude, a movable range marker is used, enabling determination of altitude within a few hundred feet.

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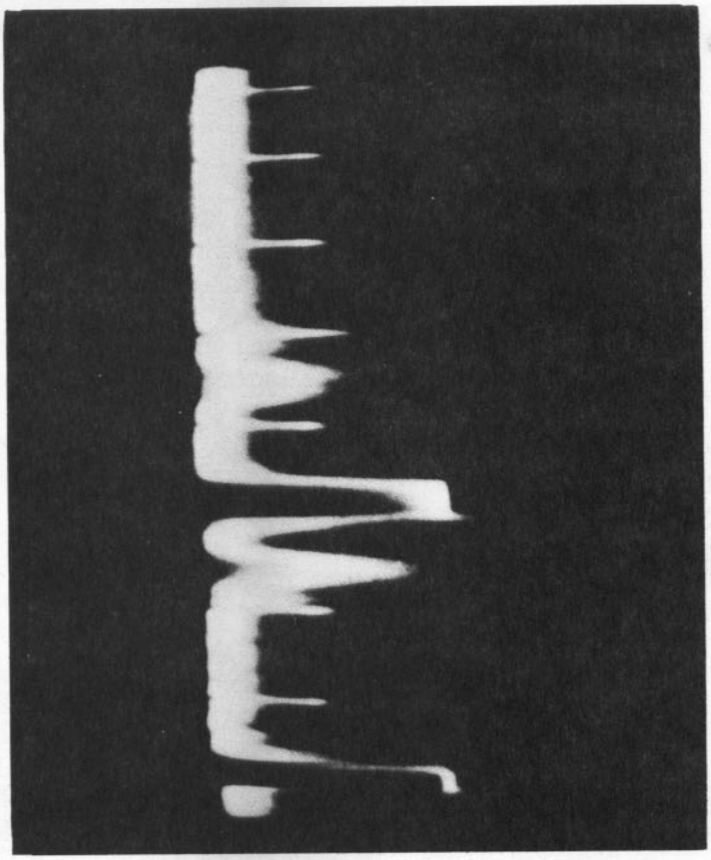
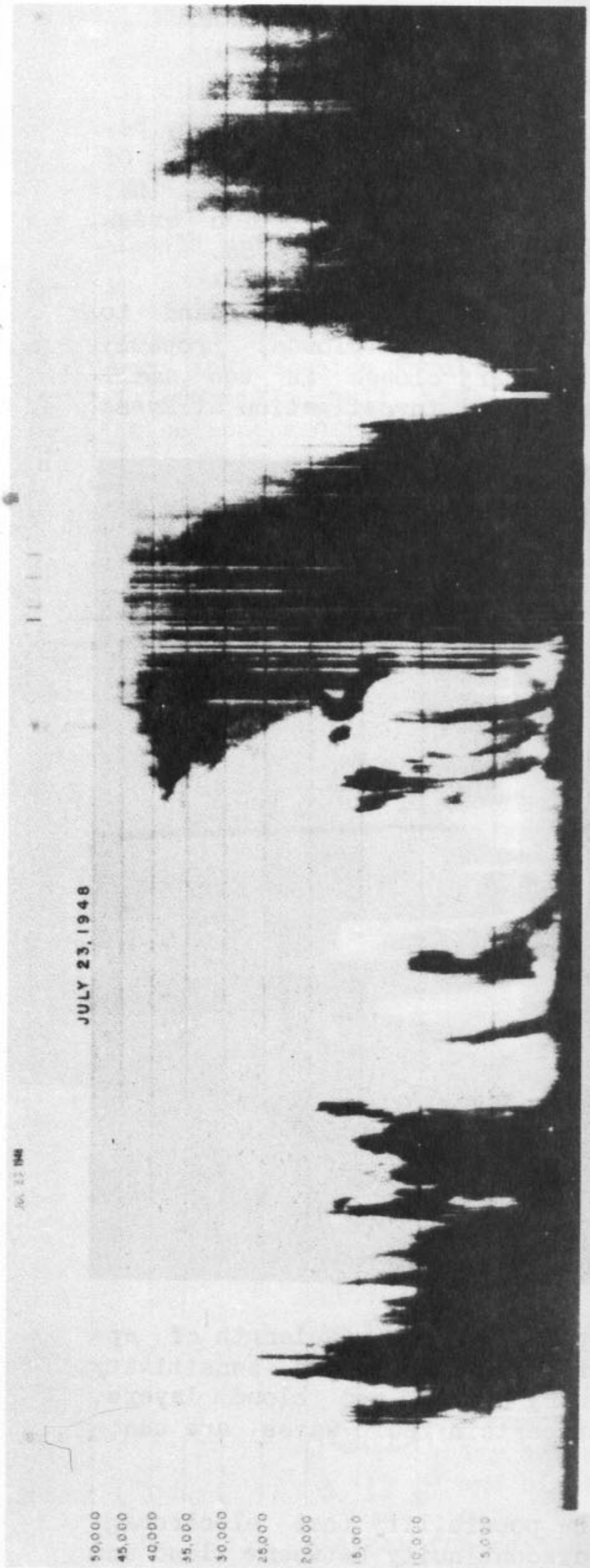


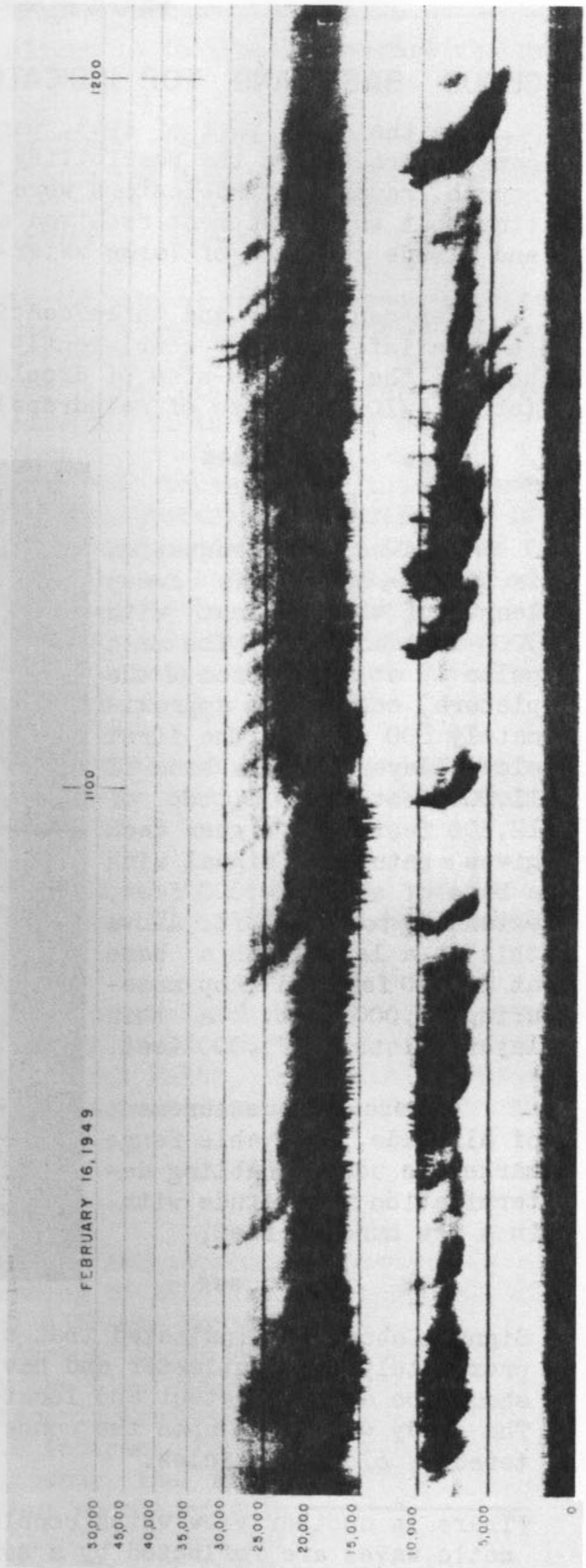
Signal Laboratory indicated that a set operating on a wavelength of approximately one centimeter and having sufficient power and sensitivity should be able to detect and locate ordinary clouds and cloud layers. The study was based upon the concept that certain radio waves are scattered by cloud particles.*

*There is another view which considers the possibility that electromagnetic waves are reflected by a surface discontinuity between a cloud and the free air adjacent to it, but personnel of the Signal Laboratory felt that their indicator detects clouds chiefly by the scattering effect.



JULY 23, 1948
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000

Fig. 2



FEBRUARY 16, 1949
1100
1200
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0

Fig. 3

Operating on a wavelength in the one-centimeter region, an experimental radar set was constructed in 1945. It was oriented so that its beam was directed vertically, presentation being given on a Type A-scope where altitude is denoted along a vertical line and signals from clouds are deflections to the right of this line. Since then, this equipment has detected clouds at heights up to 45,000 feet and has measured bases and tops of numerous cloud layers existing simultaneously. Although it is possible to locate clouds through several thousand feet of rain, considerable attenuation takes place in very heavy rainfall, so that tops of storms cannot always be located.

During the period of time the radar pulse is being transmitted upward, and for a very short period thereafter, the radar receiver is inoperative and cannot receive returned signals from the clouds. With the present experimental model, therefore, clouds cannot be detected below a minimum height of about 800 ft. However, any improvements which reduce the pulse time or recovery time of the receiver will reduce the minimum operating ceiling of the equipment.

While A-scope indications give a very good picture of cloud conditions (see Fig. 1), it is impossible for an observer to remember the changes occurring over a period of time. This pointed out the need for some sort of recording device, and, after investigation, it appeared that the facsimile recorder offered promise. Such a device was eventually modified for a slower paper speed (12 inches per hour) and used for that purpose. The trace recorded in this manner gives a plot of the altitude of cloud situations as they pass over a set (see Figs. 2 & 3). With continued improvement being made through research, this cloud indicator may soon be an invaluable aid to meteorologists, and, through them, to pilots.

Air Weather Service has a requirement with the Signal Corps for the development of a cloud base and top indicator which will be satisfactory for operation at weather stations. The foregoing account describes the research now in progress at SCEL and should not be construed to mean such equipment is ready for use in the field. AWS is kept informed of the progress of development, and any procurement must await the final development of a model satisfactory for field use. (Hq, AWS; from a paper by W. Gould, Evans Sig. Lab.)

FIGURE 2.--Sheet from the recording indicator. This shows a thunderstorm of 23 July 1948 which built up to approximately 45,000 feet before very intense rain occurred. Note the very deep hole in the recording, caused by the intense rain, attributable either to attenuation or to water in the antenna dish and waveguide. The vertical white lines resulted from the set not being in tune, a satisfactory automatic-frequency control being nonexistent at that time.

←

FIGURE 3.--Taken more recently, 16 February 1949, this picture presents a very good example of a recording as obtained from two decks of clouds.

• TECHNICAL CONTRIBUTIONS •

As an aid to field forecasters, the following discussion of effective procedures for utilizing weather reconnaissance reports is presented. The procedures described are practical, **rather than merely theoretical, and are being used at the present time by personnel in the Weather Analysis Division, Master Analysis Central, Andrews AFB.**

PUTTING WEATHER RECONNAISSANCE REPORTS TO WORK (U)

Weather reconnaissance, as it is accomplished today, is an expensive and difficult business. Thousands of dollars go into every flight; it takes a crew of from nine to twelve highly-trained men to fly an RB-29 airplane for thousands of miles over the ocean or the Polar Ice Cap. At first thought, the weather information obtained in this manner would seem to be too expensive. Actually, it's a great bargain, for the data thus obtained is unique and invaluable to the meteorologist, and through him to air travelers and the general public. As time passes, more and more forecasters everywhere are becoming aware that they simply can't get along without weather reconnaissance data. They wonder how they ever analyzed a map over the ocean without that data. It is true that not all analysts are yet fully impressed with the great value of weather reconnaissance data, but one will find that the more experienced and successful the analyst, the more reliance he places on their use.

Plotting the reports properly and completely is important, for there is an extraordinary amount of information available with each observation. None of it should be overlooked. The aerial weather observer on a weather reconnaissance flight is in an extremely favorable position to describe the weather conditions over a relatively broad area. Even on a low-level flight (1500 feet above sea level), he can see and usually accurately describe the weather, not only over a point, but over an area of some 8000 square miles. On a high-level flight the observer can see a much greater distance. For example, at 10,000 feet the distance to the horizon is about 130 miles, and the observer can see an area of over 50,000 square miles; at 20,000 feet the area within sight on a clear day is about 100,000 square miles. The greatest possible use should be made of the complete weather reports from such vantage points.

After the reports have been plotted on the synoptic weather chart they should be used to the utmost by the weather analyst and forecaster. In some ways aerial reconnaissance reports are superior to reports from fixed stations, while in other ways they are not as reliable or usable. The analyst and forecaster should be familiar with the advantages as well as the shortcomings of reconnaissance reports in order that he may attach the proper value to them.

ADVANTAGES AND DISADVANTAGES

Among the advantages of weather reconnaissance reports are the wide point of view at each observing point, the completeness of the reports in all items except pressure tendency, and their availability from remote regions where other reports are lacking.

The advantage of wide viewpoint of the observer is taken into consideration in the CAW-C Code and proposed changes in this Code. The plotting model now approved for use with the CAW-C Code allows all items of the reports to be plotted on the synoptic charts. The availability of reconnaissance reports from remote regions makes their plotting and use in all weather stations interested in oceanic analysis a "must."

One extremely useful feature of weather reconnaissance flights is the opportunity they provide to locate frontal surfaces aloft, for in combination with the surface analysis the frontal slope is thereby readily derived. However, the location of frontal positions on horizontal or constant-pressure flights is not always as simple as it might appear, and considerable care must be taken to avoid being misled by temperature changes not caused by passage through fronts. (In a later Bulletin, a sequel to this article will present examples of various types of temperature distribution associated with fronts at upper levels.--Ed.)

Apparent disadvantages are the lack of synchronism of the reports themselves as well as the lack of synchronism with regular synoptic map reports from land or ship stations, their availability for a given track only once a day, the occasional unreliability due to radio transmission difficulties, and the frequent lack of successive reports from a single location.

In the early days of synoptic meteorology, all observations were made at fixed stations on the earth's surface. Such an arrangement is clearly desirable in the interpretation and analysis of the observations, for in a network of fixed stations the time and space variations of the meteorological elements can easily be distinguished from one another. Upper-air sounding instruments, however, whether they are carried by aircraft or balloons, are moving stations, and the difference between two consecutive observations gives neither the space variations nor the time variations of the elements observed, but a combination of both. The problem of separating the space variation (i.e., the gradient) from the time variation (the tendency) is essentially the same as correcting the barometric tendency observed on a ship for the movement of the ship. This separation of time and space variables is becoming of increasing importance as meteorological techniques advance toward higher accuracy and refinement.

COMPARISON WITH "INSTANTANEOUS" RADIOSONDE OBSERVATIONS

In order to better understand the validity of soundings made by aircraft, we must first note how those soundings compare with the standard method for obtaining upper-air data -- the radiosonde.

Vertical Motions

In large-scale quasi-horizontal currents the mean vertical velocity, which is of the order of 0.05 m/sec, is negligible compared to the rate of ascent of the radiosonde balloon (about 5 m/sec). Hence, the variation shown by the instruments attached to an ascending balloon is essentially a space variation.

In local convective currents the vertical velocity of the air may change the rate of ascent of a balloon. The local rate of change of temperature due to vertical motion of the air is given by the well-known formula:

$$\frac{\partial T}{\partial t} = -\omega(\gamma_a - \gamma),$$

where γ is the actual lapse rate and γ_a is the appropriate adiabatic lapse rate. When convection is occurring, γ is usually so close to γ_a that the influence of the vertical velocity of the air is negligible as far as temperatures (in height computations) are concerned. The same is not true of the humidity measurements, however, for the lapse rate of humidity may differ appreciably from its adiabatic value.

Horizontal Currents

Since the wind carries a balloon along with it in the horizontal, the question arises as to whether or not one is justified in considering that the sounding represents, reasonably accurately, the conditions along a vertical line over the point of release. This question is easily answered as far as the pressure is concerned. Since the winds are predominately geostrophic, the horizontal component of the moving balloon will be parallel to the isobars. Hence, the horizontal motion of the balloon in a geostrophic wind field will not appreciably change the pressure recorded at the balloon.

It may also be shown that the temperature variations due to the wind may be neglected for all practical purposes. Referring to Figure 1, V_o represents the wind at the base of a layer of air, and V_1 represents the wind at the top of the layer. The so-called "thermal wind," or shear, represented by ΔV, the vector difference of V_1 and V_o, lies along the mean isotherm of the layer. As the balloon rises through the layer from level 1 to level 2, the wind vector, V_o, will tend to move it from one isotherm to another. However, the isotherms tend to move with the wind, so the temperature variation due to V_o may be neglected for all practical purposes. Since the thermal wind, ΔV, is parallel to the mean isotherm of the layer, it will not affect the temperature recorded by the radiosonde instrument.

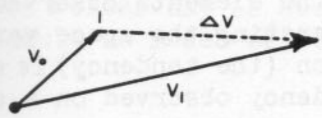


Fig. 1

It thus follows that the temperatures and pressures recorded by a balloon-carried radiosonde are largely unaffected by its horizontal motion, and as a result, such soundings may be treated as though they were made effectively along the vertical. This is strictly true, of course, only when the wind is geostrophic, but since the acceleration effects are usually small, the corrections for them would usually be much smaller than the inherent errors of the radiosonde instruments.

Now that it has been shown that radiosonde observations may be treated as instantaneous vertical soundings, we are ready to consider how meteorological reconnaissance reports can be used in conjunction with regular upper-air and surface observations.

UTILIZING RECONNAISSANCE REPORTS

Vertical Airplane Soundings

When aircraft soundings are made at the times of the regular synoptic upper-air charts, they may be used in the same way as radiosonde data. Although the airplane does not move as freely with the wind as a radiosonde balloon, it normally does drift with the wind to some extent during the ascent or descent, and probably encounters essentially the same column of air that would have been encountered in a vertical ascent, <u>within the limits of accuracy of the instruments used</u>. (The sounding is flown spirally with a radius of about 5 miles.)

When an airplane sounding is not made at the regular time of the synoptic upper-air charts, it is often desirable to correct at least some of the weather elements measured for the time difference. The simplest way to do this is to plot the sounding as received and then move the <u>location</u> of the sounding (or of any significant points in it that are to be used) a distance corresponding to the average wind, making the necessary corrections in the following manner:

Assume that it is desired to use the 700-mb data from a sounding made from 1500 feet to the 500-mb level at point A in Fig. 2. The sounding was made at 2000Z and the point is to be used on the 1500Z 700-mb chart.

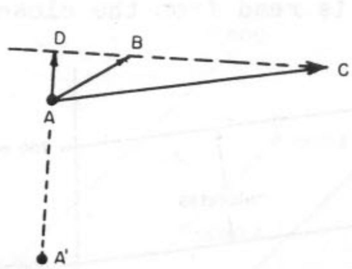


Fig. 2

The vector AB represents the wind at the 1000-mb level as determined by the airplane or from the 1000-mb chart, or the gradient wind may be used. The vector AC represents the wind at the 700-mb level as determined by the airplane or as obtained from the 700-mb synoptic chart. The vector BC then represents the thermal wind in the layer from the 1000-mb level to the 700-mb level. This vector is parallel to the mean isotherm of the 1000-700-mb layer; it represents the thickness of this layer and moves with the speed of the wind component normal to it. This is a very important feature, for it makes possible the determination of the motion of the layer between the 1000-mb and the 700-mb levels.

To determine the motion of this 1000-700-mb layer, construct the vector AD normal to the thermal-wind vector. The length of AD then represents the speed of advection of the isopleths of constant thickness (B-C) of the 1000-700-mb layers. To find where the thickness value reported by the airplane for the 1000-700-mb layer was (or will be) at some time before (or after) the actual time of the sounding, it is only necessary to move point A along AD a distance equal to the rate of motion multiplied by the time difference. Thus, AB may represent a 1000-mb wind (gradient-level wind for all practical purposes) of 40 knots. AD can then be compared to AB, either by eye, by using a pair of dividers, or, if greater accuracy is warranted, by use of a pair of proportional dividers or a slide rule. Assume that AD turns out to be 30 knots. Now, if the sounding were made at 2000Z and it is desired to use the data for the 1500Z 700-mb chart, the point A must be moved 150 nautical miles ($2\frac{1}{2}$ latitude degrees) upstream along AD to A'. A' then represents the point where the thickness value reported at 2000Z for the 1000-700-mb layer was at 1500Z. To get the height of the 700-mb level at 1500Z, it is then only necessary to add the thickness of the 1000-700-mb layer observed by the airplane over point A, to the height of the 1000-mb level at A' at 1500Z.

There are three ways of proceeding from this point.

1. If the 1000-mb chart is regularly drawn, the height of the 700-mb surface at A' at 1500Z may be determined rather accurately: the thickness of the 1000-700-mb layer measured by the airplane at A is simply added to the 1000-mb height at A' as read from the 1000-mb chart for 1500Z (see Fig. 3).

2. If the 1000-mb chart is not drawn but surface isallobars are available, the height of the 700-mb surface at A' may be determined almost as accurately with but a little more effort: the height of the 700-mb level at A is used at A' after correcting it for the difference in surface pressure between A at 2000Z (as measured by the airplane at the start of the ascent) and A' at 1500Z. The pressure at A' is read from the closest surface synoptic chart and corrected for the local barometric tendency to bring it in synchronism with the 1500Z chart. Thus, if the pressure at A' on the 1830Z chart is 1018 mb and the local tendency is minus 2 mb per 3 hours, then the pressure at 1500Z would be $1018 - (3.5 \times -\frac{2}{3})$ or 1020.3 mb. The difference in pressure between A at 2000Z and A' at 1500Z is then 5 mb (to the nearest millibar). Part of this difference is due to the differing thicknesses of the surface-1000-mb layer at A and A' and part of it to the differing contributions above 700 mb. To a first approximation, the difference may all be ascribed to the differing thicknesses of the surface-1000-mb layer. If this is done, the difference in thickness amounts to 5 x 32 or 160 feet (1 millibar is ap-

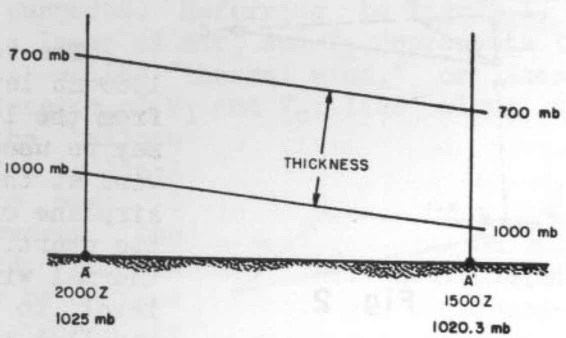


Fig. 3

proximately equal to 32 feet in the lower levels of the atmosphere). Thus the height of the 700-mb surface at A' is equal to the height at A, as reported by the airplane, minus 160 feet.

3. If the 1000-mb synoptic chart is not drawn and no surface isallobars are available, the height of the 700-mb surface at A' may be determined as in Method 2, above, with one change. Instead of using the isallobaric field to determine the pressure at A' for 1500Z, the average pressure at A' from the 1230Z and 1830Z charts is used. This method yields about the same results as obtained in No. 2.

Method 1 is definitely preferable since it involves no assumptions concerning the air column above 700 mb. For most practical purposes, Methods 2 or 3 are acceptable, although in certain rather unusual situations they may be appreciably in error.

The temperature at the 700-mb level over A' can be taken as the temperature over A unless there is a considerable height difference at the two points. If there is over a few hundred feet difference, the temperature can be corrected at the rate of about 1°C per 300 feet for unsaturated conditions and about 1°C per 400 feet for saturated conditions. This method of temperature correction is only approximate but yields results commensurate with the accuracy of the observations.

Constant-Pressure Airplane Flights

Flights at constant pressure present a problem in proper use of the data obtained but offer unparalleled opportunities to detect important meteorological features. The proper use of constant-pressure meteorological-reconnaissance flight data involves correction for lack of synchronism between the individual observations and the synoptic chart on which they are plotted. The correction for non-synchronism is actually easy to make and is well worthwhile. This correction is independent of the aircraft speed and depends almost wholly on the wind field (contour configuration). The isotherm configuration may usually be neglected for all practical purposes. In Figure 4 an observation of height and temperature is taken at point A five hours before the time of the synoptic 500-mb chart on which the report is plotted. To correct for this time difference, either the values of height and temperature at point A may be modified to account for their probable change in the following five hours, or the point may be moved to its location five hours later. The latter correction is much the simpler.

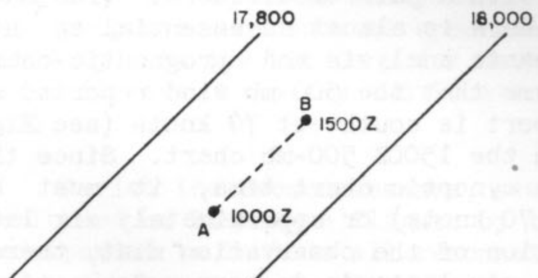


Fig. 4

To accomplish this, point A is moved downstream the distance that the existing geostrophic gradient will move it in five hours (A-B). This presupposes that an approximate contour field is available to indicate the geostrophic wind. If the contour field has not yet been constructed, the reported wind at point A, or the average wind since the preceding point, can be used to move point A.

Point B now represents the location of the parcel of air at synoptic chart time that was sampled by the aircraft at point A five hours earlier. Assuming geostrophic conditions (a reasonable assumption for the short time involved), the pressure (contour height to the first order of approximation) is the same. The temperature and humidity values at B are good approximations of their values at A since the isopleths of both of these elements move with the wind. Even the cloudiness at B usually represents that at A fairly well, at least at the level of the flight, for the clouds, too, move with the wind in most cases.

In summary, it is recommended that the observations from horizontal portions of weather reconnaissance flights be plotted as received. The analyst should then adjust the location of the individual reports to account for the time difference between the reports and the charts on which they are plotted. The location of the reports should be shifted downstream for reports earlier than chart time, and upstream for reports later than chart time. The entire report from point A should then be used as though it were at point B. Contour height, temperature, and humidity will be represented with fair to excellent accuracy. Usually cloudiness will be satisfactorily represented over oceans, although the large time and space variations of cloud systems makes any adjustment of their position only an approximation at best.

The correction for time described above need not be done on the charts regularly used for oceanic analysis. Normally it suffices to note the wind speed and mentally compute the distance that the point should be displaced. This can be computed mentally to the nearest latitude degree and the displacement picked off with a pair of dividers. (The analyst soon finds that his pair of dividers is almost as essential as his pencil and eraser, especially for oceanic analysis and prognostic-chart construction.) As an example, assume that the 500-mb wind reported at 1000Z in a regular reconnaissance report is southwest 70 knots (see Fig. 4). This report would be plotted on the 1500Z 500-mb chart. Since the report was made five hours before the synoptic chart time, it must be moved 350 nautical miles (5 hours at 70 knots) or approximately six latitude degrees (350 ÷ 60). The position of the observation must, therefore, be moved downstream (northeast) six latitude degrees. Corrections of this magnitude are obviously necessary. Actually, any correction over one latitude degree is worth taking into consideration. (Hq, AWS)

● Nothing would be done if a man waited 'til he could do it so well that no one could find fault with it.--Newman.

AWS PLANS & POLICIES...

AWS PLANS INTENSIVE SNOW AND ICE PROGRAM (U)

Weather forecasters in the high latitudes know that the occurrence or lack of heavy snow or ice is of considerable consequence in weather forecasting. The requirement for statistical data and accurate measurements of surface snow and ice conditions, therefore, becomes increasingly important in view of the military interest in the Arctic. Although the 8th Weather Squadron detachments in the North Atlantic have been obtaining certain snow and ice data since 1943, the AWS finds it necessary to expand and intensify its snow and ice reporting program.

Before January 1950, special snow and ice observations will be made part of the weather observers' duties at all AWS stations in Alaska, Canada, and Greenland. Reports of both fresh and salt water ice are to be made at least weekly in accordance with instructions contained in AWS Manual for Coding Ice Reports. Regular surface-snow observations will be taken at least weekly in accordance with instructions contained in the AWS Manual for Coding Snow Reports. Special snow and/or ice reports will be made in support of special projects, including trafficability tests by the Corps of Engineers. Reports will be forwarded by electrical means to operational snow and ice analysis centers in the areas concerned, and records will be compiled and forwarded to Hq, AWS, the Data Control Unit, Navy Hydrographic Office, and other using agencies as desired.

New measuring devices are being procured to permit taking standardized quantitative snow and ice observations. A snow kit similar to that developed by the Canadian National Research Council will soon be available at all arctic AWS stations to accurately and conveniently measure such properties of snow as specific gravity, temperature, depth, compressibility. An ice kit is under development and will become available later for use at the few AWS locations where suitable opportunities prevail.

Aerial ice reconnaissance, similar to that now being commendably performed on Ptarmigan flights by the 375th Reconnaissance Squadron, will be expanded to include all reconnaissance tracks over ocean ice fields. Under the new program, ice photographs, radar-scope pictures, and track charts will be obtained on each reconnaissance flight in northern latitudes.

Snow and ice analysis centers will be established at the strategic weather centrals at Elmendorf AFB, Alaska, and Harmon AFB, Newfoundland. Both centers will have the mission of furnishing these services:

a. Dates of average breakups and freezeups at specific locations in the operational area.

b. Analyses and forecasts of dates of occurrence of types of ice, of thicknesses of ice, based on current and forecast meteorological data as required by the Corps of Engineers and other using agencies.

c. Analyses and forecasts of snow depths and snow characteristics as required in trafficability forecasts by using agencies.

d. Studies of snow and ice conditions as related to and affecting other meteorological phenomena.

Full implementation of this program is not anticipated before 1953, particularly of the analysis and forecasting phases, but it is important that the observing and collection of data begin immediately. Further information will be forthcoming in AWS numbered letters and manuals. (Hq, AWS)

BRIEFING OF INEXPERIENCED PILOTS STRESSED (U)

Station Weather Officers must play a key role in a phase of the USAF Flying Safety Program which aims to see that new pilots now being graduated in increasing numbers from the Flying Division of the USAF Training Command are briefed very thoroughly, particularly for IFR flights. Flying Safety officials are stressing this important and often overlooked point, that a briefing given a pilot with, say, 200 to 500 hours must necessarily be more detailed than one delivered to a pilot having 1000 or 2000 hours flying experience.

Consider thunderstorms. Procedures for flying in thunderstorm areas and the dangers thereof (and this applies equally well to icing, turbulence, or fog) are taught pilots during their flight and correlated ground training. But it is rather easy for an inexperienced pilot to become confused when unexpectedly encountering those conditions in flight. It is urgent, therefore, that each SWO impress on all forecasters under his jurisdiction their responsibility for appropriately briefing a new pilot on any and all weather hazards he will encounter on his proposed route. The difference between flying air mass and frontal thunderstorms; temporary effects of thunderstorms on ceiling and visibility at a given station; difference between reported surface visibility and the lower visibility usually encountered aloft in precipitation; these are but a few of the sort of items which the briefing forecaster often assumes the pilot understands but of which the new pilot must be made cognizant.

With more careful attention to the new pilots' needs, the number of accidents and near-accidents due to weather should be minimized. (Hq, AWS)

● No personal consideration should stand in the way of performing a public duty.--Grant.

SWO'S URGED TO SCAN UR DIGEST (U)

Headquarters, AWS notes that many Station Weather Officers are unaware of the valuable information which may be obtained from the UR Digest, a publication of the Air Materiel Command. The UR Digest is available to all personnel responsible for operation and maintenance of materiel covered in the publication; the section concerning meteorological equipment comes under the heading "Communications Meteorological Equipment."

All Station Weather Officers are encouraged to check with Base Supply for distribution of that publication. If not obtainable there, the UR Digest files at Base AIO may be consulted. Personnel are reminded that the corrective action suggested in the Digest is not directive upon using personnel, but it is desirable that information contained therein be utilized where possible. (Hq, AWS)

CORRECT CARD-PUNCHING ON THE UPSWING (U)

From the beginning of the program for in-station punching of observations in 1946, a continued effort has been made by the Climatological Division and the Data Control Unit of Headquarters, Air Weather Service to increase the accuracy of both the observations and the punching of them on IBM cards. The favorable results of this campaign are a measure of the great emphasis which Station Weather Officers have been placing on its objectives. For during the past quarter, with few exceptions, all participating stations have shown a very pronounced increase in the number of correct observations and in the associated cards forwarded to the Data Control Unit. As an indication of what can be done, and what all stations should strive for, is the record established by Brookley AFB for the month of May 1949: one observing error and no punching errors! For the same month, Tyndall AFB was a close second with only one of each type of error. To make such a fine showing in both observing and punching for any one month is entirely without precedent. Weather personnel at Brookley and Tyndall Air Force Bases are to be heartily congratulated for their commendable accomplishments. (Hq, AWS)

LT. COL. KNIGHT RECEIVES FRENCH HONORS (U)

At a ceremony held during June at the French Embassy in Washington, D. C., Lt. Col. Archie J. Knight, CO, 2104th Air Weather Group, was presented with two orders of the French Croix de Guerre. The presentations were made by Brigadier General Charles Lauzin, Air Attache of the French Embassy, and consisted of the Order of Division for Cooperation afforded French troops and the Order of Fighter Aviation, which cited Colonel Knight's personal direction of a number of missions of destruction against lines of communication and enemy convoys in central Italy during World War II.

AWS ACTIVITIES

NEW NAVIGATIONAL TECHNIQUES PERFECTED BY 375TH (U)

Using all the refinements and innovations in the polar navigational technique discovered by the Navigation Section of his Squadron, 1st Lt. Donald H. Sherr, a navigator assigned to the 375th Reconnaissance Squadron (VLR) Weather, Ladd Air Force Base, Alaska, single-handedly accomplished all the navigational duties on a recent flight to the North Pole. Navigation is one of the critical factors in long-range flights into polar areas, and heretofore two navigators have always been required to accomplish the duties adequately on Ptarmigan missions.

The problems that require a second navigator in polar areas are those of determining direction and maintaining heading. When the 375th Reconnaissance Squadron (VLR) Weather initiated polar weather reconnaissance flights in March 1947, the second navigator's job was a time-consuming procedure involving a great many arithmetical computations and mental interpolations often leading to errors. However, with the perseverance and cooperation of time- and motion-study experts, squadron navigators continually sought methods and procedures which would streamline or eliminate many of the existing techniques employed in high-latitude navigation.

The first great time-saver for the second navigator was the Local Hour Angle Computer received by the Squadron from Air Materiel Command for testing purposes. This instrument relieved him of the drudgery of consulting Almanac tables, Greenwich Hour Angle tables, and Star tables, in addition to eliminating the step of computing the Local Hour Angle arithmetically. He still, however, had to maintain records of the precession rates of the gyro compass which were clumsy to use and difficult to interpret and evaluate either quickly or accurately.

The idea of substituting a graph for the cumbersome gyro logs was suggested by F/Lt Leslie F. Banks, RAF, on TDY with the 375th. By this method the plane's heading and precession of the gyro compasses were illustrated graphically in flight. The plane's heading for any instant or for any given period of time could be determined at a single glance. Observational errors could be averaged out by the use of an average precession line and future headings predicted accurately by extending the line through the desired time period.

The only arithmetical computation now necessary for the second navigator was the determination of grid heading (used in polar areas) from true heading and longitude. This still necessitated the use of scratch paper or a mental computation, liable to error, especially after long hours of flying. Then, acting upon a suggestion by Lt. David W. Anderson, 375th Reconnaissance Squadron, the astro compass, from which the airplane's true heading is obtained, was modified by adding a longitudinal scale to the base just beneath the rotating azimuth ring. With this device, after setting up the astro compass in the normal manner, it was possible to read grid heading directly by referring to the longitude scale.

Using the above methods and procedures, Lt. Sherr performed all the navigational duties on one of the Squadron's weather reconnaissance missions to the North Pole last winter. The flight was successful, and the navigational procedures, as carried out by one man under far from ideal conditions, were accurate and consistent. A measured wind and a dead-reckoning position were obtained every thirty minutes. Lt. Sherr reported that at no time was he pressed for time beyond that normally demanded on long-range reconnaissance missions nor was he unduly fatigued at the end of the flight.

Other crew members of the 375th Reconnaissance Squadron apparently are a bit disturbed over the activities of their navigators. They fear that the efficient star-gazers might devise a method of eliminating their duties. (Info. Bull. No. 5, 308th Recon. Gp.)

MOBILE UNIT SUPPORTS NATIONAL SOARING CONTEST (U)

Pilots from every section of the U. S. were entered in the annual National Soaring Contest held in Elmira, New York, during the first week of July. To provide upper-air data required by Mr. B. L. Wiggin, the Weather Bureau forecaster assigned to the contest, Lt. W. L. Followell and 5 airmen of the 2060th Mobile Weather Squadron journeyed to Elmira and set up shop. Although the mission of the mobile station did not include forecasting duties, AWS personnel voluntarily helped in the preparation of synoptic maps and other charts.

In his briefings to the sailplane pilots, Mr. Wiggin, who has been forecasting for the annual soaring meet for the past ten years, covered these points:

1. Type, location, direction of movement, and intensity of pressure systems and fronts.
2. Location of zones of convergence.
3. Discussion of the general instability of the air mass affecting the flying area, indicating inversions aloft which would limit thermal lifting.
4. Direction and velocity of winds aloft.
5. Areas of ridge winds due to terrain.

After the contest, awards were made to pilots for outstanding endurance and distance flights as well as for acrobatic performance in soaring craft. The pilot giving the best over-all performance was recognized as the National Soaring Champion.

On 8 July the 2d Joint Meeting of the Institute of Aeronautical Science and the Soaring Society of America convened in Elmira. The evening session was devoted to meteorology with presentation of papers, "Prefrontal Waves and Their Significance to Soaring and Transport Aviation" by Walter Georgii, Meteorological Service of Argentina; "Some Effects of Wind on Cumulus Clouds and Thermals" by Joanne Starr Malkus, Woods Hole Oceanographic Institute; and "The Techniques and Possibilities of Mountain Wave Soaring" by Joachim Kuettner, AMC, USAF.

In a letter forwarded to General Yates through the Weather Bureau upon conclusion of the meet, Mr. Wiggin commended Lt. Followell and his unit for their noteworthy contributions to the success of the contest. (Hq, AWS)

AWS IN SPORTS (U)

(Extracted from Field Monthly News Letters)

Two AWS officers finished in the top bracket in MATS Golf Tournament held in Washington, D. C., 18-21 July 1949. Capt. Richard Dineen of the 2108th AW Group, Westover AFB, and Capt. William R. Roath of Hq., AWS finished in 3rd and 6th places, respectively. Both went to Wright-Patterson AFB, Wright Field, Ohio, to participate in the Air Force Tournament.

* * *

In a recent 72-hole medalist golf tourney held at the Nagoya Country Club, Japan, M/Sgt. Erbie H. Krause of the 20th Weather Squadron tied for third place with S/Sgt. Henry Church of the 1951st AACS Squadron. From the ten low scorers, a five-man team was to be formed to represent Nagoya AFB in the Fifth Air Force competition.

* * *

2104th AW Group conducted a Handicap Golf Tournament during two weeks in May at Pine Needles Golf Course near Ft. Valley, Georgia. The Medal Play for 36 holes, computed at 80% from par, was won by Major Robert R. Osborn, who shot a par 144. Colonel Archie J. Knight finished second with 154. Other participants included Lt. Col. Jerome A. Pryber, Major William E. Zimmerman, Capt. Oscar H. True. Capt. Marion L. Farmer, Capt. Carl V. Hull, Jr., Capt. Perry J. Emmert, 1st Lt. Alex F. Daley, 1st Lt. Angelo A. Piccillo, CWO Lee V. Anderson, and CWO Herman A. Kutz.

* * *

After a ten-minute search in vain for a presumably lost ball, T/Sgt. Guy Parker of the 2103d AW Group, while playing a recent round of golf with Lt. Alva Smith, was agreeably shocked to find the ball resting comfortably in the cup -- a hole-in-one on No. 3, 140 yards from the tee. For this feat he was presented with a certificate signed by the eminent golfer, Walter Hagen.

In June, Lt. William Shiver of the AWS Detachment 20-5, Haneda, teamed up with S/Sgt. Paul Cromwell to take the Fifth Air Force tennis doubles crown from Bonner and Simmons of FEAF. Later he teamed with Major Bonner to take the doubles championship in the FEAF meet at Bofu. Shiver, along with Major Bonner, who nosed him out for the singles crown in both meets, departed for the States to participate in the All Air Force tennis tournament at Army-Navy Club, near Washington.

* * *

Capt. Malcolm L. O'Neale of the 15th Weather Squadron represented the Air Force in the Okinawa Tennis Tournament held in June. Placing fourth in the finals, he was delegated to represent Okinawa in the FEAF Tournament held in Tokyo. There he finished in sixth place after a three way play-off for that position. He proceeded to Washington, D. C. to represent FEAF in the Service-wide tournament.

* * *

The "Thinclads" of the 20th Weather Squadron made their presence known recently when they garnered 18 points to tie for third place in the Nagoya AFB track and field meet held in May at the Nagoya stadium. The squadron cindermen placed in all but three events entered -- the mile run, 220-yard dash and the broad jump. First places included the javelin throw and the 440-yard relay. Second places were taken in the 100-yard dash and the pole vault, and third spots were won in the half-mile run and shot put. The team was composed of Capt. Donald F. Moore, Lt. William G. Wells, Lt. Willie T. Johnson, and Sgt. Charles F. Buehring. Those making the first three places had the opportunity of trying for the base team to represent Nagoya AFB at the Fifth Air Force meet scheduled at Tachikawa.

* * *

Early in May the 2143d AW Wing "Cloudbusters" played their opening game of the FEAF Base Softball League. In spite of the stellar no-hit pitching of the Wing's ace, Sgt. Joe Poszwa, the Cloudbusters lost by a score of 2-1 to the FEAF A-2 Nine. Allowing no hits, Poszwa walked only one man and struck out 13 of the first 15 men to face him. Errors accounted for the A-2 Nine winning runs.

* * *

Members of the Weather Bowling Team of the 375th Reconnaissance Squadron, Ladd AFB, Alaska, are interested in knowing if any other AWS team can top a recent showing made by them. During a league game the team toppled the maples to the tune of 842 pins per game with a grand total of 2528.

● **Habit, if not resisted, soon becomes necessity.--St. Augustine.**

FROM THE FIELD NEWS LETTERS (U)

2143D AIR WEATHER WING

AWS Activities Cease in China

All AWS activities in China ceased with the recent withdrawal of the AWS detachment from Shanghai. Admiral Badger, Commander of Naval Forces in China, passed on the message "well done and good luck" to the departing AWS personnel.

514th Receives Honors

The 514th Reconnaissance Squadron received first honors in an Operational Readiness Test, administered by MATS from 27 March to 2 April. Colonel Thomas S. Moorman, CO, 2143d Air Weather Wing, commended the squadron for the outstanding performance.

IMO Conference Held in Manila

Lt. Col. Roy W. Nelson, Jr., Lt. Frank P. Rymer, Jr., and Lt. Jack D. Foard of the Wing represented SCAP at a conference on storm warning procedures held in Manila in June. The conference met as a sub-committee of Region II, International Meteorological Organization.

Dr. Casimiro del Rosario,Director of the Philippine Weather Bureau, organized and convened the conference, and Mr. G. S. P. Heywood of the Royal Observatory, Hong Kong, was elected Chairman. Representatives of the Air Force, United States Navy, and Weather Bureau were present, as well as those from the Philippines, Japan (SCAP), British Royal Navy, Hong Kong, Siam, China, and French Indo-China.

The purpose of the conference was to consider a means of improving existing systems of typhoon warnings and methods of attaining greater uniformity and closer coordination between the typhoon warning services of the different weather agencies.

It was agreed that "Tropical Depression" would be defined as a tropical cyclone with winds up to 34 knots, "Tropical Storm" a cyclone with wind intensities between 35 and 64 knots, and "Typhoon" a tropical cyclone with wind velocities of 65 knots or greater. Use of knots and nautical miles as the units of measurement for velocity and distance was agreed upon as were certain day and night signals for ports and harbors.

Initiate Easterly-Wave Project

A program has been inaugurated to track easterly waves from their inception or point of pick-up through the various regions covered by squadrons of the 2143d Weather Wing. This project is being handled by Captain Harold Garber, 1st Lt. Alvan Bruch, and 1st Lt. Merle E. Wilson. If determined that it is possible to track the major portion of easterly waves, appropriate operational recommendations are to be made to Headquarters, 2143d Weather Wing.

2105TH AIR WEATHER GROUP

2105th Represented at Teletype Conference

Captain Robert W. Wininger, Communication Officer of the 2105th Air Weather Group, attended a European Weather and Teletype Conference held at Stockholm, Sweden, during 20-30 April 1949.

Mobile Unit Serves "Exercise Shower"

The 18th Weather Squadron participated in a recent military maneuver "Exercise Shower," by furnishing a complete mobile weather unit. Personnel from the Stuttgart weather detachment under the supervision of the Detachment Commander, Capt. Charles G. Jackson, operated the unit throughout the exercise with the aid of other weather personnel from the detachments at Furstenfeldbruck and Kaufbeuren. The mobile unit provided "round-the-clock" observing and forecasting service.

2107TH AIR WEATHER GROUP

H. O. Representatives Visit Eielson AFB

Lt. Commander Alton B. Moody, US Navy, on active duty with the US Hydrographic Office, visited the 375th Reconnaissance Squadron during June for the purpose of studying innovations in Arctic navigation developed by the squadron; also Mr. Charles C. Bates of the Hydrographic Office visited the squadron to coordinate ice studies being conducted by his office.

2108TH AIR WEATHER GROUP

Snow in Bermuda!

Lt. James A. Ashcraft and RB-29 crew, on TDY at Eielson AFB, Alaska from the 373d Reconnaissance Squadron, flew the 4000-mile return trip to Bermuda non-stop in 13 hours and 57 minutes. The personnel injected a human interest angle by delivering to Lt. Col. Clyde A. Ray, Squadron CO, a bucket of well-frozen Alaskan snow.

6th Weather Squadron Trains Venezuelans

Under the auspices of the Caribbean Air Command and the Venezuelan government, the 6th Weather Squadron recently completed the training of nine Venezuelan military personnel in a course covering fundamentals of weather forecasting and observing. Six of the students were from the Venezuelan Air Force and three from the Army. T/Sgt. William L. Rishel was in charge of instructions. Upon completion of the training, certificates were awarded by Lt. Col. Hass, both in his capacity as CO of the squadron and as Assistant Latin American Air Missions Coordinator for CAirC, representing Major General Willis H. Hale, CG, CAirC.

Americans and Portuguese Fly Reconnaissance from Lagens

The aerial reconnaissance performed by Detachment No. 10, 8th Weather Squadron, at Lagens, Azores, in conjunction with the airmen of the Portuguese government, is an example of the type of liaison that AWS is maintaining with the weather agencies of many foreign nations.

The Air Force personnel at Lagens, commanded by Major N. A. Hess, work in close relationship and coordination with the Portuguese in making regular weather reconnaissance flights over the middle and northern Atlantic. AWS provides two B-17 aircraft and the Portuguese government one, the AWS making a flight every two days and the Portuguese every fifth day.

2059TH AIR WEATHER WING

Weather Bureau Officials Visit 2059th

During April a representative group of U.S. Weather Bureau officials participated in a familiarization visit to Hqs, 2059th Air Weather Wing and the Base Weather Station, Tinker AFB, Oklahoma. Headed by Mr. H. L. Jacobson, Supervisor of the Bureau's Kansas City Regional Office, the party of weathermen included Mr. M. C. Harrison, Field Inspector of the Fort Worth Region, Mr. W. E. Maughan, Director for Oklahoma, and Mr. G. P. Crawford of the Oklahoma City Office.

Acting as hosts to the visiting officials were Colonel H. L. Smith, Wing CO, and Colonel O. W. Howland, Base Executive Officer. A discussion of various Air Force forecasting techniques was presented by Major R. W. Miller, Tinker AFB Weather Officer. Commenting on the visit, Mr. Jacobson stated that he was "very much impressed by the high state of morale apparent and the efficient, businesslike atmosphere in which station personnel carried on their activities."

Mr. Jacobson extended an invitation to Colonel Smith for an officer of the Wing to attend a forthcoming seminar of forecasters of the Kansas City Region, to present a summary of certain AWS special forecasting procedures and take part in a mutual exchange of ideas and techniques for the benefit of all concerned.

Familiarization visits among weather personnel represent noteworthy steps forward in the growing spirit of cooperation at the field level between the AWS and the U. S. Weather Bureau.

ANDREWS CENTRAL ORGANIZES TRAFFIC SECTION (U)

The recent B-50 round-the-world flight (ref. WSB No. 7, p. 47) greatly aided the AWS by bringing into focus existing weather communications problems and emphasizing the difficulties plaguing forecasters who require weather reports from the entire Northern Hemisphere.

Mainly as a result of the problems thus encountered, the Chief, Air Weather Analysis Division (Andrews AFB), organized a Weather Traffic Section. One of the principal functions of this section is to make surveys on incoming meteorological data, showing what scheduled data are being received and taking action to obtain those which are missing. Often the data can be obtained in time to be of use to the forecasters preparing analyses of the entire Northern Hemisphere; when they are received very late, however, they can be used only for climatological and historical purposes.

At present a general survey is being conducted which consists of a check of all surface-synoptic and upper-air bulletins. During one three-week period the check showed that the over-all reception of both upper-air and surface data from the Northern Hemisphere increased from 45% to 60% at Andrews Air Force Base. While still too low, the fact that the percentages are on the increase is encouraging.

Also in progress is a survey for checking in detail the receipt of 0300Z and 1500Z data from each raob station in the Northern Hemisphere. Results of this check show up those stations not reporting as frequently as they should, and action can then be taken through proper channels to correct any difficulties encountered. One report for a two-week period indicated that 59% of all the scheduled reports were received. Taking into consideration that very little data were received from occupied countries, this is a fair percentage, but improvement is, of course, desired. Work continues toward that end.

Special surveys, consisting of detailed logging in of all bulletins from an area and the number of reports in each bulletin, are set up from time to time on collections from areas where data are especially scanty. If a collection is not received by a specified time, a tracer message is sent to the originator asking for a rerun, if available, or an explanation as to why it is not available. This procedure has proven rather effective for obtaining information from areas where data are so scarce that every report is necessary.

A continuous check is maintained on the number of reports received from all reconnaissance flights originating at USAF bases in the Atlantic and Pacific areas. Comparison with the known number of reports actually sent reveals any existing communication difficulties.

Certain relatively small matters cause some trouble. The transmission of weather bulletins containing more than one type of weather data, and for more than one observation time, requires considerable additional effort in separating and plotting the data. Occasional radio blackouts and line or equipment trouble add up to keep the percentage of incoming data rather low.

Receipt of scheduled data into the Central at Andrews Air Force Base has varied between a low of 45% and a high of 64% during the periods when surveys were made. It is hoped that continued probing through these surveys will result in improvement -- not the spasmodic or temporary increases of the past, but permanent, even though gradual, improvement. (Major Dawson, Chief, Weather Traffic Section, WAD)

KNOW YOUR COMMANDERS (U)

During the past six months, numerous changes have taken place in the command roster of groups and squadrons. Some of the new commanders are sketched below; other brief biographies will follow in subsequent issues of the WSB.

* * *

Lt. Col. Robert G. David, now commanding the 512th Recon. Sq. at Fairfield-Suisun AFB, is a Floridian by birth. He attended Georgia Military College and the Citadel, where he graduated with a B. S. in Civil Engineering. Col. David was manager of an airport and flying instructor in South Carolina prior to deciding that the Air Corps was the place for him in 1940. After finishing his pilot training, he continued flying at Randolph Field as a 2d Lt. instructor pilot;from there he went to Stockton, Hemet, and Victorville (Calif.), at the latter field as a Squadron CO. Before going overseas in 1943, Col. David was stationed at La Junta (Colo.) and Hobbs (N. Mex.) and finally with the 447th Bomb Group at Harvard (Neb.). He was Group Operations Officer with the 447th in England and later became Squadron CO of the 709th Bomb Sq. Returning in 1945, Col. David attended the Command and General Staff School at Ft. Leavenworth and upon graduation remained there as an instructor until August 1946 when he became Deputy CO of the 1st Air Weather Group and later of the 308th Reconnaissance Group at Morrison Field (Fla.). From there he was transferred to Kindley Field (Bermuda) in June 1947 as CO of the 53d Recon. Sq. (now the 373d Recon. Sq.). He served for 6 months as CO of the 1st Weather Recon. Sq. and another 6 months as CO after it became the 2078th. In May 1949 he became CO of the 512th Recon. Sq. at Fairfield-Suisun AFB. He is a Major in the regular Air Force.

* * *

Major Roger T. Derr, present CO of the 11th Weather Sq. at Ft. Richardson, Alaska, began his army career as a machine gunner in 1933 after enlisting in the infantry at Salt Lake City, Utah, his birthplace. He was transferred to the Signal Corps in 1934 and served as a weather observer and Station Chief prior to attending the forecasters' school at Chanute Field in 1941. Major Derr went to OCS in 1943 and graduated in February 1944 as a 2d Lt. He served as a weather officer at Hill Field (Utah), Santa Monica (Calif.), Gowen Field (Idaho), and March Field (Calif.) prior to embarking for overseas in 1946 and assuming the duties of SWO at various stations in the 6th Weather Squadron. He was separated from the service in December of that year,returning as SWO at Kelly Field (Tex.) in April 1947. Major Derr attended the Air Tactical School, and in 1948 was transferred to the 7th Weather Group in Alaska. Two months later he joined the 11th Weather Sq., became S-3 officer, and in June 1949 was appointed its CO. Major Derr was promoted to Major in the regular Air Force in July 1948.

* * *

Born in Dallas, Texas, Lt. Col. John A. Hass attended Dallas High School and the College of Commerce in Kansas City. His first hitch in the Army in 1936 found him working as a weather observer and, prior to his discharge in 1939, as a forecaster. He accepted a position as meteorologist for TWA in Kansas City in 1939 and in July 1942 after being commissioned as a 2d Lt. in the Air Corps was sent to Biggs Field (Tex.) as SWO. By November he was on his way to India to serve with the 10th Weather Sq. as SWO at Chakulia, Kurmitola, and Bangalore for 1½ years. During the last half of 1944 he became Staff Weather Officer to the 10th Air Force and by August 1945 had accumulated enough time overseas to head back to the ZI and home. Col. Hass was released from active duty in February 1946 and recalled in November of that year as Executive Officer of 103d Weather Group (Kelly Field) and in early 1947 as Regional Control Officer of the 104th Weather Group (Robins Field). A year later he attended Air Tactical School, subsequently being assigned as Deputy Chief of Staff and later Chief of Staff for 59th Weather Wing before going overseas as CO, 6th Weather Sq., Albrook AFB, C.Z. in April 1949. Col. Hass holds a Captain's commission in the regular Air Force.

* * *

Lt. Col. Oliver K. Jones is an Arizonian by birth, but attended high school in Mercedes, Texas, and graduated from the University of Texas at Austin with a B. S. in engineering. In 1940 he went to C. I. T. as a meteorology cadet, graduating with a 2d Lt.'s commission in July 1941. He served as SWO at Brooks and later Ellington Field (Tex.) prior to being assigned Group Weather Officer to the 78th Fighter Group at Hamilton Field (Calif.). That unit went to England as part of the 8th AF, where Col. Jones became a Wing Weather Officer, then Staff Weather Officer to the 8th Fighter Command, and an AF Weather Officer assigned to Hq., 8th Air Force. He left England in June 1945 for the States, taking assignment as Staff Weather Officer to Hq., 2d Air Force in Colorado. Since March 1946 Col. Jones was at Maxwell Field as instructor in weather in the Logistics Division of the Air Command and Staff School and the AWS liaison officer to the school. In January 1949 he transferred to the 2143d Air Weather Wing in Tokyo, acting briefly as Secretary of the Joint Meteorological Committee, GHQ, FEC. In April 1949 he assumed the duties of CO, 20th Weather Sq. in Japan.

* * *

Major Thomas J. Kelley, since June CO of the new 1st Weather Squadron, Wright-Patterson AFB, was born in Massachusetts and attended Gloucester (N.J.) High School and the University of Alabama. Enlisting in the army in 1932, he attended the weather schools at Ft. Monmouth (N. J.) and later at Patterson Field, rising to the rank of M/Sgt. In March 1942 he was commissioned a 1st Lt. and sent to Moody Field (Ga.) as a weather officer. In August 1942 he departed for overseas and was "fortunate" enough to spend Christmas on Christmas Island with a detachment of the old 7th Weather Squadron. Shortly after the first of the year he went to Hawaii, becoming OIC of the Weather Central in Oahu, later SWO, and in April 1944 Assistant RCO of the 7th Region. He attended the

Forecasters' Refresher Course at Chanute Field in 1944, finally returning to the U. S. in October 1945. From then until March 1949 Major Kelley was SWO at Olmsted AFB (Pa.). He served briefly as temporary CO of the 12th Weather Sq. before becoming CO of the 1st Weather Sq. Major Kelley holds a warrant as WOJG in the regular Air Force.

* * *

Lt. Col. Morrill E. Marston, a West Point graduate of 1940, was born in Iowa and attended school in Minnesota and Kansas. He entered pilot training shortly after graduation from the Point and then attended the University of Chicago meteorology course, finishing in March 1942. Col. Marston was immediately assigned as Staff Weather Officer, 4th Fighter Command and later to the 4th Air Force (San Francisco) and the 85th Fighter Wing in the Philippines. In February 1945 he was made Group Deputy CO (Prov.), 15th Weather Sq., subsequently being assigned as CO, 20th Weather Sq. at Manila, P. I. Returning to the States in February 1946, Col. Marston became CO of the 104th Weather Group, Robins Field (Ga.). A year later he returned to the Far East as Staff Weather Officer of the Air Div., AAG, to the Chinese Air Force in Nanking. He arrived back in the U. S. in December 1948 and after attending school assumed command of the 2108th Air Weather Group, Westover AFB, in June 1949.

CADETS SEE AWS DISPLAY AT MACDILL AFB (U)

The Military Air Transport Service participated in the USAF 1949 Summer Indoctrination Tour for the USMA Cadets at MacDill AFB, Florida in June 1949 and again on 28 July 1949. Major General Harold M. McClelland, MATS, Brigadier General Donald N. Yates, AWS, and representatives from Air Sea Rescue, AACS, and Flight Service addressed the group of cadets at the first session and presented the mission and functions of MATS. Col. Lewis L. Mundell, Chief of Staff, AWS, represented AWS at the second session.

For the AWS, the 2104th Air Weather Group demonstrated activities of the Base Weather Station, the 2060th Mobile Weather Squadron displayed and operated mobile weather equipment, and the 308th Reconnaissance Group demonstrated weather reconnaissance techniques.

- The first issue of "Tropic Topics," a new monthly publication of the 31st Weather Squadron at Hickam AFB, T. H., rolled from the press at Hickam on 1 July 1949, adding one more to the number of squadron publications begun during the past year.

On The Lighter Side

THE POOR WEATHERMAN (U)

In going through volumes of war-time publications by the various weather squadrons, the following little ditty by an unknown author was noted. (It is readily apparent that the first three lines of the last paragraph have not been valid since VJ-day.--Ed.)

* * *

The bards through the ages have filled many pages
Extolling the infantry's glory;
They loved to enlarge the cavalry's charge
And make it the theme of their story.

The boys in the tanks are beginning to rank,
And the caissons keep rolling along,
While the pilot and the plane will always attain
Full credit and glory in song.

The news hounds adore the parachute corps;
The medics come in for their praise.
But there's always a crew, a forgotten few,
On which Glory's light doesn't blaze.

They spend their full hours in forecasting showers
And judging the height of clouds;
But their anticipation of precipitation
Elicits no cheers from the crowds.

The problems climatic are not as romantic
As shooting down Japs from the blue;
But you can bet your last dollar the fliers would holler
If the weathermen failed to come through.

When the bomber command has a mission all planned
And are set to raise hell with the Japs,
There's a question of whether all's well with the weather
Enroute to that spot on the map.

That's the weatherman's call to get on the ball
And get all the dope for the flight.
He can't ask for breaks, or allow for mistakes--
No guessing -- he's got to be right.

When there are no planes to clear he'll sit on his rear,
He's lazy, that point's conceded;
He'll loaf on the job; he'll "jawbone an Ob,"
And he ain't worth a damn -- TILL HE'S NEEDED!

AIR WEATHER SERVICE STATISTICS

RAWINSONDE PERFORMANCE, APRIL—JUNE 1949 (U)

Air Weather Service rawinsonde performance during the three-month period, April through June 1949, is shown in the accompanying tables and graphs. As in past issues of the Bulletin, performance ratings have been made on an over-all basis according to the system explained in WSB No.5, item 137.

Most over-all figures show improvement from April to June. A comparison of the figures for June 1949 with those of June 1948 also indicates that radiosonde performance has improved during the past year in all phases of operation covered by the figures. The Average Highest Run figures have jumped by more than 18,000 feet, mainly due to the increased use of the balloon ML-391/AM. Average heights of all runs have increased by better than 3,000 feet. These figures exemplify a consistent and universal trend toward increased heights. Runs to better than 100,000 feet are now commonplace; runs over 120,000 feet are not unusual. In June of 1948, for example, only one station, Maxwell, reported a maximum height greater than 100,000 feet. In June of 1949, 18 stations exceeded 100,000 feet, while 8 stations bettered 120,000 feet.

The best over-all radiosonde performance is that of Wiesbaden. Under a scoring system assigning 10 points for each first place ranking, 9 points for each second, 8 points for each third, etc., Wiesbaden is credited with 26 points for the three-month period. Wiesbaden also ranked first over the five-month period covered in the last issue of the Bulletin. All Wings and Independent Groups are represented in the five leading radiosonde stations. Chanute, with 21 points, is the leading rawin performer.

The striving for higher runs must be tempered somewhat by the fact that the balloons ML-391/AM have an apparent ceiling in the 130,000- to 140,000-foot range. The ML-391/AM balloon may possibly exceed this ceiling, but such runs must be very carefully inspected prior to acceptance. Balloon burst at these heights is extremely difficult to ascertain without very close inspection of the recorder record. The runs to the maximum possible height are desired, but data obtained from a questionable high run will not add to the knowledge of that region of the atmosphere.

The height evaluations above 10 mb are not accomplished in the same manner as for the preceding portion of the ascent. The present adiabatic chart, WBAN-31B, terminates at 10 mb, and if the points above 10 mb are plotted, the chart must be extended by the operators. This procedure is of doubtful accuracy since the chart is based on a logarithmic pressure scale, and accurate extrapolations cannot be made by station personnel.

It is contemplated that an AWS policy to eliminate all height evaluations above 10 mb will be established in the very near future and continued until such time as the new adiabatic chart, WBAN-31C (pressure limit 2 mb), new computation tables, and an improved radiosonde instrument become available.

The transmitter AN/AMT-4, for use with the AN/GMD-1, has an improved baroswitch which will greatly increase the accuracy of height evaluations above 100,000 feet. (Hq, AWS)

AIR WEATHER SERVICE OVER-ALL FIGURES*

RADIOSONDE	APR 49	MAY 49	JUN 49	JUN 48
Average Highest Run (ft.)	79,601	80,706	87,885	69,231
Average Height of All Runs (ft.)	42,265	44,916	46,929	43,916
Percent of Scheduled Runs Completed	79%	81%	84%	82%
Stations Average Height >40,000 Ft.	37	39	45	37
Stations Average Height >50,000 Ft.	3	9	9	5
Stations Highest Run >70,000 Ft.	30	17	33	16
Stations Highest Run >100,000 Ft.	10	11	18	1
Stations Completing All Scheduled Runs	5	6	11	6
RAWIN				
Average Height of All Runs (ft.)	36,859	38,250	38,748	43,976
Percent of Scheduled Runs Completed	87%	84%	90%	84%
Stations Average Height >50,000 Ft.	2	4	5	8
Stations Average Height >40,000 Ft.	17	25	30	30
Stations Completing All Scheduled Runs	5	9	11	6

*Number of stations reporting monthly was either 50 or 51.

OUTSTANDING PERFORMANCES FOR PERIOD, APRIL-JUNE 1949

(Based on assignment of 10 points for each first place, 9 points for each second place, 8 for third, etc.)

RADIOSONDE

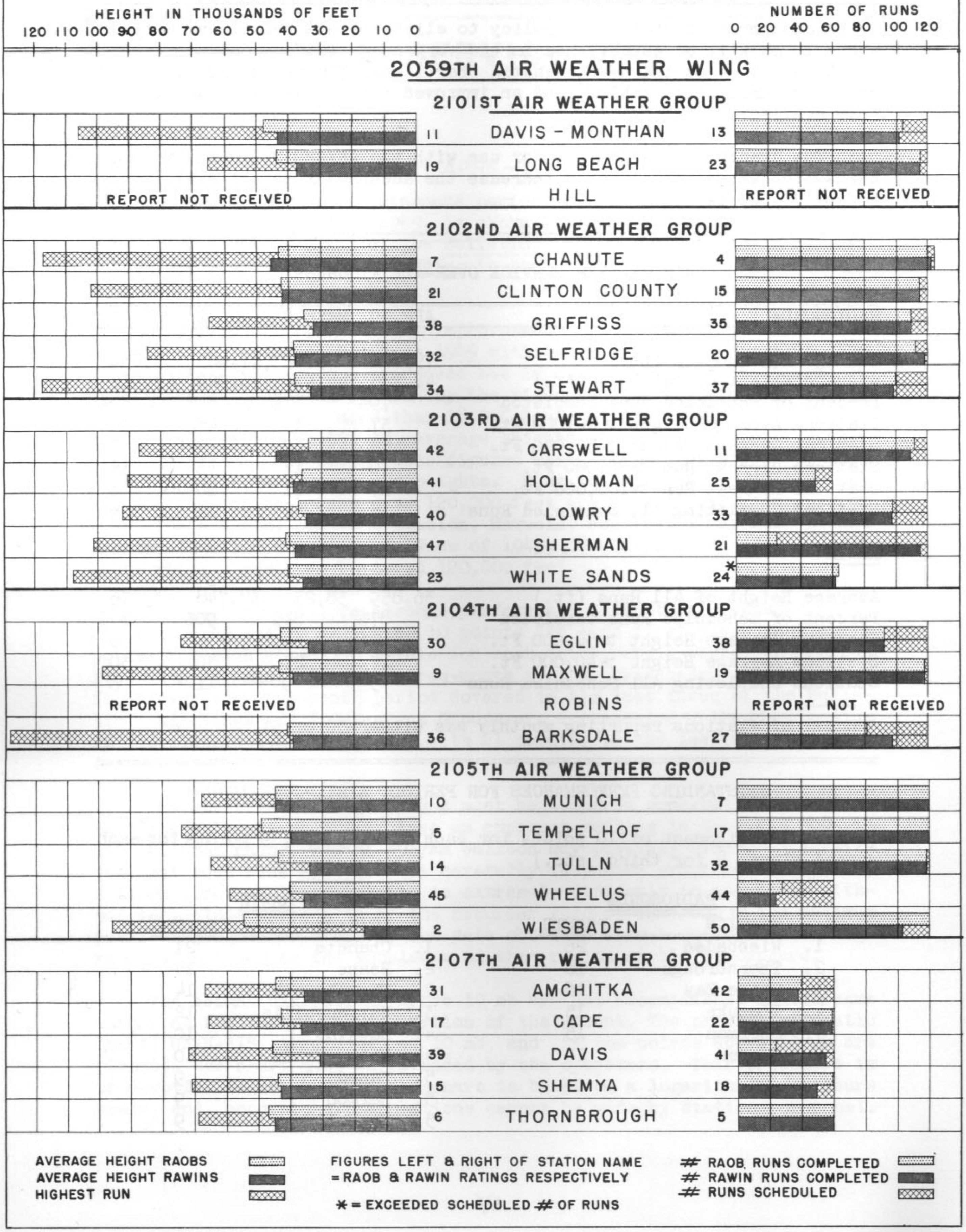
	STATION	POINTS
1.	Wiesbaden	26
2.	Thornbrough	18
3.	Goose Bay	16
4.	Itazuke	15
4.	Sherman	15
5.	Mingan	10

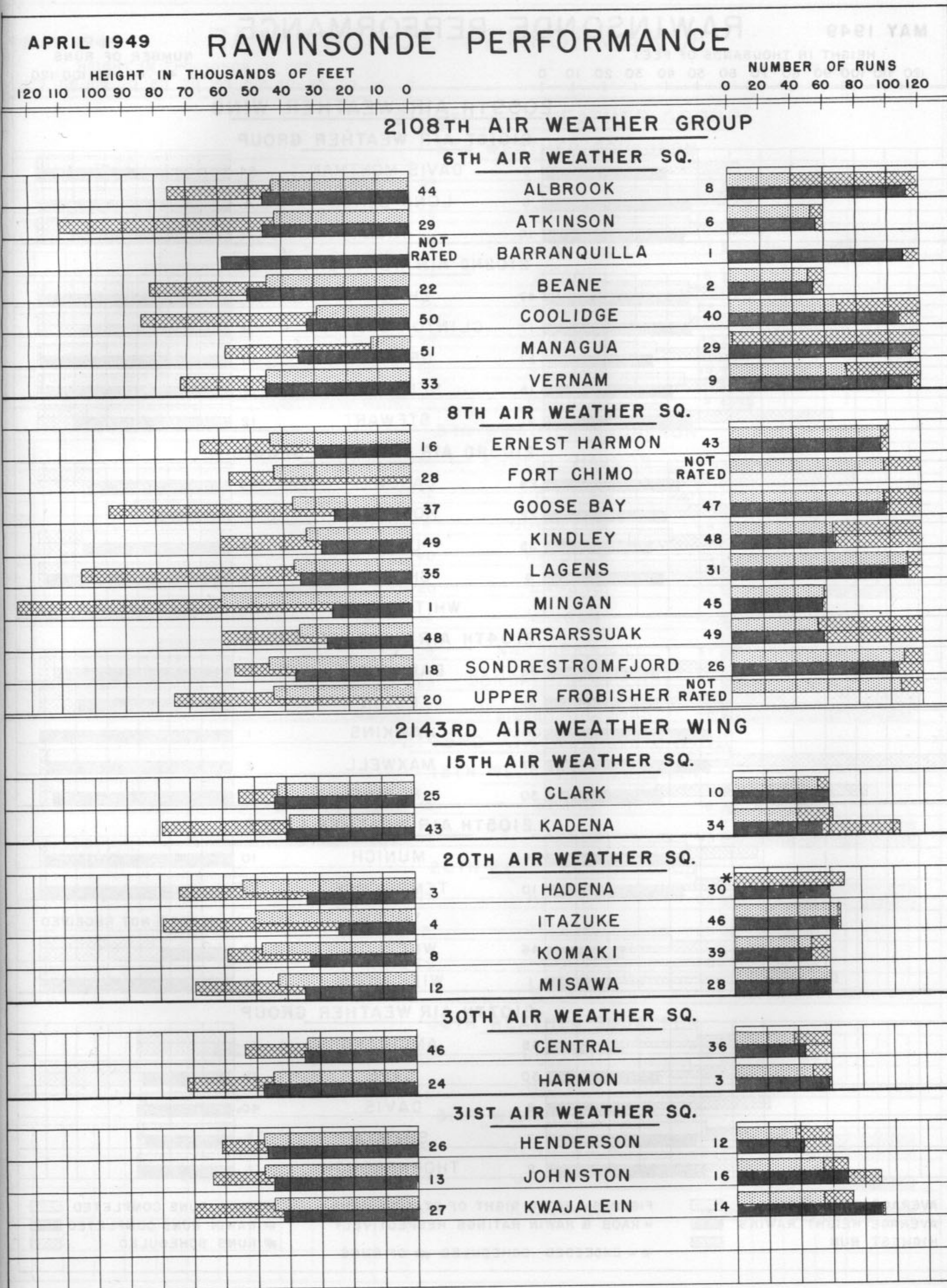
RAWIN

	STATION	POINTS
1.	Chanute	21
2.	Beane	14
2.	Thornbrough	14
3.	Barranquilla	12
4.	Hawkins	10
4.	White Sands	10
5.	Haneda	9
5.	Harmon	9
5.	Maxwell	9

APRIL 1949

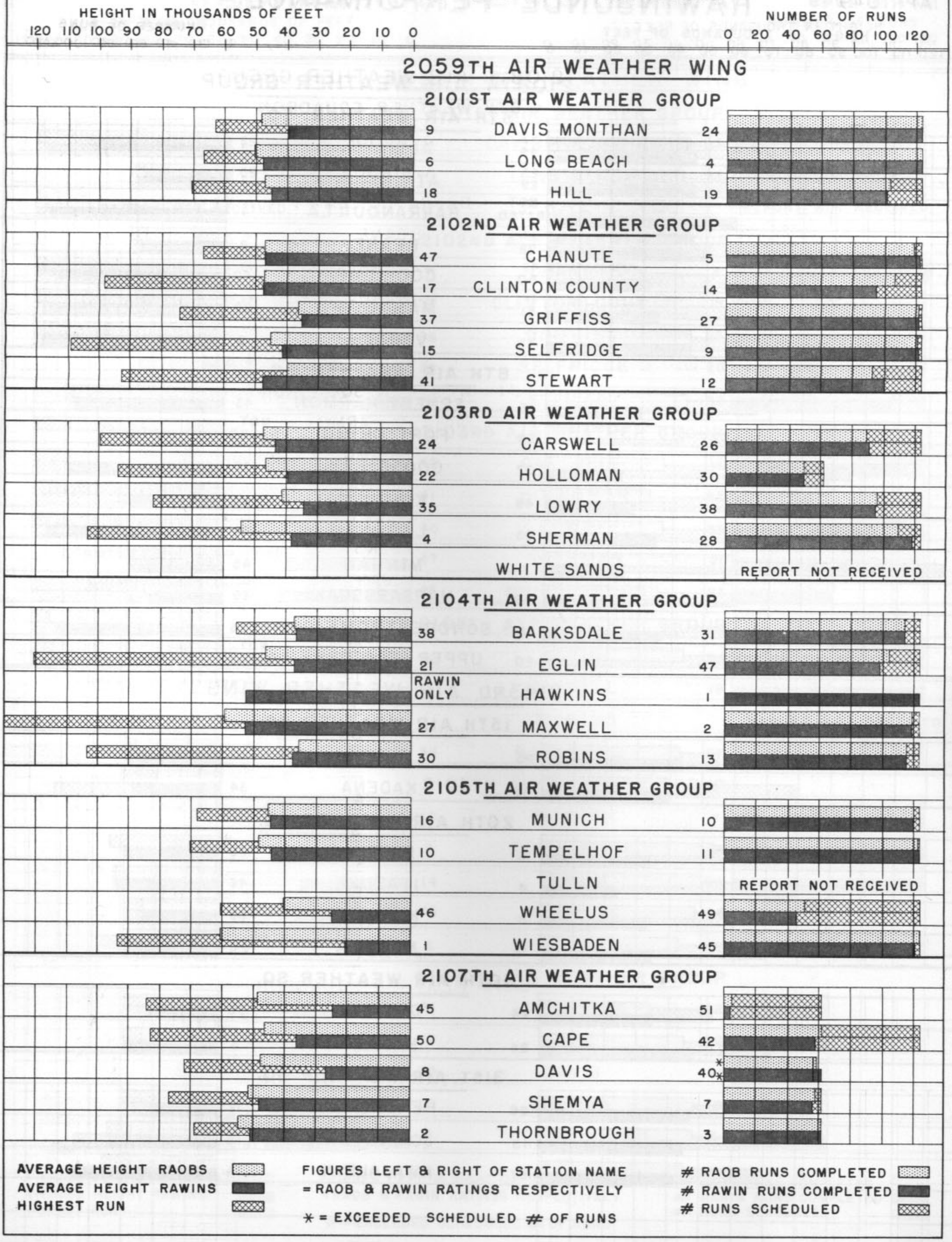
RAWINSONDE PERFORMANCE



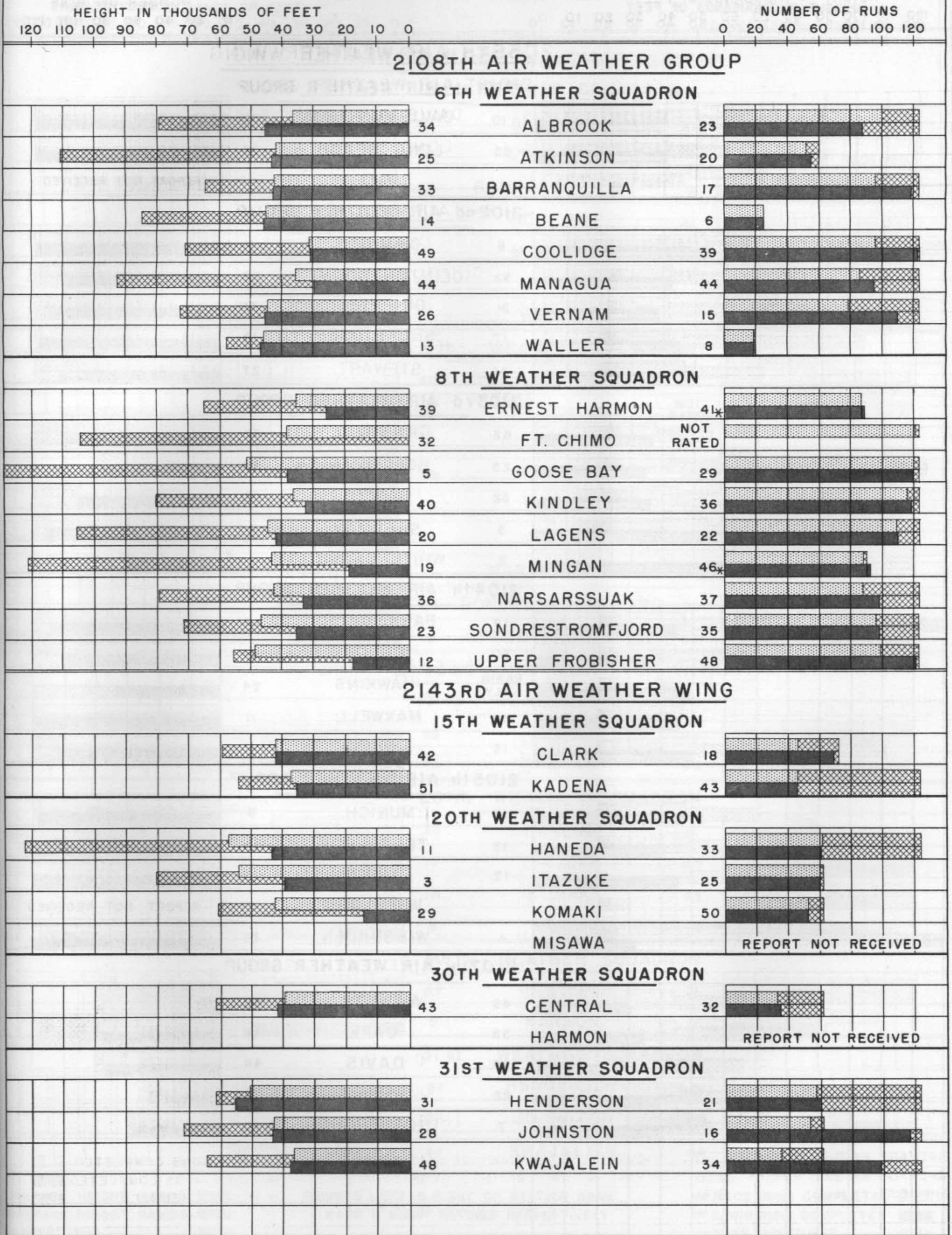


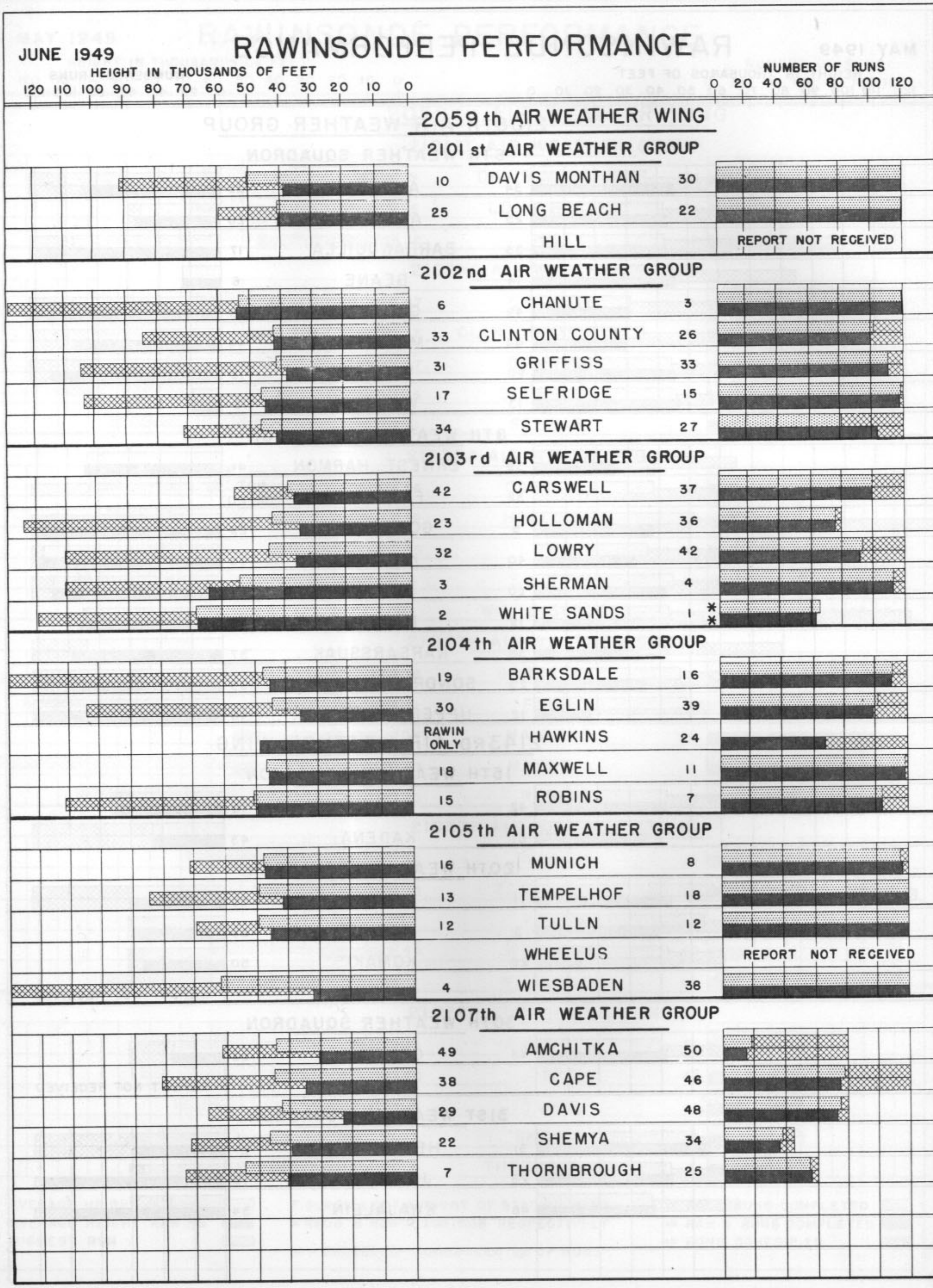
APRIL 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
2108TH AIR WEATHER GROUP
6TH AIR WEATHER SQ.
44 ALBROOK 8
29 ATKINSON 6
NOT RATED BARRANQUILLA 1
22 BEANE 2
50 COOLIDGE 40
51 MANAGUA 29
33 VERNAM 9
8TH AIR WEATHER SQ.
16 ERNEST HARMON 43
28 FORT CHIMO NOT RATED
37 GOOSE BAY 47
49 KINDLEY 48
35 LAGENS 31
1 MINGAN 45
48 NARSARSSUAK 49
18 SONDRESTROMFJORD 26
20 UPPER FROBISHER NOT RATED
2143RD AIR WEATHER WING
15TH AIR WEATHER SQ.
25 CLARK 10
43 KADENA 34
20TH AIR WEATHER SQ.
3 HADENA *30
4 ITAZUKE 46
8 KOMAKI 39
12 MISAWA 28
30TH AIR WEATHER SQ.
46 CENTRAL 36
24 HARMON 3
31ST AIR WEATHER SQ.
26 HENDERSON 12
13 JOHNSTON 16
27 KWAJALEIN 14

MAY 1949 RAWINSONDE PERFORMANCE



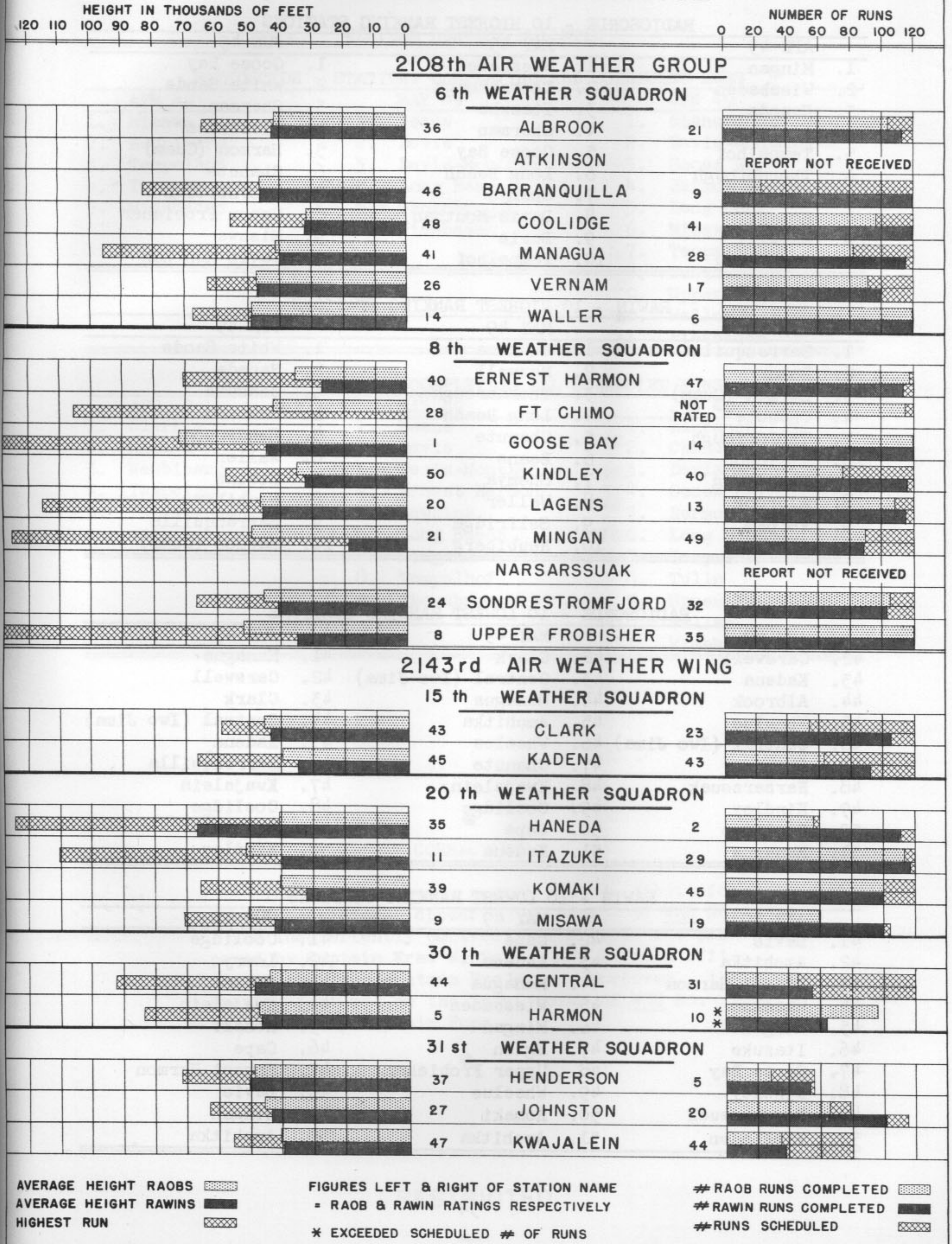
MAY 1949 RAWINSONDE PERFORMANCE




JUNE 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
2059 th AIR WEATHER WING
2101 st AIR WEATHER GROUP
10 DAVIS MONTHAN 30
25 LONG BEACH 22
HILL
REPORT NOT RECEIVED
2102 nd AIR WEATHER GROUP
6 CHANUTE 3
33 CLINTON COUNTY 26
31 GRIFFISS 33
17 SELFRIDGE 15
34 STEWART 27
2103 rd AIR WEATHER GROUP
42 CARSWELL 37
23 HOLLOMAN 36
32 LOWRY 42
3 SHERMAN 4
2 WHITE SANDS 1 *
*
2104 th AIR WEATHER GROUP
19 BARKSDALE 16
30 EGLIN 39
RAWIN ONLY
HAWKINS 24
18 MAXWELL 11
15 ROBINS 7
2105 th AIR WEATHER GROUP
16 MUNICH 8
13 TEMPELHOF 18
12 TULLN 12
WHEELUS
REPORT NOT RECEIVED
4 WIESBADEN 38
2107th AIR WEATHER GROUP
49 AMCHITKA 50
38 CAPE 46
29 DAVIS 48
22 SHEMYA 34
7 THORNBROUGH 25

JUNE 1949

RAWINSONDE PERFORMANCE



RADIOSONDE - 10 HIGHEST RANKING STATIONS

APR 49	MAY 49	JUN 49
1. Mingan	1. Wiesbaden	1. Goose Bay
2. Wiesbaden	2. Thornbrough	2. White Sands
3. Haneda	3. Itazuke	3. Sherman
4. Itazuke	4. Sherman	4. Wiesbaden
5. Tempelhof	5. Goose Bay	5. Harmon (Guam)
6. Thornbrough	6. Long Beach	6. Chanute
7. Chanute	7. Shemya	7. Thornbrough
8. Komaki	8. Davis-Monthan	8. Upper Frobisher
9. Maxwell	9. Davis	9. Misawa
10. Neubiberg	10. Tempelhof	10. Davis-Monthan

RAWIN - 10 HIGHEST RANKING STATIONS

APR 49	MAY 49	JUN 49
1. Barranquilla	1. Hawkins	1. White Sands
2. Beane	2. Maxwell	2. Haneda
3. Harmon (Guam)	3. Thornbrough	3. Chanute
4. Chanute	4. Long Beach	4. Sherman
5. Thornbrough	5. Chanute	5. Henderson
6. Atkinson	6. Beane	6. Waller
7. Neubiberg	7. Shemya	7. Robins
8. Albrook	8. Waller	8. Neubiberg
9. Vernam	9. Selfridge	9. Barranquilla
10. Clark	10. Neubiberg	10. Harmon (Guam)

RADIOSONDE - 10 LOWEST RANKING STATIONS

APR 49	MAY 49	JUN 49
42. Carswell	42. Clark	41. Managua
43. Kadena	43. Central (Iwo Jima)	42. Carswell
44. Albrook	44. Managua	43. Clark
45. Wheelus	45. Amchitka	44. Central (Iwo Jima)
46. Central (Iwo Jima)	46. Wheelus	45. Kadena
47. Sherman	47. Chanute	46. Barranquilla
48. Narsarssuak	48. Kwajalein	47. Kwajalein
49. Kindley	49. Coolidge	48. Coolidge
50. Coolidge	50. Cape	49. Amchitka
51. Managua	51. Kadena	50. Kindley

RAWIN - 10 LOWEST RANKING STATIONS

APR 49	MAY 49	JUN 49
41. Davis	42. Cape	41. Coolidge
42. Amchitka	43. Kadena	42. Lowry
43. Ernest Harmon	44. Managua	43. Kadena
44. Wheelus	45. Wiesbaden	44. Kwajalein
45. Mingan	46. Mingan	45. Komaki
46. Itazuke	47. Eglin	46. Cape
47. Goose Bay	48. Upper Frobisher	47. Ernest Harmon
48. Kindley	49. Wheelus	48. Davis
49. Narsarssuak	50. Komaki	49. Mingan
50. Wiesbaden	51. Amchitka	50. Amchitka

RADIOSONDE - STATIONS COMPLETING ALL SCHEDULED RUNS

APR 49	MAY 49	JUN 49
1. Misawa	1. Beane	1. Chanute
2. Neubiberg	2. Davis	2. Davis-Monthan
3. Tempelhof	3. Davis-Monthan	3. Goose Bay
4. Thornbrough	4. Long Beach	4. Harmon (Guam)
5. Wiesbaden	5. Thornbrough	5. Long Beach
	6. Wiesbaden	6. Misawa
		7. Tempelhof
		8. Tulln
		9. Upper Frobisher
		10. Waller
		11. Wiesbaden

RAWIN - STATIONS COMPLETING ALL SCHEDULED RUNS

APR 49	MAY 49	JUN 49
1. Clark	1. Beane	1. Barranquilla
2. Misawa	2. Davis	2. Chanute
3. Neubiberg	3. Davis-Monthan	3. Davis-Monthan
4. Tempelhof	4. Ernest Harmon	4. Goose Bay
5. Thornbrough	5. Hawkins	5. Harmon (Guam)
	6. Long Beach	6. Long Beach
	7. Mingan	7. Tempelhof
	8. Tempelhof	8. Tulln
	9. Thornbrough	9. Upper Frobisher
		10. Waller
		11. Wiesbaden

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CORRECTION

The editors deeply regret that the credit for "The Thunderstorm" appearing on page 4 of WSB No. 7 was inadvertently omitted. The article was prepared by Captain Fred W. Pope, AWS Liaison Officer to the Thunderstorm Project. Moreover, the drawing featured on the front cover of WSB No. 7 was loaned by Captain Pope.

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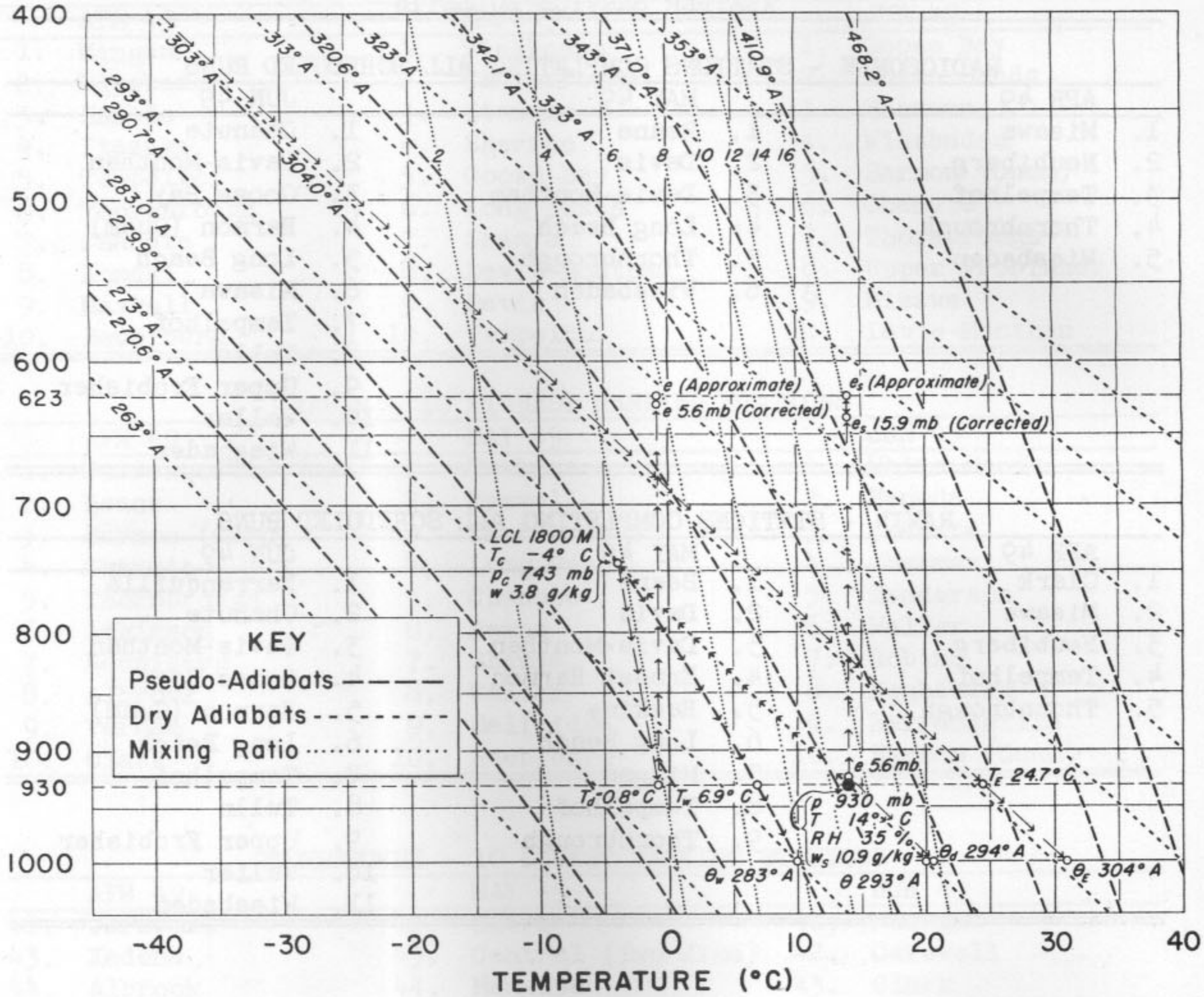
EVALUATIONS ON THE PSEUDO-ADIABATIC DIAGRAM



SYMBOLS

- p — Pressure
- T — Temperature
- RH — Relative Humidity
- w_s — Saturation Mixing Ratio
- w — Mixing Ratio
- p_c — Condensation Pressure
- T_c — Condensation Temperature
- LCL — Lifting Condensation Level
- T_d — Dew-point Temperature
- T_w — Wet-bulb Temperature
- θ_w — Wet-bulb Potential Temperature
- θ — Potential Temperature
- θ_E — Equivalent Potential Temperature
- T_E — Equivalent Temperature
- e_s — Saturation Vapor Pressure
- e — Vapor Pressure
- θ_d — Partial Potential Temperature of Dry Air

DIRECTIONS

Given p T and RH

Read w_s at (p T)

Compute w from (RH x w_s)

For p_c and T_c up dry adiabat from (p T) to w

Compute LCL from $(T-T_c)$ x 100 meters

For T_d down w from LCL to p

For T_w down pseudo-adiabat from LCL to p

For θ_w down pseudo-adiabat from T_w to 1000 mb

For θ down dry adiabat from (T·p) to 1000 mb

Read θ_E near top of pseudo-adiabat through LCL

For T_E down dry adiabat whose $\theta = \theta_E$ to p

For approximate e_s up isotherm T to 623 mb and read $e_s = w_s$ at (T 623 mb): correct by moving down isotherm T to $(623 + e_s)$ mb and read e_s = new w_s

For e same method using isotherm T_d

For θ_d up isotherm T from p to (p-e) then down dry adiabat to 1000 mb

Prepared by US Weather Bureau

HEADQUARTERS
AIR WEATHER SERVICE
Andrews Air Force Base
Washington 25, D. C.

SUBJECT: Thirtieth Anniversary Meeting American Meteorological Society

TO : Air Weather Service Reservists

1. The thirtieth anniversary meeting of the American Meteorological Society sponsored by the Mid-western Chapters of the Society will be held in St. Louis, Missouri, 4, 5 and 6 January 1950. All officers and airmen who are assigned to the Air Weather Service on active or reserve status are encouraged not only to attend but to actively participate in the planned program.

2. To facilitate travel to and from St. Louis, all Z.I. transport aircraft assigned to the Air Weather Service are being made available to regulars and assigned reservists desiring to attend the meeting. All reservists interested in utilizing USAF aircraft for travel to St. Louis should immediately make the fact known to the unit to which they are assigned. Within the limits of available space, transportation will be provided.

3. Regulars and reservists attending the anniversary meeting will be placed on travel orders by the unit to which they are assigned; no per diem authorized. Further arrangements for transportation will be made by groups and squadrons of the Air Weather Service when the number and location of personnel traveling can be determined. By Air Force regulation, the uniform must be worn while traveling in USAF aircraft. The meetings at St. Louis are not authorized reserve meetings and neither credit nor inactive duty training pay can be obtained as a result of attendance or participation.

4. The Hotel Jefferson, 12th Boulevard at Locust Street has been designated as the official headquarters for the session. A meteorological exhibition during the meetings will feature exhibits by the Air Weather Service and leading manufacturers and distributors of scientific instruments and materials. According to the September 1949 issue of the Bulletin of the American Meteorological Society, those planning to attend should make room reservations as far in advance as possible by writing directly to the Hotel Jefferson.

5. Lest there be any misunderstanding, lower echelons of the Air Weather Service will within their capabilities transport personnel who make themselves available at convenient locations. For those living in the vicinity of West Grapefruit, Idaho, Unter-Oberphaffenhoffen, Germany or to that one 8219 who lives in Bangkok, Siam, please don't be disgruntled if a plane does not arrive to provide personal airlift.

Richard M. Gill
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Lt. Colonel, USAF
Chief, Reserve Forces Section

HEADQUARTERS
MILITARY AIR TRANSPORT SERVICE
ANDREWS AIR FORCE BASE
WASHINGTON 25, D. C.

D/PL/RES — Reserve Forces Information Bulletin — 25 October 1949

LETTER FROM THE COMMANDER

Being fully aware of the all important role played by reserve personnel in the organization, administration and operation of the Air Transport Command and the Naval Air Transport Service during and after World War II, it is with keen personal interest that the senior members of our organization join me in our work on the MATS Reserve Program.

In our global air route command it is necessary to be constantly prepared for immediate transition from our current tempo in a period of relative peace to the feverish activity of war. You have seen how quickly the normally quiet "Vittles" routes sprang into unprecedented activity when the supply of Berlin by air assumed national importance and was delegated to this command. Operation Vittles met and solved a relatively minor problem imposed by "cold" war. You can well imagine the magnitude of MATS requirements in the event of national emergency on a global scale.

It was this requirement together with corollary conditions that led to the inclusion, in my ten point program for MATS for the current fiscal year of the directive for: "A strong Air Reserve Program to insure for MATS a Reserve body fully manned by able, experienced personnel whose interest and support are maintained by a well-managed program of training and information."

It is with full realization of your importance to us that I take this opportunity to welcome you into the MATS official family. Be assured that you are as welcome as you are necessary and that we shall do the utmost in our power to make your stay with us profitable, educational and mutually advantageous.

Sincerely,

/s/Laurence S. Kuter
LAURENCE S. KUTER
Major General, USAF
Commanding

LETTER FROM CHIEF, RESERVE FORCES DIVISION

The mission of the Reserve Division of the Military Air Transport Service is to promote "A strong reserve program to insure for MATS a reserve body fully manned by able, experienced personnel whose interest and support are maintained by a well-managed program of training and information."

Our concept of a modus operandi for the accomplishment of this mission is to place the entire MATS structure behind the project. Accordingly, authority and responsibility for operational and administrative functions have been delegated through this headquarters, the three transport divisions and the four services to all MATS organizations involved in the Reserve Program. The result is a strong, united front solidly backing the program.

Participation in one or more of the five parts of the FY 50 Reserve Program is available to all Air Reservists. It is not always possible for that participation to be exactly that which is desired, but it should never be less than that required for retention of rank or grade status and assurance of retirement benefits.

This division will shape policies, maintain liaison and disseminate information for the benefit of MATS organizations and MATS reservists. The chances are remote

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This division will shape policies, maintain liaison and disseminate information for the benefit of MATS organizations and MATS reservists. The chances are remote that one small office can seek out and exploit all the angles which may prove beneficial to each category involved. We will always welcome any suggestions or constructive criticisms which may help the MATS Reserve Program to be the best in the Air Force. We shall be satified with nothing less and not content with that.

Sincerely,

/s/W. O. Eareckson
W. O. EARECKSON
Colonel, USAF

DEFINITIONS: MOBILIZATION ASSIGNMENTS AND MOBILIZATION DESIGNATIONS

Mobilization Assignments:

1. To whom given. Mobilization Assignments will be given to those individuals of the Air Force Reserve in an inactive duty status who volunteer and are assigned by competent authority to positions in which it is anticipated they will serve if called to active duty in event of mobilization. These individuals must signify, in writing, their willingness to accept an assignment in the Organized Air Reserve, with or without pay, and to comply with those requirements now or hereafter established for retention of status as a member of the Organized Air Reserve.

2. Inactive Duty Training Pay. Individuals with mobilization assignments with or without inactive duty training pay will be members of the Organized Air Reserve.

3. Eligibility for Inactive Duty Training Pay. Individuals with mobilization assignments will be eligible to receive inactive duty training pay to the extent of funds available for the pay of mobilization assignees.

4. Retention of Mobilization Assignment. In order to retain a mobilization assignment an officer must maintain his proficiency as evidenced by earning an average of at least 35 points annually during any three-year period. Accordingly, any officer of the Organized Air Reserve who, in any period of three consecutive years, fails to earn a total of at least 105 points will be considered to have not properly maintained his proficiency.

Mobilization Designations:

1. To whom given. Certain key individuals who, by virtue of their civilian occupation are considered to be especially qualified, may be earmarked for mobilization positions by means of mobilization designation. Mobilization designations will be given to those individuals of the Air Force Reserve in an inactive duty status who volunteer and are assigned by competent authority to positions in which it is anticipated they will serve if called to active duty in event of mobilization. A mobilization designation may be given when an individual either is unable or unwilling to accept a mobilization assignment in the Organized Air Reserve, or to comply with those requirements now or hereafter established for retention of status as a member of the Organized Air Reserve.

2. Volunteer Air Reserve. Individuals with mobilization designations will be assigned in the Volunteer Air Reserve and must signify, in writing, their intention to comply with the requirements now or hereafter established for retention in the Volunteer Air Reserve.

3. Retention of Mobilization Designation. In order to retain a mobilization designation an officer must maintain his proficiency as evidenced by earning an average of at least 15 points annually during any three-year period. Accordingly, any officer of the Volunteer Air Reserve who, in any period of any three consecutive years, fails to earn a total of at least 45 points will be considered to have not properly maintained his proficiency.

4. Mobilization designees will not receive inactive duty training pay and will receive active duty training only when funds remain after all mobilization assignees have had an opportunity to perform such active duty training.

ATTENTION: ALL RESERVE PERSONNEL

Recent Congressional action has provided an additional gratuitous year of satisfactory service for retirement purposes. Under previous regulations, the required earning of 50 retirement points annually was effective 29 June 1948. Effective date has now been established as 1 July 1949. All Reserve personnel receive credit for a year of satisfactory service for retirement purposes; however, this change did not affect required earning of credits for promotion and retention of commission during Fiscal Year 1949.

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CALLING ALL REPORTERS

It is the desire of the Commander, MATS, that this information bulletin serve the maximum number of Reserve personnel possible. All personnel are invited to contribute newsworthy articles reflecting Reserve unit or individual activity of general interest to MATS Reserve people. Contributions should be submitted to the Reserve Coordination Officer of the parent unit for necessary editing and forwarding to Headquarters MATS, Reserve Forces Division, for publication. Editorial success of this bulletin depends upon participation of all concerned. Every contribution will be given consideration and those considered most representative and of greatest general interest will be published.

PLEASE HELP US TO HELP YOU!