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WEATHER SERVICE Bulletin

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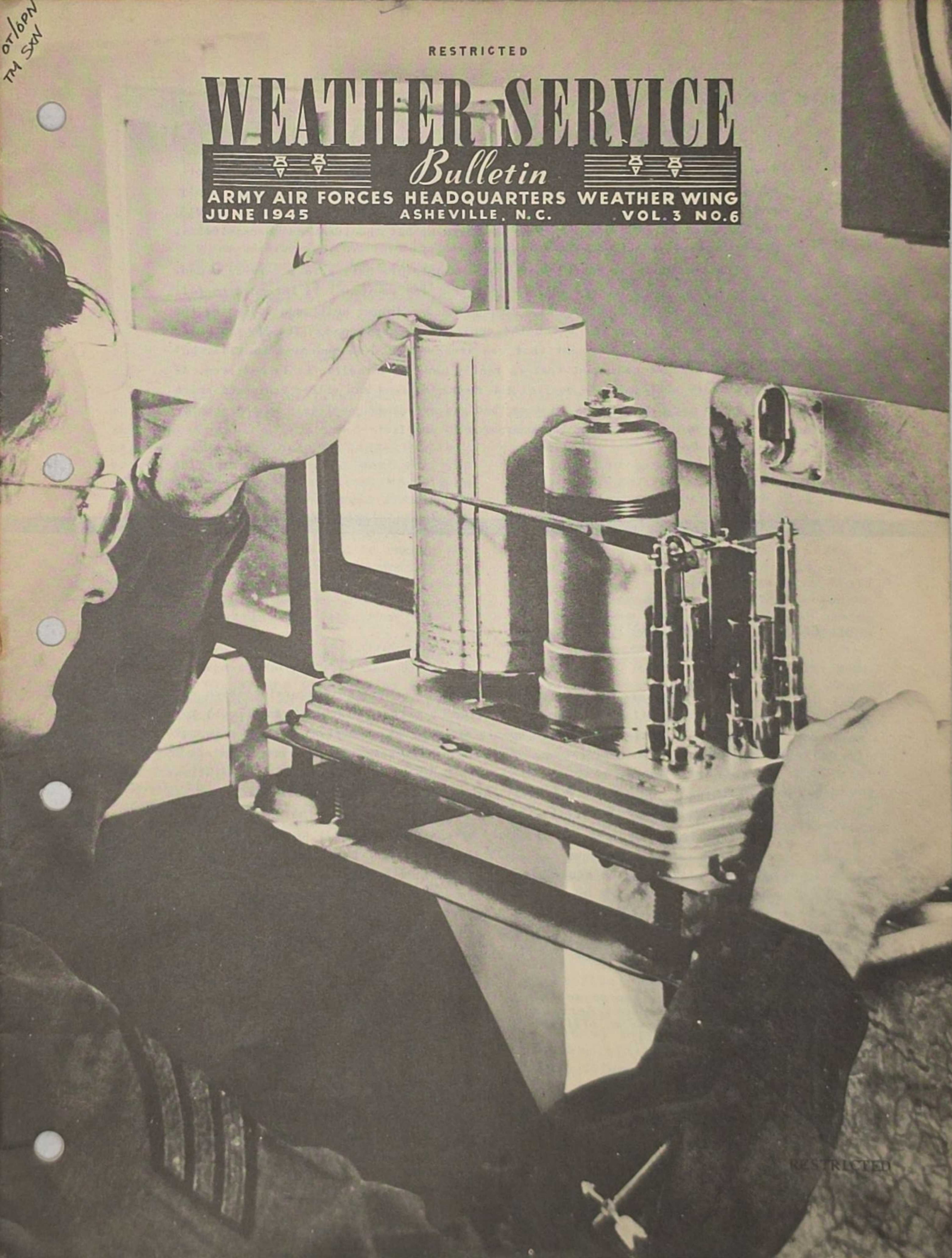

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STANDARD NOMENCLATURE

Order finally has been introduced to the designation of new electronic equipment. In early 1943 the "Joint Army-Navy Nomenclature System" was adopted, in a move to simplify and standardize the symbols used by the various supply and using agencies. The ML- prefix, in the designation of baroswitch ML-213, for example, is well known to Army weathermen, but the identical baroswitch is given a different designation by the Navy.

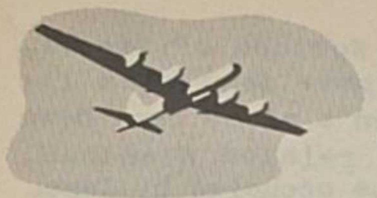
The Army-Navy, or "AN," system of nomenclature cuts across service boundaries, reveals at a glance the function that the equipment is intended to fulfill, tells whether the item is a component of a larger unit, and indicates the type of installation for which the equipment is designed. The AN system is not used to rename equipment that was standard or developmental in 1943, but only to designate equipment that is really new. Eventually, it is believed, AN nomenclature will apply to most of the communications and allied equipment which will be in use. The system is described and explained completely in the supplement to this issue inserted between pages 10 and 11.

PUBLICATION OF TECHNICAL ARTICLES

Before weathermen are permitted to offer a written discussion which concerns military affairs in any way (including meteorological abstractions) to a civilian publication, they must comply with certain policies of the War Department. The written material and accompanying illustrations in final form are to be forwarded through channels to the War Department Bureau of Public Relations for clearance. The W.D.B.P.R. will not consider any article which is not on its way directly to an editorial office. Therefore, if the author plans his work for a particular periodical, he should make reference to its name and address in the basic letter of transmittal. If the author has no preference, this headquarters will make the necessary arrangements with the staff of an appropriate publication.

As a matter of courtesy, the author should inclose at least four copies of his work. Then the publisher can receive the two copies which are useful for his purposes, and pertinent files in Asheville and in Washington can be maintained.

(This statement has no reference to the Weather Service Bulletin, *which is an official military journal).*



JAPAN'S Invisible Ally

condensed from "Brief",
a publication of AAFPOA.

by S/Sgt. Bob Speer and Cpl. Richard Dugan

Home from an attempted raid over Japan, the B-29 crew told a strange story. "We couldn't get to the target. As we neared the coast of Japan, the closer we got the less progress we made. Finally the coast became outlined in our instruments, but then the plane lost ground. Soon the coast disappeared altogether and we never did see it again."

Another crew came back with an equally fantastic story. "We were pushing our way along until we reached the coast. Then with all four engines roaring full blast, we couldn't gain an inch. We weren't flying backwards, but we weren't going forward either. We just hovered motionless over the coast. Finally we gave up and came back."

Shortly after the first B-29 raid on Tokyo (from Saipan on 23 November 1944), the Superforts had run head-on into the biggest single obstacle to high-altitude, precision bombing of Japan: weather. The weather problem was a tough one, worse than anything the Allied air forces ever faced over Europe. It was so critical that for a few black weeks it threatened to nullify much of the B-29 program and to change the strategy of high-altitude bombardment. The Commanding General of the 21st Bomber Command violated standard communique procedure by admitting the failure of several raids.

The winds over Honshu were incredible. Superfort crews who had trained over the plains of Texas, the prairies of Kansas, and the mountains of Colorado had never encountered anything to prepare them for such an experience. If planes did succeed in fighting their way beyond the target and then in turning to slide downwind over it, they clocked speeds in excess of 450 knots. Before the bombardier could even begin his calculations he would be past the target. When he had to go back and try the run a second time, he became an unpopular character with everyone in the crew. The boys didn't like their flak in double doses.

Then there were the clouds. The Superforts would find the target hidden under several different layers of clouds, apparently moving in different directions. It was impossible to bomb through that stuff, even with instruments. Something as big as a city might be hit, but plans called for dropping eggs right on the nose of important military objectives.

There were also the crosswinds. The bombardier might drop his bombs from 30,000 feet into the teeth of a 250-knot westerly gale, with a wind correction calculated for that westerly gale. But when the bombs had fallen to 10,000 feet, they might have entered an easterly current of 60 knots. A bomb is almost perfectly streamlined and is practically unaffected by conflicting wind currents during medium bombardment. But even a small deflection produces a whopping error---one of perhaps several hundred yards---during the six-mile fall of bombs from a Superfort. Which, in turn, may mean the difference between pulverizing a factory or just helping to cultivate a rice field. There were quite a few rice field paddies cratered by early raids on Honshu Many crews came back disgusted after having hauled their bombs 1,500 miles and seen them miss the target.

Weather wasn't always at fault when the early missions didn't pan out. Sometimes a plane fouled up one way or another, but that was a problem of engineering. Every new plane is expected to show bugs, and the B-29 was no exception. Aeronautical experts nursed it through its trial combat period just as they had babied along the B-17's and B-24's when they first hit the air. Gradually, mechanical kinks were straightened out until B-29 air and ground crews agreed that they had a good weapon. But while weather may not have been the only problem, it was acknowledged by all to be the main one. Until it was solved, the Superforts' best efforts would not be good enough to satisfy the perfectionists of Very Heavy Bombardment.

Pacific weathermen had not been idle. They even knew what was wrong---but they hadn't been able to do anything about it. The latest complete weather maps they possessed of the Japanese Islands dated back to before the war, and they were not reliable. Published studies of Japan's climate were rare, and most of them had been issued in the days when a weatherman's main chore was figuring whether rain would come to save crops, not trying to estimate cloud coverage over a specific target area for high altitude bombers.

"Generally speaking, the weather over Honshu is an east-coast type," said a staff officer to Colonel W. S. Stone, Director of AAF Weather Services in the Pacific Ocean Areas. "But conditions over Japan are unusually intense. Great masses of very cold air sweep eastward out of Siberia. The world's title for 'coldest spot on earth' goes to Verkhoyansk in Siberia, where a record low of 94 degrees below zero has been noted. And Verkhoyansk is roughly the same distance northwest of Japan that Saipan is southeast."

The forecasting problem for B-29 raids is in large part to anticipate the rapid frontogenesis which is characteristic of the China Seas. Storms form there and sweep northeastward over the Japanese Islands within 24 hours. But before the capture of Iwo and Okinawa, the Weather Service had no reporting stations which could observe these disturbances.

Faced with these facts, weather experts thrashed out the problem and decided that aerial reconnaissance over the dubious areas by weather forecasters would be the best solution. A call went out to Pacific weather officers for volunteers. Eight men were picked: Captain Edward A. Everts of Berkeley, California; six lieutenants; and a warrant officer, Jasper E. Grantham. The eight volunteers flew on exhausting schedules, risked their lives on their own forecasts, and endured attacks by ack-ack, searchlights, and fighters. They experienced weather phenomena so out-of-this-world that they didn't believe it themselves, even after they had recorded it and had sent the information back to base. Four of the weathermen were forced to take to life rafts after their B-29's had crashed.

Mr. Grantham was the first weatherman over Tokyo, on 8 December 1944. And when his plane ran out of gas 65 miles from home, he also was the first to take part in a ditching. "We lost two gunners in the crash," he said. "I bruised my back badly, and two other men were cut up. Even so, those of us who survived managed to get into two five-man rafts. A Navy PBM spotted us one hour later when we released our dye marker into the sea. Then some P-47's buzzed us and led a destroyer over within a few hours." A couple of weeks later, Lt. Robert J. Moore of San Jose, California, also underwent a ditching experience and was adrift for more than a day before being rescued.

Lt. Frederick R. Worthen of Tacoma, Washington, had a rougher deal than the first two men. "Worthen's plane came down near a small island," related Grantham, "which was believed to be occupied by Japs. There was a heavy sea running, so the ditching was a rough one: several men were hurt in the crash. Fortunately, Worthen knew how to handle himself in the water. The lieutenant, who had been on the swimming team at Stanford University, towed one man whose legs were broken through the surf to a rocky beach. The rest of the crew made shore safely. The men huddled together on the beach, trying to look like lava and escape the Japs' attention. Luckily they were spotted by a search plane, and soon a dozen more planes showed up, swooping and diving about the crew to discourage the Japs from trying any funny business. A destroyer appeared, but couldn't get to the beach. The men had to swim for it. Worthen towed his man back out through the surf to a whaleboat."

The weathermen usually flew in B-29's on snooper duty, although some accompanied major raids. Their reports of route weather and target conditions were radioed back for the guidance of Superfort fleets sweating out a takeoff. On return from gruelling 14-hour flights, the men would supplement their radio reports by exhaustive post-flight analyses of the weather to and from the target, adding their data to the large amount collected by ground stations in Allied territory and by the regular Army and Navy patrol planes. The result was an up-to-date and accurate check of the weather to and from Japan.

The weathermen flew over Jap territory for about three months. During that period they encountered some extraordinary conditions, the most amazing of which was the westerly gales out of Asia. Despite the forward push of 8,800 horsepower generated by four great engines, several B-29's sailed *backwards* during their attempted approach to Japan. Weathermen described that sensation as the eeriest they had ever experienced. Sometimes for as long as half an hour the Superforts would hang in the air, absolutely motionless. Gagsters suggested installing a jib or mainsail so that the plane could tack back and forth in the wind to make some headway.

Cloud conditions were sensational, too. Southeasterly trade winds, warm and moist as they followed the Japanese current, boiled up against opposing cold winds from Asia along the Japanese coastline. Clouds formed in layers and decks all the way up, moving at conflicting speeds and directions

Weather Wisdom

(1) Fifty percent of the AAF forecasters in the U.S. each day give a 24-hour spot forecast of pressure which is correct to within:
a) *1 mb* b) *3 mb* c) *5 mb* d) *7 mb*

(2) Which one of the following electronic methods locates discharges of static electricity in the atmosphere which are occurring within 1,500 miles:
a) *Radar* b) *Sferics* c) *Rawins*

(3) A. The 700 mb surface on the average is below the 10,000 foot surface along the U.S.-Canadian border:
a) *True* b) *False*

B. The difference in height between the two surfaces along the Gulf of Mexico's north coast on the average is:
a) *200 feet* b) *600 feet* c) *1,000 feet*

(4) Isotherms on a constant-pressure surface are *not* isopleths of:
a) *Potential Temperature* b) *Density*
c) *Saturated Mixing Ratio* d) *Equivalent Potential Temperature*

(5) The crosswind component found by altimetry (absolute and pressure) acts perpendicular to the:
a) *True Heading* b) *True Course* c) *Total Wind Vector* d) *Rhumb Line*

(6) The *Weather Service Bulletin* is distributed to:

A. All AAF weather stations all over the world.
a) *True* b) *False*

B. Weather stations of the Royal Australian Air Force.
a) *True* b) *False*

(7) In the series of charts printed in the April *Weather Service Bulletin*, a poor analysis was made of the temperature field over the Great Basin and West Coast of the U.S. Although the values were drawn for with care, the pattern given contradicts climatology. Name the chart to which reference is made.

(8) In the absence of surface obs, a good indication of the synoptic ceiling is that height at which Rawin ascents conclude. If Rawins are taken to 45,000 feet, it can be concluded that no ceiling exists:
a) *True* b) *False*

---

to provide a king-size headache for the bombardiers. After lead formations had found the target clear, rear elements five minutes behind might find it socked in.

According to Capt. Everts, weather will always be a serious problem in bombing operations over Japan. Although lower wind speeds can be expected to prevail through the spring and summer into the fall, when the hurricane season begins, this advantage is offset by the unfavorable cloud conditions that are present during the summer months. Generally, clear skies over Japan are rare outside of the autumn season. Some of the world's best meteorologists (Carl-Gustav Rossby, Jakob Bjerknes, John Bellamy, and others) have gone to the Pacific area to help solve the problems that interfere with heavy bombardment of Japan.

Insofar as the weather over the Jap Empire can be predicted and turned to advantage, much of the job now has been accomplished. Every once in a while a Superfort crew will cuss out the forecasters for giving them a wrong steer, but no major strike in a recent period failed because of weather. Many a mission that would have proved abortive never had to leave the ground by virtue of a forecaster's warning. The Weather Service's ballistic data have improved bombing accuracy. And literally dozens of Superforts which otherwise might have been forced to ditch by lack of fuel have been kept safe by correct headwind forecasts.

Since the early days of inauspicious raids, B-29 operations have been front-page news. More and bigger raids: factories hit, then damaged badly, finally wiped out completely. Right up until the great air battle of 27 January the Superforts encountered fanatical opposition. But as they demonstrated their terrific slugging power, loss ratios became lower and lower. The Japs have shown no answer for the recent 500-plane attacks which have been recorded as the most destructive assaults in air warfare. Important results are already in the book, but greater blows are in the making.

E-6B: A WEATHER GADGET

By Lt. W. R. Fuller & Pvt. Lester Machta

The E-6B Computer can be used to solve the geostrophic wind equation for constant-pressure surfaces and to calculate wind speeds in flight from absolute altimeter data. Only a slight modification to this standard AAF device is necessary: a latitude scale must be drawn upon a certain blank section of the Computer. The E-6B, present in every AAF Operations Office and Navigation Kit, accomplishes wind calculations accurately and quickly when it is so modified.

With the increased use of constant pressure charts in forecasting, and with the new importance and scope of weather reconnaissance, it is desirable to have a rapid means for solving the geostrophic wind equation in both the forms shown below.* A simple addition to the markings on the familiar *Aerial Dead Reckoning Computer* (E-6B) will accomplish this objective.

The term (21.47/sin ϕ) has been evaluated in Table I for 2.5° intervals of latitude between 35° and 55°. The values of this term fortunately appear on the *minutes* scale of the E-6B's inner dial just above one of the two blank areas. Therefore, it is possible to construct a radial line from the *minutes* scale into the blank area for each value of (21.47/sin ϕ) in Table I, and to label each line with its corresponding value of latitude. Figure 1 shows an E-6B Computer with the new scale already added, entitled "DEG. LAT". Notice, for example, that 40° is the new label of a line from the *minutes* scale value of 33.5.

GEOSTROPHIC WIND DETERMINATION

To use the modified E-6B Computer for determining the geostrophic wind from the spacing of contour lines (or isoDees) on constant-pressure charts, proceed as follows:

(1) Set the appropriate latitude on the *minutes* scale opposite the contour spacing (in nautical miles) on the *miles* scale.

(2) Read the geostrophic wind (in knots) on the *minutes* scale opposite

*GEOSTROPHIC WIND EQUATION FOR CONSTANT-PRESSURE SURFACES

WEATHER MAP FORM

$$c = \frac{21.47}{\sin \phi} \frac{\Delta z}{\Delta n},$$

where c = geostrophic windspeed (knots)

ϕ = latitude (degrees)

Δz = contour interval (feet)

Δn = distance between contours (nautical miles)

ALTIMETRY FORM

$$c_n = \frac{21.47}{\sin \phi} \frac{(D_2 - D_1)}{x},$$

where c_n = speed (in knots) of the wind component which is normal to the True Heading.

$D_2 - D_1$ = difference (in feet) between the altimeter corrections read at the end and at the start of a flight made with a constant reading of the pressure altimeter (i.e., a constant pressure altitude) and on a particular True Heading.

x = distance (in nautical miles) flown in the time elapsed between the two readings of the altimeters.

If the constant in either equation is changed to 28.50, the units become statute miles and miles per hour instead of nautical miles and knots.

Table I: The values of ϕ are plotted on the E-6B Computer *below the corresponding values of 21.47 / sin ϕ. The latitude values between 35° and 55° are given because they fit conveniently into an unused area of the* Computer, *but there is no reason why the new scale could not be extended throughout the whole range by overprinting values of ϕ on the labels already stamped on the E-6B dial. Where statute miles and mph, rather than nautical miles and knots, are the accepted units of distance and speed, a similar table should be prepared instead which uses 28.50 / sin ϕ.*

ϕ	$\frac{21.47}{\sin \phi}$
35°	37.5
37.5°	35.4
40°	33.5
42.5°	31.8
45°	30.4
47.5°	29.2
50°	28.1
52.5°	27.1
55	26.3

the contour interval in feet on the *miles* scale.

The Computer was designed solely for navigational purposes, which explains the nomenclature *miles* and *minutes* for the fixed and movable scales, respectively. Those designations should not confuse the weatherman if he thinks of the E-6B scales as he would the *C* and *D* scales of an ordinary (circular) slide rule. The latitude and geostrophic winds are found on the movable dial, while the contour spacing and the contour interval appear on the fixed scale.

CROSSWIND DETERMINATION

The absolute and the pressure altimeter are used in combination to determine the crosswind on weather reconnaissance missions flown over water. This procedure finds that component of the wind speed which is acting perpendicular to the aircraft's True Heading (the direction in which the plane's nose is pointing). Necessary calculations involve the solution of equation (2) in the box on page 4, which can be done readily with the modified E-6B *Computer*. Proceed as follows:

(1) Set the appropriate latitude, ϕ, on the *minutes* scale opposite the distance covered, x (in nautical miles) found on the *miles* scale.

(2) Read the crosswind, c_n, on the *minutes* scale opposite the difference in altimeter correction, $D_2 - D_1$, on the *miles* scale.

DRIFT AND TOTAL WIND DETERMINATION

The reverse face of the E-6B *Computer* was designed to perform several calculations which are of value to the flying weatherman. The standard operations and functions of this unmodified face are discussed at length in the *Navigator's Information File*.

If a "Double Drift" procedure (Fig. 3) is flown on which altimeter readings are taken at the ends of each leg, data are obtained which reveal the total wind vector after computation with the E-6B. And either the total wind or the crosswind vector can be used to find drift. (The angle between True Heading and True Course is determined principally by the crosswind. The use of the crosswind alone, therefore, provides a good approximation to the true drift; while use of the total wind vector will reveal the true drift exactly.)

(1) On the reverse side of the rule, set the True Heading (plus or minus 90° as the case may be) to the True Index, and plot the wind vector downwind from the

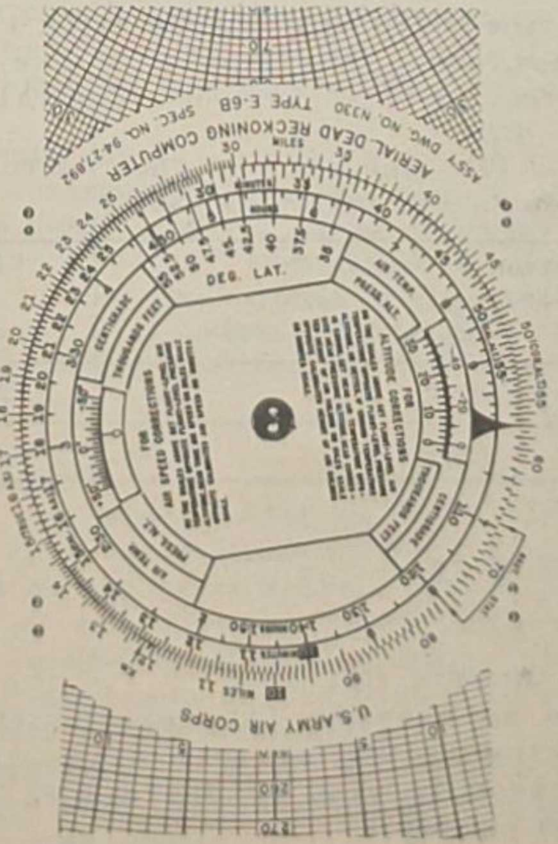


Figure 1: Showing an *E-6B Computer* to which a latitude scale has been added for solving meteorological formulas. The scale is entitled 'DEG. LAT.' and appears on the inner (movable) dial. Weathermen who are concerned with latitudes above 55° can extend the scale.

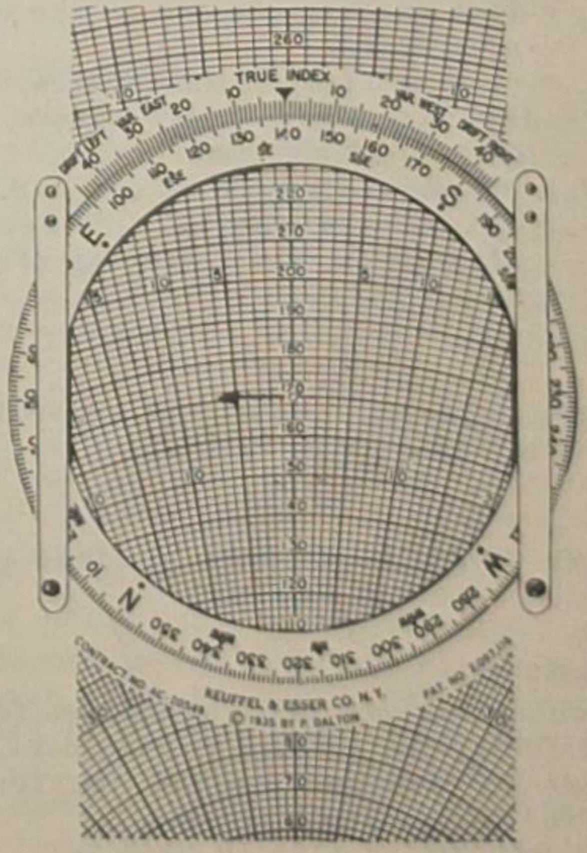


Figure 2: This is the rear face of the *E-6B Computer*, which was designed for several purposes that the weatherman will find useful. Example 3 shows how the Drift Angle can be found from the True Heading and the wind vector. Other uses are given in the *Navigator's Information File*.

grommet (the center point of the transparent disc).

(2) Rotate the transparent disc until the True Heading is set to the True Index.

(3) Set the True Air Speed to the grommet and read the drift angle at the end of the wind vector (see Figure 2).

CORRECTION FOR DEVIATION FROM CONSTANT PRESSURE-ALTITUDE.

The method of determining the crosswind which uses the absolute and pressure altimeters, discussed and illustrated above, assumes a run at constant pressure-altitude. Since it is not always possible to maintain a given pressure-altitude, it is necessary to correct $D_2 - D_1$ of equation (2) for the change in pressure-altitude that may occur during the run.

If this change in pressure-altitude is less than 200 feet, no correction need be applied. If it is greater than 1,000 feet, the whole run should be abandoned. If it is greater than 200 feet but less than 1,000 feet, the following correction should be added *algebraically* to D_2-D_1.

$$\left[\Delta Z_p - \frac{T_2}{T_{p_2}} \cdot \Delta Z_p \right]$$

where

T_2 = free air temperature at the end of the run.

T_{p_2} = standard temperature corresponding to the pressure-altitude at the end of the run.

ΔZ_p = pressure-altitude at the end of the run minus the pressure altitude at the beginning of the run.

This correction can readily be determined on the E-6B Computer as follows:

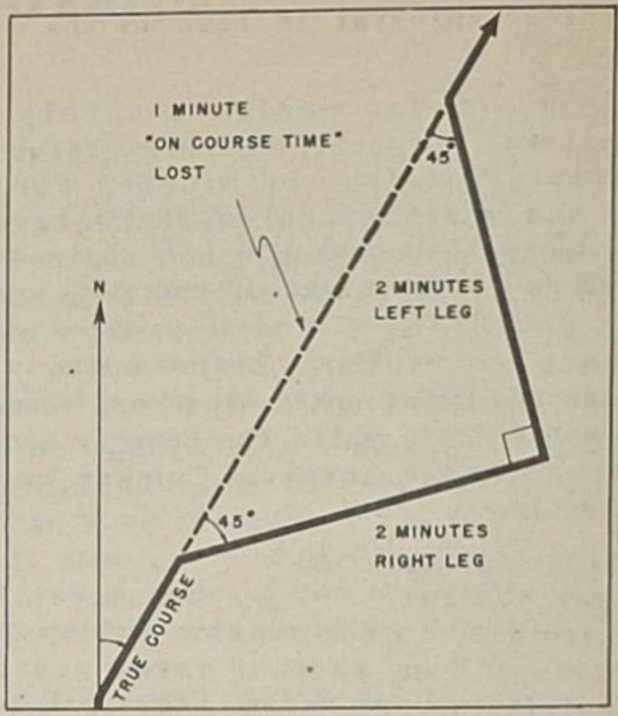


Figure 3: This DOUBLE DRIFT flying procedure involves the least loss of "on route time" and the least confusion of Dead Reckoning logs.

(1) Set the free-air temperature, T_2, opposite the final pressure-altitude in the box.

(2) Determine ΔZ_p by subtracting the pressure-altitude at the beginning of the run from the pressure-altitude at the end of the run.

(3) Locate ΔZ_p on both the *minutes* and *miles* scales. Count the number of feet (on the *miles* scale) separating these two locations. The result is the desired correction which is added algebraically to D_2 - D_1.

(4) The sign of this correction is given in the following table:

Location of ΔZ_p on the *minutes* scale to right or left of ΔZ_p on *miles* scale	Sign of ΔZ_p	
	−	+
Right	+	−
Left	−	+

PROBLEMS WHICH ILLUSTRATE WEATHER USES OF THE E-6B.

Example (1):

On a 500mb chart, contours are drawn for every 150 feet. The contour spacing over a station at 45° latitude is 220 nautical miles. Find the geostrophic wind.

Solution:

(1) Set 45° on the *minutes* scale opposite 220 on the *miles* scale.

(2) Find 150 on the *miles* scale and read the geostrophic wind of 20.8 knots on the *minutes* scale.

Example (2):

Same as example (1), except that the spacing is 220 statute miles, and the geostrophic wind is desired in statute miles per hour.

Solution:

(1) Set 220 statute miles on the *minutes* to the statute miles index.

(2) Under the nautical mile index, read 191 nautical miles on the *minutes* scale.

(3) Set 45° on the *minutes* scale to 191 on

the *miles* scale.

(4) Opposite 150 on the *miles* scale read the geostrophic wind of 24 knots on the *minutes* scale.

(5) Set 24 on the *minutes* scale to the nautical mile index, and read the answer under the statute mile index on the *minutes* scale. The number so found is 27.6, which is the geostrophic wind in statute miles per hour.

Example (3):

The altimeter corrections at the beginning and end of a 95 nautical mile run at constant pressure-altitude were +10 feet and +75 feet and the True Heading was 140°. Find the velocity and direction of the crosswind if the latitude was 50° North.

Solution:

(1) Set 50° on the *minutes* scale opposite 95 on the *miles* scale.

(2) Opposite $D_2 - D_1 = +65$ feet (=75 - 10) on the *miles* scale read the crosswind of 19.2 knots on the *minutes* scale.

(3) As the run is toward higher elevation (i.e. $D_2 - D_1$ is positive) the crosswind is from the right, that is from 140° + 90° or 230°. Hence on the reverse side, set 230° to the True Index and plot the crosswind of 19.2 knots downwind below the grommet.

(4) Rotate the transparent disc until the True Heading of 140° is at the True Index.

(5) Set the True Air Speed (say 170 knots) at the grommet, and read the approximate drift angle of 6½° at the end of the crosswind vector just plotted (2).

Example (4):

A run at constant pressure-altitude is made at a True Heading of 75° for 40 minutes, at a True Air Speed of 165 knots (latitude 42.5°N). Find the crosswind and drift angle if the altimeter corrections at the beginning and end of the run are +140 and +100, respectively.

Solution:

(1) Set the black index on the *minutes* scale (i.e. at 60 minutes) to the T.A.S. of 165 knots on the *miles* scale. Opposite 40 minutes on the *minutes* scale note the distance covered on the *miles* scale: 110. Set 42.5° latitude on the *minutes* scale opposite 110 on the *miles* scale.

(2) Opposite $D_2 - D_1 = -40$ feet on the *miles* scale read the crosswind of 11.6 knots on the *minutes* scale.

(3) As the run is toward lower elevation (i.e. $D_2 - D_1$ is negative), the crosswind is from the left; that is, from 75° - 90° or 345°. Hence on the reverse side set 345° to the True Index and plot the crosswind of 11.6 knots downwind below the grommet.

(4) Rotate the transparent disc until the True Heading of 75° is at the True Index.

(5) Set the True Air Speed of 165 at the grommet, and read the drift angle of 4° at the end of the crosswind vector just plotted.

Example (5):

A run at a constant pressure-altitude of 15,000 feet is made at a True Heading of 340° for 25 minutes at a *calibrated* air speed (i.e. indicated air speed corrected for instrumental and installation errors) of 150 knots, (latitude 41°N). Find the crosswind, if the altimeter corrections at the beginning and end of the run are -10 and +70 feet, respectively. (Free-air temperature = - 20°).

Solution:

(1) Set -20°C opposite 15,000 feet pressure-altitude in the air speed box. Opposite the calibrated air speed of 150 knots on the *minutes* scale note the True Air Speed (187) on the *miles* scale. Set the black index on the *minutes* scale (i.e. at 60 minutes) to this value (187) on the *miles* scale. Opposite 25 minutes on the *minutes* scale note the distance covered on the *miles* scale (78). Set 41° latitude on the *minutes* scale opposite this value of distance covered (78) on the *miles* scale.

(2) Opposite $D_2 - D_1 = +80$ feet on the *miles* scale, read the crosswind of 33.7 knots on the *minutes* scale.

Example (6):

Given $D_2 - D_1 = +70$ feet measured for a certain run. The pressure-altitude at the beginning of the run was 5,000 feet. The pressure-altitude at the end of the run was 5,500 feet. The corrected free-air temperature at the end of the run was -10°C. Find the corrected value of $D_2 - D_1$ to substitute in equation (2).

Solution:

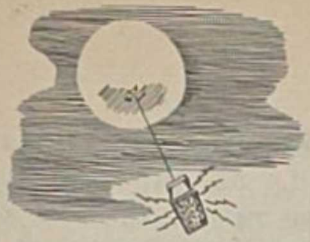
(1) Set -10° opposite the final pressure altitude of 5,500 feet in the altitude box.

(2) Subtract 5,000 feet from 5,500 feet, getting $\Delta Z_p = +500$ feet.

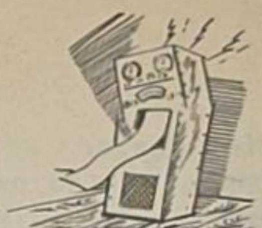
(3) Locate 500 feet on both the *minutes* and *miles* scale. The number of feet (counted on the *miles* scale) separating 500 on the *miles* scale from 500 on the *minutes* scale is 25 feet (Figure 3). This is the correction to be added algebraically to the measured value of $D_2 - D_1$: +70 feet.

(4) The sign of this correction is plus, because 500 on the *minutes* scale is to the left of 500 on the *miles* scale and ΔZ_p is plus (See above table).

(5) Therefore, the corrected value of $D_2 - D_1$ to use in equation (2) is 70 + 25, or 95, feet.



RAWINSONDE



Rawins and Raobs are being taken simultaneously from a single balloon ascent, the novel "Rawinsonde" observation, at several Weather Service installations. The necessary equipment for this procedure is flowing out to the field in a steady stream, and before long the economy of Rawinsondes will be established on a widespread basis. In view of the developments which have already taken place and those which are anticipated, a report follows on the AAF use of electronic equipment in radiosoundings and RDF wind observations.

The radiosonde *AN/AMQ-1()* now is in use at all AAF radiosonde stations. Its ceramic temperature element and electric hygrometer are described in "Headquarters Notes," *Weather Service Bulletin* for February 1944.

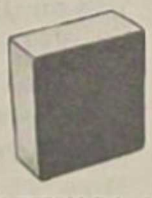
The radio set SCR-658, Radio Direction Finding apparatus, obtains about half of all the Rawin data now being made available to AAF weather stations. This set finds the velocity of winds aloft to an average height of 40,000 feet under all weather conditions. Extensive tests have indicated that *SCR-658* winds are correct to ± 5mph in speed and to ± 5^0 in direction, an accuracy comparable to that of the double-theodolite method. At the same time, Pibal runs were proven to be subject to large errors. *SCR-658* tracks the free-air path of radio transmitter *BC-1253*, which signals on a frequency of 397 mc in conjunction with baroswitch *ML-213()*. Refer to the article "RAWIN" in the September *Weather Service Bulletin* for further details.

BATTERY BA-67

FOR USE WITH: Radiosonde AN/AMQ-1()
Radiosonde AN/AMT-1
VOLTAGES: 3v, 90v

BATTERY BA-67 PACKAGED

UNPACKING BATTERY BA-67



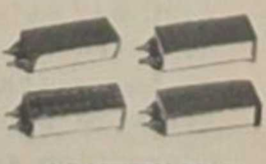
BATTERY BA-67 UNPACKAGED

BATTERY PACK BB-208/AMT

FOR USE WITH: Radiosonde AN/AMT-2
Radio Transmitter BC-1253 and Baroswitch ML-213()
Radio Transmitter BC-1253 combined with Radiosonde AN/AMQ-1()
VOLTAGES: BB-51: 6v; BB-52: 36v

CONSISTS OF:

BATTERY PACK BB-208/AMT



1 BATTERY BB-51
3 BATTERIES BB-52

ACTIVATING BATTERY PACK BB-208/AMT

BATTERIES PLUGGED INTO RADIOSONDE TRANSMITTER T-69( )/AMT-2

Important changes are in progress, and others expected. For example, the radiosonde *AN/AMT-2* is in the early stages of mass production. This instrument will provide a signal for Rawin observations by *SCR-658* at the same time and on the same frequency that it transmits a radiosounding of pressure, temperature, and relative humidity. The principal advantage of the Rawinsonde is a major economy. The fact that only one balloon, one baroswitch, one transmitter, one launching, and one battery are necessary for a combined observation will save 50% in the old cost of all these items.

Radiosonde *AN/AMT-2* is composed of three elements and a battery pack. The elements are radiosonde modulator *ML-310()/AMT-1*, ventilation duct *ML-351/AM*, and radiosonde transmitter *T-69()/AMT-2*---all combined and held together by strings and buttons. The impermanence of this combination permits its use in part at stations which are not equipped to accomplish the Rawinsonde ascent. Substitution of transmitter *T-49()/AMT-1* makes the assembly suitable for use with the receptor *AN/FMQ-1* to take Raobs alone. This combination, shown in Figure 4, looks like *AN/AMT-2* but emits a signal of 72.2 mc and is designated as *AN/AMT-1*. To take Rawins only, the temperature and humidity elements as well as the ventilation duct can be left unused, and the transmitter *T-49()/AMT-1* substituted: this will replace the combination of baroswitch *ML-213()* and transmitter *BC-1253*.

For use until the newly-developed *AN/AMT-2* can be placed into mass production, a "Stop-Gap" method to accomplish Rawinsonde ascents has been introduced to the field Service. The method (Figure 6) makes use of radiosonde *AN/AMQ-1()* working on 72.2 mc and transmitter *BC-1253* on 397 mc, both powered by a common battery. These units are assembled by use of the conversion kit *ML-354/AM* and are sent up on the same balloon. Separate signals for *SCR-658* and for the receptor *AN/FMQ-1* are transmitted. This method saves one balloon, one battery, and one baroswitch on each ascent.

Figure 7 (a) shows the different batteries which are now supplied. *BA-67*, shown at the top in various stages of undress, is the familiar dry battery which supplies 3 volts to the filaments and 90 volts to the plates of the radiosondes *AN/AMQ-1()* and *AN/AMT-1*.

Figure 7 (b) shows the battery pack *BB-208/AMT*, which supplies 6 volts to the filaments and 108 volts to the plates of transmitter *BC-1253*, radiosonde *AN/AMT-2*, and the Stop-Gap combination. This pack consists of four wet storage batteries. One is *BB-51*, the 6-volt source, while the other three are *BB-52* of 36 volts each. The three *BB-52's* are connected in series to give the required plate voltage of 108 volts when plugged into the transmitter.

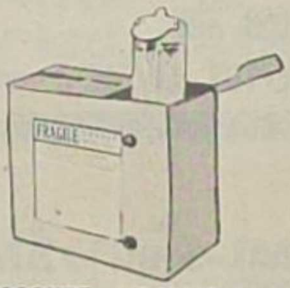
The conversion kit *ML-354/AM* adapts the filament voltage and the plate voltage for use with radiosonde *AN/AMQ-1* when the Stop-Gap combination is used.

As may be seen in Figure 7, the batteries making up *BB-208/AMT* are shipped in a metal container from which the air has been removed. This vacuum serves to protect the batteries from deterioration in storage and shipping; and, through the use of the special opener illustrated in the figure, it provides a means for filling the batteries with activating electrolyte when they are ready for use. Since *BB-208/AMT* is stored and shipped dry, it has no shelf deterioration. *BA-67*, a conventional "dry" battery, is of course subject to deterioration, but new methods of moisture-proof packing have lengthened its shelf life. Tropical stations especially benefit from these improvements.

RADIOSONDE FLIGHT
RADIOSONDE AN/AMQ-1( )

PROVIDES: Radiosonde data (72.2 mc)

REQUIRES: Radiosonde Receptor AN/FMQ-1



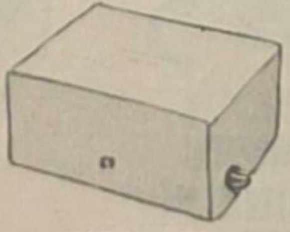
RADIOSONDE AN/AMQ-1( )
(USES BATTERY BA-67)

RADIOSONDE RECEPTOR
AN/FMQ-1

SCR-658 RAWIN FLIGHT
BAROSWITCH ML-213() AND RADIO TRANSMITTER BC-1253

PROVIDES: Rawin data (397 mc)

REQUIRES: Radio Set SCR-658 (or SCR-658-T1)



BAROSWITCH
ML-213( )

RADIO TRANSMITTER
BC-1253 (USES BATTERY PACK BB-208/AMT)

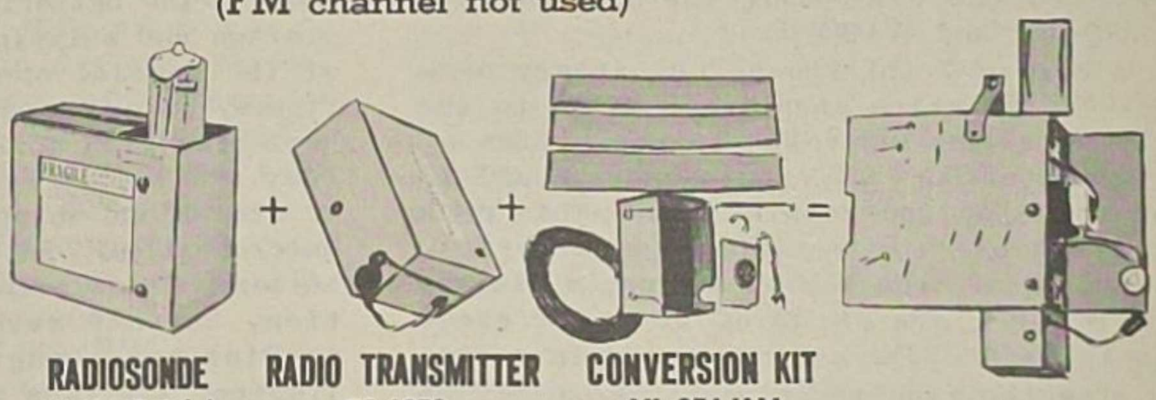
RADIO SET SCR-658 AND
OPERATOR PLOTTING DATA

To summarize, the familiar procedure of independent Raob and Rawin ascents is being replaced by the Stop-Gap Rawinsonde; and before the winter of 1945, the radiosonde *AN/AMT-2* is expected to supersede the Stop-Gap method. So, the Weather Service now has one radiosonde working on 72.2 mc, one Rawin transmitter on 397 mc, and one type of Rawinsonde using both 72.2 mc and 397 mc. Eventually, the total number of types will be reduced to two: one for radiosonde transmissions on 72.2 mc, and one for Rawinsondes or Rawins on 397 mc.

COMBINED RADIOSONDE- RAWIN FLIGHT (STOP-GAP METHOD)

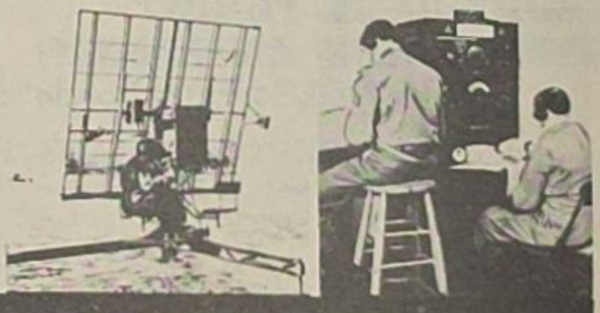
PROVIDES: Radiosonde data (72.2 mc) and
Rawin data (397 mc)

REQUIRES: Radiosonde Receptor AN/FMQ-1 (complete)
Radio Set SCR-658 (or SCR-658-T1)
(FM channel not used)



RADIOSONDE AN/AMQ-1( ) RADIO TRANSMITTER BC-1253 CONVERSION KIT ML-354/AM

(USES 1 BATTERY PACK BB-208/AMT TO OPERATE BOTH TRANSMITTERS)



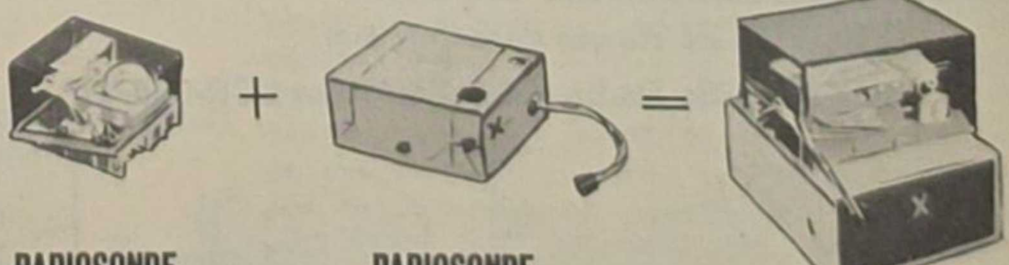
RADIO SET SCR-658 AND RADIOSONDE RECEPTOR AN/FMQ-1

SCR-658 RAWIN FLIGHT

RADIOSONDE MODULATOR ML-310( )/AMT-1 AND RADIOSONDE TRANSMITTER T-69( )/AMT-2

(REPLACES BC-1253 AND ML-213( ))

PROVIDES: Rawin data (397 mc)
REQUIRES: Radio Set SCR-658



RADIOSONDE MODULATOR ML-310( )/AMT-1 RADIOSONDE TRANSMITTER T-69( )/AMT-2

(USES BATTERY PACK BB-208/AMT)

RADIO SET SCR-658 AND OPERATOR PLOTTING DATA

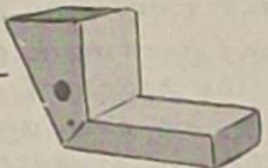
COMBINED RADIOSONDE-RAWIN FLIGHT RADIOSONDE AN/AMT-2

PROVIDES: Radiosonde and Rawin data (397 mc)

REQUIRES: Radiosonde Receptor AN/FMQ-1
(receiver not used)
Radio Set SCR-658

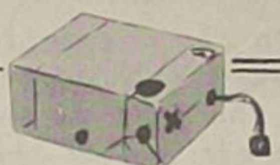
RADIOSONDE
MODULATOR
ML-310( )/AMT-1*

+



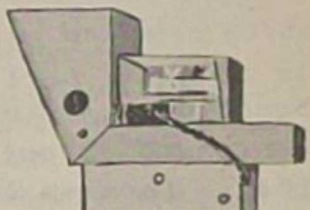
VENTILATION
DUCT
ML-351/AM
(ASSEMBLED)

+



RADIOSONDE
TRANSMITTER
T-69( )/AMT-2

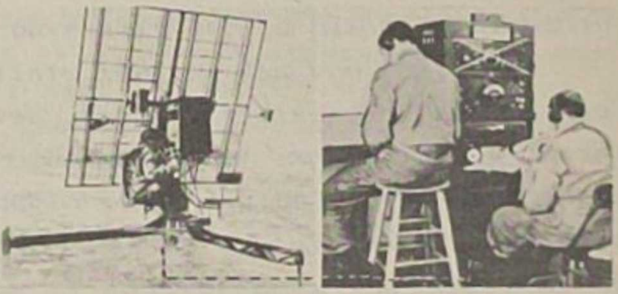
=



RADIOSONDE
AN/AMT-2

(USES BATTERY PACK BB-208/AMT)

*(NOTE: DOES NOT USE HUMIDITY AND TEMPERATURE ELEMENTS)



RADIO SET SCR-658 AND
RADIOSONDE RECEPTOR AN/FMQ-1

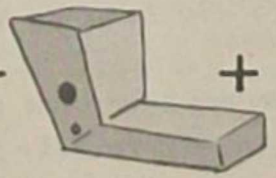
RADIOSONDE FLIGHT RADIOSONDE AN/AMT-1 (REPLACES RADIOSONDE AN/AMQ-1( ))

PROVIDES: Radiosonde data (72.2 mc)

REQUIRES: Radiosonde Receptor AN/FMQ-1

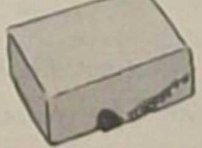
RADIOSONDE
MODULATOR
ML-310( )/AMT-1

+



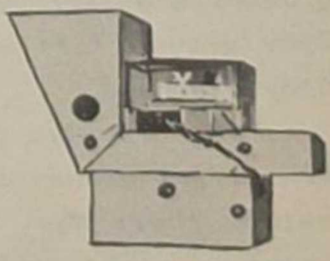
VENTILATION
DUCT
ML-351/AM
(ASSEMBLED)

+



RADIOSONDE
TRANSMITTER
T-49( )/AMT-1

=



RADIOSONDE
AN/AMT-1

(USES BATTERY BA-67)

RADIOSONDE RECEPTOR
AN/FMQ-1

Salween Campaign

Victory in the Salween campaign of Burma and Western Yunnan province in China, which resulted in the reopening of China's overland supply route from India, was due in no small part to the ingenuity and hard work of members of the 10th Weather Squadron. Air activity began with the start of the campaign in May 1944 and continued through the fall of Wanting on the Burma-China border on 19 January 1945. Forming the air arm of the Chinese Expeditionary Forces which dislodged the Japs from the Salween region, Major General C. L. Chennault's Fourteenth Air Force "Flying Tigers" were faced throughout the campaign with limitations in fuel, planes, personnel, and most of all---operational weather. The fierce, unpredictable weather of the monsoon season taxed the skill and ability of pilots in their efforts to fly tactical fighter and bomber missions and to drop supplies to Chinese in the forbidding terrain of the Himalayan ranges.

With just one AAF weather station operating in the combat area, Captain Kaye A. Yoder, 69th Wing weather officer, devised a system of collecting weather intelligence which, when combined with weather recon flights over target areas, produced data of great accuracy. Captain Yoder organized ground force, non-weather personnel working with the Chinese into the "Wing Tactical Weather Net." Each man was given a letter of instruction, a phrase chart, and 45 minutes of schooling in observing simple weather elements. The phrase chart contained a series of numbers corresponding to cloud types, directions, and heights as well as other weather elements. The observer merely had to radio the correct numbers to the operations base to give a clear picture of the weather in his area. Reports were received at base from eight to 15 minutes after observation and used for forecasting weather for fighter and bomber operations.

With fighter operational hours down to 32 for the entire month of June, and to 40 for July, the effectiveness of the Wing Weather Net and aerial recon became highly important. Captain Yoder and his assistant, S/Sgt Leland L. Holland, went along on the priority supply missions over the Tengchung and Lungling areas in Burma to observe active weather phenomena. Frequently, flights were made pretty rough by enemy ground fire and by the need to fly between mountain peaks in order to evade enemy aircraft.

"The dramatic part of our technique was that while we were in the air we were able to get planes into action immediately to take advantage of what little flyable weather there was," Captain Yoder said. "And if planes were airborne toward the target we could call them back should the weather begin closing in." It is impossible to estimate the number of gallons of gasoline thus saved for the fuel-hungry Fourteenth, but the results were evident.

During the historic September siege of the walled city of Tenchung, Captain Yoder flew over the city, found the weather right, and called out the fighters and bombers. Then his plane climbed higher aloft and watched as striking aircraft breached the wall. A few days later the Chinese captured the city.

Captain Yoder and S/Sgt Holland called the signals for the strikes and they called them right. Only two percent of the operational hours in the Salween campaign were abortive because of weather. The percentage could have been much greater.

UNRELIABLE WINDS

by Lt. Arnold Court

In combat theaters or in isolated areas it is often necessary to decide whether a certain wind-aloft ascent is reliable, where the success of an entire prognosis depends upon a correct decision. This article explains how the change of wind with height over a station is related to the horizontal gradient of mean temperature. When the $\overline{T}$ gradient determined in this way contradicts synoptic or climatic indications, the Rawin or Pibal report should be examined and either "smoothed" or discarded. And where an analysis has been placed without the aid of actual wind reports, the vertical change in geostrophic wind can be criticized in like manner.

Winds aloft observations can be checked by considering whether the horizontal temperature gradients indicated by the observed wind data are likely to exist. In the free air, changes in wind speed and direction with height ("vertical shear") measure the horizontal temperature distribution. Shears which reveal improbable temperature gradients thus indicate inaccuracies, either in original data or in computations.

When the wind varies in speed without changing direction through a layer, the magnitude of shear is simply the difference between the speeds at the bottom and at the top of the layer. Under such conditions, Table I gives the horizontal temperature gradient for any observed shear. The tabulated value for the particular temperature and latitude is to be multiplied by the observed shear magnitude.

When the wind changes in direction, whether or not it changes speed, Table II is used first, to determine the amount of shear; then Table I is scanned to find the temperature gradient corresponding to that shear. In either table, intermediate values can be found by interpolation. The horizontal gradient of mean temperature in any free-air layer between analyzed charts can be found with use of Tables I and II.

In deciding whether a certain indicated shear actually exists, or whether the wind reports should be checked and perhaps smoothed somewhat, the synoptic situation should be considered carefully. As far as climatic limits are concerned, no tabulations are available as to the maximum horizontal temperature gradients which can or do exist in the atmosphere, but study of upper-air charts for the Aleutians shows that gradients exceeding 5°C per degree of latitude there are rare. Any aerological observation which indicates shears requiring gradients of this magnitude should be investigated.*

The relationship of temperature gradient to wind change is based upon an assumption that geostrophic conditions exist. Within the surface frictional layer, especially in the vicinity of mountains, the observed wind shears may be far in excess of those due to thermal conditions. But for most winds in the free air, changes of speed or direction which indicate abnormal temperature gradients should be viewed with skepticism, unless there is a synoptic reason to believe that the unusual gradients are real.

Changes which must be made in original wind obs to suit the values for transmission sometimes may violate the data and

	TEMPERATURE									
LATITUDE	-60°	-50°	-40°	-30°	-20°	-10°	0°	10°	20°	30°
90°	.513	.537	.561	.585	.609	.633	.657	.681	.705	.729
80°	.507	.531	.555	.579	.603	.626	.650	.674	.698	.722
70°	.484	.507	.529	.552	.575	.597	.620	.643	.666	.688
60°	.446	.467	.487	.508	.529	.550	.571	.592	.613	.634
50°	.394	.412	.431	.449	.468	.486	.505	.523	.542	.560
40°	.330	.346	.361	.377	.392	.408	.423	.439	.454	.470
30°	.257	.269	.281	.293	.305	.317	.329	.341	.353	.365
20°	.175	.184	.192	.200	.208	.217	.225	.233	.241	.250

Table I: Horizontal temperature gradient in C° per degree of latitude corresponding to a shear of magnitude 1 mph per 1,000 feet.

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*The magnitude of the shear, in mph per 1000 feet, associated with a horizontal temperature gradient of 5°C per degree of latitude is: $2061/T \sin \phi$

introduce improbable T gradients. If the winds given in the example at the end of this article were to be encoded, the report would read ...81344 1547... The shear computed for the encoded data would indicate a gradient of 7.4°C per degree of latitude instead of the 6.0° found from the original data. The encoding caused a 1.4° error.

Accuracy of angular measurements in upper-wind observations varies with the type of equipment used, and with the training of the observers. In no Rawin equipment in current use is the accuracy greater than 0.2°. One type of equipment, although read to the nearest 0.1°, has electrical limitations which introduce a possible error of 0.3° or more: another type usually is read only to the nearest scale divisions, which are 1.4° apart, although with care readings may be estimated to the nearest 0.3°. Pibal obs are subject to instrumental and operational shortcomings, and large errors are common.

Thus, when a Rawin or Pibal ascent is put on a plotting board for evaluation, each point is merely an approximation of the observed position of the balloon. Any point could justifiably be moved in azimuth and/or in distance by an amount corresponding to the possible error. Adjustment of points within these limits often will smooth the plot enough to eliminate excessive changes in speed or direction; sometimes, however, it may be necessary to assume one or more readings to be in error, either in value or in time, to eliminate improbable values.

In practice, excellent results are

Init. Speed (mph)	Chge in Dir.	Change in Speed (mph)								
		decrease					increase			
		40	30	20	10	0	10	20	30	40
20	10°				10	3	11	21	30	40
	20°				11	7	13	22	32	42
	30°				13	10	16	25	34	44
	40°				14	14	20	28	37	
	50°				16	17	23	31	40	
	60°				17	20	27	35	44	
	70°				19	23	30	38		
	80°				21	26	33	42		
	90°				22	28	36			
30	10°			20	11	5	11	21	31	41
	20°			21	13	10	16	24	33	43
	30°			22	16	16	22	28	37	
	40°			23	20	21	27	33	42	
	50°			24	23	25	31	38		
	60°			26	27	30	35	43		
	70°			28	30	34	38			
	80°			30	33	39	41			
	90°			31	36	43				
40	10°		30	21	12	7	13	22	31	42
	20°		31	22	16	14	18	26	35	
	30°		31	25	20	21	25	32	40	
	40°		32	28	26	27	33	39		
	50°		33	31	31	34	39			
	60°		35	35	36	40				
	70°		36	38	41					
	80°		38	42						
	90°		41							
50	10°	40	30	21	12	9	14	22	32	42
	20°	40	32	24	18	17	22	29	37	
	30°	41	34	28	25	24	30	37		
	40°		37	33	32	34	39			
	50°		41	38	39	42				
60	10°	40	31	22	14	11	15	23	33	42
	20°	41	33	26	22	21	25	32	39	
	30°		37	32	30	31	35	41		
	40°		42	39	39	41	46			
70	10°	41	31	22	15	12	16	24	34	43
	20°		35	28	25	24	28	34	42	
	30°		41	36	35	36	40	46		
80	10°	41	32	23	16	14	18	25	34	43
	20°		37	32	28	28	31	37		
	30°			41	40	41				
90	10°	42	32	24	18	16	19	26	35	44
	20°		39	34	31	31	34	40		
100	10°	42	33	25	19	17	21	27	36	45
	20°		41	37	34	34	38	43		
110	10°	43	34	27	21	19	23	29	37	46
	20°		44	40	38	38	41			
120	10°	44	36	28	22	21	24	31	38	
	20°			43	41	41				
130	10°	44	36	29	24	22	25	32	39	
140	10°	45	37	30	26	24	27	33	40	
150	10°		38	32	27	26	29	34	42	
160	10°		39	33	29	28	30	36	43	
170	10°		40	34	30	30	32	37	44	

Table II: Magnitude of shear (mph) shown by various changes with height of a wind of given speed. Vectorial substraction of the wind vector at one level from the vector at another level yields results identical with those derived from this table (See page 24, *Wea Svc Bul*, April 1945).

obtained by drawing a smooth curve near all the plotted points of an ascent, and then by adjusting the points to the curve so that they are regularly spaced. The higher the wind speed, the straighter the line will be: with winds of 100mph or more, a straight-edge can be used to advantage.

The "Thermal Wind Equation" expresses the relationship between horizontal temperature gradient and change in wind with height. It can be written:

$$\frac{\partial T}{\partial x} = \left[\frac{2\omega T \sin \phi}{g}\right] \frac{\partial V}{\partial z}$$

$$= \left[\frac{.0002139 \, LT \sin \phi}{g}\right] \frac{\partial V}{\partial Z}$$

The constant given is correct for the following units:

ΔT = C° per degree of latitude
L = length in km of a degree of latitude
T = the absolute temperature
ϕ = the latitude
g = the acceleration due to gravity in m/s
Δv = the change in speed expressed in miles per hour per 1000 feet.

If average values for L and g are used, the formula reduces to:

$$\Delta T = 0.002426 \, T \sin \phi \, \Delta V$$

using the same units. Development of this equation in other forms may be found in Brunt (p. 199ff), Hewson nd Longley (p.98ff), and other texts and articles. It is obvious that Tables I and II have been prepared by the use of average values of g and L in the Thermal Wind Equation.

GIVEN

latitude 48°N
temperature -13°C
7,850ft wind: 130°, 43mph
9,150ft wind: 150°, 48mph

SOLUTION

Referring to Table II: at 40mph initial speed, a 20° turn and a 5mph increase determine a shear of 16mph (interpolating between speed changes of 0 and 10). But the actual initial speed was 43mph, interpolation for which reveals the shear to be 17mph.

The thickness of the layer is 1,300ft. Then we have 17 ÷ 1.3 = 13mph, the shear/1,000feet. Under the given conditions of latitude and temperature, the gradient for this shear is obtained by double interpolation from Table I: 0.464°C per degree of latitude. The solution, then, is 13 x .464, or 6°C per degree of latitude.

MONTHLY REVIEW OF AIR INSPECTORS' REPORTS
(for March 1945).

SUMMARY OF REPORTS

		TOTALS	
1.	Average Rating:	Excellent	
		No.	%
2.	Reports Received:	138	100
3.	No Deficiencies:	32	23.2
4.	No Irregularities:	32	23.2
5.	Improper Care and Maintenance of Instruments:	59	42.7
6.	Inadequate Security Precautions:	53	38.4
7.	Filing System Inadequate:	42	30.4
8.	Improper Management of Station:	36	26.0
9.	Maps and/or Charts Improperly Analyzed:	30	21.7
10.	Forecasts (incl. AAF Form 23) not Properly Prepared:	24	17.4
11.	Maps and/or Charts Improperly Plotted:	21	15.2
12.	Training Program Inadequate:	19	13.7
13.	Improper Military Correspondence Procedures:	17	12.3
14.	Non-compliance with AAF Ltr 50-65:	11	7.2

Definition of Generalized Categories
(See May issue Wea Svc Bul, for Items 1-9,11-12)

Forecasts not Properly Prepared:
This item contains all irregularities and/or deficiencies and/or recommendations which indicate improper compliance with existing directives relative to the preparation of route and terminal forecasts and to the entries of items under Section C of AAF Form 23.

Improper Correspondence Procedures:
This item contains all irregularities and/or deficiencies and/or recommendations which indicate improper compliance with existing directives relative to the preparation of military correspondence.

Non-Compliance with AAF Letter 50-65:
This item contains all irregularities and/or deficiencies and/or recommendations which indicate that forecaster personnel are not complying with the provisions of AAF Letter 50-65.

Guerrlla Observers

By Sgt. T. A. Graham

The weathermen of the 19th Weather Squadron in the Middle East like to hear Baker tell the story. He does it with so much verve and adds so many embellishments that to them it's like watching an actor perform on the stage. Boiled down to the actual facts, Baker's experiences with the guerrillas in Yugoslavia still make an exciting yarn.

The Squadron wanted three men to get into the Yugoslav country and send back reports to be used for forecasting bombing weather over Austria, the Ploesti oil fields, and other targets in occupied territory. The men who volunteered for the job were S/Sgts Ralph C. Baker and Joseph W. Newmyer, observers, and 1st Lt. Robert J. Schraeder, forecaster. Because it was known that German patrol units frequently scouted the area to which these men would be assigned, it was decided that the quickest and safest way to get them there would be to drop them from a plane.

There were five rigorous days of calisthenics and tumbling at a paratrooper training school, followed by five actual jumps from a plane below 1,000 feet. On the night of 13 March 1944, Baker and Newmyer took off from an Italian base. A Partisan named Marian went along as an interpreter and radio operator. Lt. Schraeder couldn't make it because of an ear infection. He would join them at a later date.

Over the Partisan area, which the pilot spotted by signal fires, supplies and equipment were dropped first. The plane circled the area once and then Marian, Newmyer, and Baker went over in turn. When Baker landed, he thought he knew just about where the Partisan camp was located and started to walk in that direction. Before long he realized that he was lost. He did the wisest thing possible under the circumstances: he cleared away the snow at his feet, wrapped himself up in the parachute, and went to sleep.

Meantime, Newmyer and Marian found their way to the Partisans without any difficulty. Newmyer, through Marian's translation, tried to get the Partisan leader to organize a search party to pick up Baker. The Partisan leader explained that the German lines were only 10 miles away and the best thing for everybody concerned at the moment would be to put out the signal fires and go to sleep.

Early the following morning Baker was found wandering around aimlessly in the woods. When he was delivered to Newmyer and Marian back at camp, they greeted each other as men would who had spent years in scaling mountainous barriers to keep a rendezvous here at this spot. They were finishing breakfast when a Partisan walked up to Marian and told him a patrol of eight Nazis were heading toward the camp. The men were getting ready to clear out now. Baker wanted to know who was going to look for the equipment that was dropped last night. The Partisan explained that it would have to wait until they reached headquarters 30 miles north.

For four days the men stayed in a small village near headquarters while the Partisans searched for the equipment. When it was finally found and brought in, a theodolite, a plotting board, some clothing and rations were missing. Evidently the items had fallen into the hands of the Germans. Even so, the boys considered themselves lucky to have gotten back the rest of the supplies. The theodolite and plotting board would have to be replaced.

The weather station was to be set up in an old Italian inn on the outskirts of a small village. There were already a small group of Partisans there when the weathermen arrived. These men served as a dropping ground crew for supplies and personnel occasionally flown over by the British.

When it came to setting up the station, the weathermen had difficulty in determining how high they were above sea level. None of the Partisans seemed to know. It remained for Newmyer to discover the answer. One afternoon he strolled over to the village schoolhouse to get some information on local geography. When he arrived the children were playing games in the yard. The schoolteacher was off in a corner with some youngsters tossing quoits around a wooden stake in the ground. During his conversation with the teacher Newmyer noticed an inscription on the stake and asked the teacher what it meant. It turned out to be the elevation of the village.

Their next difficulty was in establishing contact with their base. The power supply for their radio was furnished by batteries that required constant re-charging. The "muscle builder" on hand for the purpose wasn't much good to start with, and finally it broke down altogether. Fortunately, a small gasoline generator was obtained from the American Mission at Partisan headquarters. This, too, failed after a while but Newmyer was able to nurse it along so that it continued to serve its function.

The first time the boys contacted their base, 15 Stuka dive bombers came over to pay their respects. The weathermen had been expecting them since there was an enemy airfield about 30 miles on the other side of the mountain. If the village were equipped with an air raid warning system, the Americans never knew about it because the first evidence they had of the bombers was the sound of the wind whistling through the screamers of the falling bombs, which was followed by a terrific shower of dust, plaster, glass, bricks, and roof tile as the bombs tore into the roots of the building. The boys took out for the tall grass in the country. They had run about 50 yards when Baker turned his head to see a formation of three Stukas peeling off. He was sure they had him square in their sights. He yelled to Newmyer to hit the ground and he himself dove over a bank at the edge of the road into a clump of blackberry vines. Either Newmyer hadn't heard him or was too frightened to stop running, but he continued making tracks down the road. Then Baker heard the rising whine of the falling bombs and dug his face into the earth, hardly breathing. When a rain of sod landed in the middle of his back, he thought he was hit and waited for the warm, sticky blood to come. It took him a few minutes to realize he was all right.

The attack lasted for about 20 minutes. More than half the village was destroyed and eight persons were killed. Baker and Newmyer---Newmyer had escaped unhurt---kidded themselves into thinking the Germans were after the weather station primarily and any other Partisan installations in the village were secondary targets.

The inn was in bad shape following the attack, but miraculously enough, the only weather equipment that was damaged was the barograph. With a pair of pliers, some cardboard, and ingenuity, it was restored to smooth running order. Shop was temporarily set up in a hay barn several miles outside the village. The boys strung a new antenna and were able to make contact with their headquarters. By the 30th of April, the Germans had started a local offensive. As the mortar and machine gun fire drew closer, the Partisan leader advised them to pack everything they couldn't carry and bury it underground. They were to lie low at the home of a Partisan friend until things quieted down.

After several days they were on the move again. This time they ended up at an abandoned Partisan hospital that had been converted from Italian barracks. The building was surrounded by tall spruce and so cleverly camouflaged with brush that although the men were within 100 feet of it, it took them nearly 30 minutes to spot it. It was raining heavily when they got to the area and they felt pretty foolish having had to trudge around in the densely wooded valley before finally locating the building.

Living quarters here were fine, but the locality was bad for making observations. The boys decided to set up their station on top of a 200-foot hill about half a mile from the village. This meant that every morning they would have to lug a portable radio, code books, and other paraphernalia up a slippery trail to a pup tent at the observation point and every evening would have to take the equipment back to the barracks.

On 14 May Lt. Schraeder arrived with a theodolite, a plotting board, mail, PX supplies, fresh rations, and reading material. He had been held up by bad weather and by difficulty in getting a plane to drop him. On two previous trips over the valley, the pilot had refused to let him bail out because he had been radioed information a few minutes earlier that there were Jerries scouting the area. The men remained at the mountain retreat for about two months in comparative peace and uneventfulness. Always, enemy mortar fire and shells could be heard exploding in the Partisan village 25 miles away. Occasionally, there were alerts because of enemy patrols in the nearby woods.

On 1 July Partisans brought word that it was safe to move back to the village. This was welcome news because of the hardship involved in having to set up the station every morning in the pup tent on top of the hill. They had progressed to the point where they were about two miles outside the village when news was received that another local Nazi offensive was under way. They turned around and headed back to the hospital. Several days later they learned that the Germans had taken the town and had partially burned it. By the 7th of July, the enemy had moved across the river, vacating the town; the weathermen moved in right behind and resumed operations.

On 22 July Newmyer received word that he was to proceed to headquarters to return to the States under the rotation system. Schraeder and Baker continued working until 6 August when they received orders to close the station and return to Italy. They had

(concluded on page 20)

SHORT RANGE VERIFICATION

RELATIVE STANDING OF DOMESTIC FIELD FORECASTERS
Weeks 1-76; 4 October 1943 to 4 April 1945

THE 100 LEADING FORECASTERS (2,500 participants)

National Ranking	Name	Rank	Region	Station	"R" Value	"S" Score	Regional Ranking
1	Melhorn, W. N.	2Lt	4	Bluethenthal	94	421	1
2	Jordan, H. J.	MSg	4	Smyrna AF	95	455	2
3	Auslander, H.	SSg	23	Offutt FD	93	535	1
4	Brumbach, J. J.	2Lt	25	Reading AF	89	614	1
5	Hoffman, R. E.	1Lt	4	Jacksonvl AF	92	615	3
6	Katz, Y. H.	MSg	1	Stockton FD	93	627	1
7	Clarke, R. F.	TSg	23	Kansas City	95	636	2
8	Posey, J. W.	SSg	23	McCook AF	85	640	3
9	Hirschfeld, W. P.	TSg	25	Ft. Dix AB	94	662	2
10	Moir, J. F.	2Lt	4	Avon Park AF	85	687	4
11	Whiteley Jr., G.	Cpt	1	Luke FD	71	690	2
12	Taft, H. E.	1Lt	3	Tulsa	93	707	1
13	Kautz, E. D.	MSg	1	Salinas AB	94	733	3
14	Law Jr., E. A.	2Lt	2	Patterson FD	86	736	1
15	Peterson, B. J.	TSg	24	McChord FD	93	737	1
16	Gans, W. L.	SSg	25	Olmsted FD	92	742	3
17	Ace, E. R.	2Lt	1	Coolidge AF	91	743	4
18	Gleason, J. M.	2Lt	4	Chatham AF	90	744	5
19	Brouns, R. C.	2Lt	2	Fargo AP	84	747	2
19	Bluhm, W. C.	SSg	25	Pittsburgh AP	92	747	4
21	Wetzel, W. E.	1Lt	25	Bolling FD	93	750	5
22	Koss, H. D.	TSg	2	George FD	93	753	3
23	Smith, H. F.	2Lt	4	Venice AF	89	756	6
24	Criscillis, P. A.	2Lt	4	Asheville WX WG	94	762	7
25	Laseur, N. E.	SSg	23	Sherman FD	94	765	4
25	Reed, C. K.	1Lt	23	Rosecrans FD	95	765	4
27	Pedersen, R. A.	SSg	23	McCook AF	87	766	6
28	Moraski, J. J.	MSg	25	Pittsburgh AP	92	773	6
29	Anderson, E. E.	2Lt	4	Drew FD	92	776	8
30	Tomchek, E. J.	MSg	4	Maxwell FD	96	780	9
31	Lutz, G. H.	2Lt	4	Bartow AF	89	781	10
31	Henry, A. J.	TSg	25	Pittsburgh AP	92	781	7
33	Sheperd, K. R.	2Lt	4	Venice AF	91	784	11
33	Heggie, G. D.	1Lt	23	Des Moines	94	784	7
35	Webb, F. E.	1Lt	4	Chatham AF	94	785	12
36	Kleyensteuber, C. J.	TSg	1	Coolidge AF	94	786	5
36	Hoffman, C. E.	Cpt	2	Chanute FD	95	786	4
38	Lee, G. M.	MSg	24	McChord FD	94	787	2
39	Lenon, D. R.	2Lt.	23	Rapid City AB	89	788	8
40	Grasso, C. H.	2Lt	4	Asheville	92	791	13
41	Norris, D. E.	2Lt	23	Sherman FD	85	792	9
41	Davison, W. R.	SSg	23	Kansas City	94	792	9
43	Blashkin, P. G.	2Lt	23	Strother FD	75	793	11
44	Aichele, W. J.	1Lt	25	Pittsburgh AP	93	794	8
45	Onsager, G. G.	TSg	24	Redmond AF	94	795	3
46	Johnson, P. A.	1Lt	1	Los Angeles	93	796	6
46	Werner, W. L.	2Lt	23	Lincoln	85	796	12
48	Morris, J. C.	2Lt	4	Asheville WX WG	91	799	14
49	Jones, M. V.	MSg	4	Maxwell FD	94	800	15
50	Salon, L.	1Lt	25	Syracuse	88	801	9

51	Toyli, M.	MSg	4	Jacksonvl AF	93	803	16
51	Hayes, N. E.	Maj	25	Ft. Dix AB	63	803	10
53	Allers, H. D.	TSg	4	Asheville WX WG	92	804	17
54	Maugans, W. R.	2Lt	25	Pittsburgh AP	87	805	11
55	Williamson, G. A.	Cpt	4	Maxwell FD	96	807	18
56	King, T. L.	2Lt	25	Pittsburgh AP	91	808	12
57	Welch Jr., A. E.	MSg	4	Memphis AP	96	810	19
57	Parker, R. L.	CWO	4	Maxwell FD	93	810	19
59	Koller, C. R.	2Lt	4	Sarasota AF	92	812	21
60	Horn, L. H.	Sgt	2	Chanute FD	69	813	5
61	Murphy, E. E.	SSg	3	Stuttgart AF	94	815	2
61	Olsen, J. W.	1Lt	4	MacDill FD	81	815	22
61	Vanderzee, C. E.	1Lt	23	Kansas City	94	815	13
61	Begg, E. L.	SSg	23	Lowry FD	92	815	13
61	Lampert Jr., W. B.	WJG	25	Bolling FD	89	815	13
66	Dalrymple, H. R.	TSg	1	Douglas AF	94	816	7
66	Lee, J. D.	SSg	9	Morrison FD	2	816	1
68	Wagner, I.	TSg	4	Bluethenthal	93	817	23
68	Meyerson, A.	TSg	23	Denver	94	817	15
70	Strum, A.	TSg	1	Mather FD	91	819	8
70	Moore, W. G.	1Lt	3	Carlsbad AF	94	819	3
70	Cable, D. A.	TSg	4	Sarasota AF	93	819	24
73	Eberhart, L. L.	2Lt	3	Dalhart AF	90	820	4
73	Lawless, K. R.	2Lt	4	Morris FD	95	820	25
75	Neff, R. E.	TSg	23	McCook AF	93	821	16
76	Kaminski, H. S.	TSg	4	Drew FD	95	823	26
77	Harms, R. W.	1Lt	4	Courtland AF	94	825	27
78	Solomon, M. L.	SSg	24	Portland AB	93	826	4
79	Sugg, A. L.	Cpt	23	Peterson FD	47	827	17
80	Gillespie, L. V.	Maj	1	Long Beach	94	829	9
80	Hronek, R. M.	1Lt	3	Perrin FD	93	829	5
80	Herman, P. B.	2Lt	4	Buckingham AF	90	829	28
80	Rubin, M.	2Lt	24	Wendover FD	88	829	5
84	Musa, R. C.	2Lt	4	Cp. Davis AF	89	830	29
85	Wooldridge, G. L.	2Lt	3	Enid AF	90	831	6
85	Simpson, D. L.	2Lt	4	Cp. Davis AF	94	831	30
87	Dorsch, R. G.	2Lt	2	Patterson FD	84	832	6
87	McCrabb, H. S.	1Lt	3	Perrin FD	95	832	7
89	Luck, E. C.	Cpt	4	Sarasota AF	92	833	31
89	Branche, J. B.	1Lt	4	Tuskegee AF	95	833	31
91	Irons, D.	1Lt	2	Romulus AF	8	834	7
91	Heinmiller, C. S.	2Lt	3	Hondo AF	89	834	8
91	Riley, J. A.	2Lt	23	Liberal AF	88	834	18
94	Dale, A. C.	2Lt	4	Nashville AP	93	836	33
95	Coulter, G. G.	MSg	1	Los Angeles	94	837	10
95	Wright, W. A.	TSg	2	Baer FD	94	837	8
95	Garrison Jr., J. B.	2Lt	4	Memphis AP	91	837	34
95	Ruzicka, R. R.	SSg	25	Boston AP	90	837	[illegible]
99	Culbertson, H. M.	2Lt	1	March FD	94	838	11
99	McCummings Jr., J.	TSg	4	Jacksonvl AF	94	838	35
99	Toporoff, C.	TSg	23	Sedalia AF	94	838	19
99	McGovern, F. J.	1Lt	24	Medford AF	91	838	6

RESULTS BY REGIONS

Regions	*Forecasters Participating*	*Distribution of Grades (%)*				
		A	B	C	D	E
Fourth	505	16	33	38	10	03
Twenty-third	298	13	33	34	17	03
Twenty-fifth	184	15	29	35	18	03
Second	202	08	36	38	14	04
All	2,241	10	30	40	15	05
Twenty-fourth	145	09	27	46	14	04
First	319	07	28	47	15	03
Third	509	05	27	43	17	08

RAOB FORECASTS

Weathermen who forecast radiosounding curves (usually for service to artillery units in predicting ballistic density) will see the advantage of using several transparent overlays to the adiabatic diagram. The top overlay would be blank, ready for working-out the forecast sounding: underneath would appear the latest two or three radiosonde observations in different colors, in place for ready performance of comparison and extrapolation. Afterward, the forecast overlay would be erased, and the observed sounding plotted in its place; then the overlay on the bottom would be placed on top and wiped clean to receive the next forecast. The "Regular Arch" clip serves well to keep the overlays oriented properly and to facilitate the shuffling.

Lt. Orval Feather and Sgt. Hermas Smith, in the course of preparing a chart and a method for forecasting ballistic densities, adopted the above procedure for their work in the 24th Weather Region.

ANSWERS TO "WEATHER WISDOM"

(FROM PAGE 3)

(1c) *Within 5 mb.* See the article "One Year of SRV" in the February Wea. Svc. Bul.

(2b) *Sferics.* See the article of the same name in the February *Wea. Svc. Bul.*

(3Aa) *True.* See "Contour Charts" in the April *Wea. Svc. Bul.*

(3Ba) *200 feet.* Same reference.

(4d) *Equivalent potential temperature.* If isopleths of wet-bulb temperature on constant-pressure surfaces are isolines of equivalent potential temperature.

(5a) *True Heading.* See *Wea. Div. Rept.* #708

(6Aa) *True.* Three thousand copies each month go to AAF weather stations.

(6Ba) *True.*

(7) *The 13 km chart for 8 February 1945.* The isopleths of potential temperature should open to the *south*, since it is a system of low potential temperature which is represented.

(8b) *False.* Rawins can be taken through and within cloud decks. Runs do not terminate because of adverse conditions of visibility.

(concluded from page 17)

to wait until the 20th before the weather was suitable for their departure. And by that time the Germans had blocked off the road leading to the spot where they were to pick up their plane. They were finally able to get out 3 September.

On the day of departure, while waiting for their plane, they heard the approaching roar of bomber aircraft. Ready to make a dash for a shelter, they were stopped in their tracks by the spontaneous cheering of the townspeople. They looked up at the sky and beheld the thrilling sight of several hundred bombers of the 15th Air Force enroute to targets in Austria. The people cheered and laughed as they tried to count the planes framed in the vapor trails of escorting Lightnings and Mustangs. All around them the weathermen heard expressions of great joy and admiration. Over and over, the people kept repeating, "Oh, Madona, the Amerikanc."

CONTRIBUTORS

Lt. **ARNOLD COURT** is a climatologist in the Weather Central of the 11th Region at Anchorage, Alaska. Before the war he was with the U.S. Weather Bureau. Later, Lt. Court collected valuable climatic data in the Antarctic, as a member of the last Byrd Expedition.

Lt. **W. R. FULLER** and Pvt. **LESTER MACHTA** are staff members of the Weather Department at Chanute Field. Lt. Fuller, a graduate of the September cadet class at Grand Rapids, was a mechanical engineer before the war. Lester Machta as a civil service employee was a senior instructor in meteorology at the AAF Weather School, in charge of cadet courses in auxiliary charts and single station analysis among other duties. Recently he was drafted and returned to Chanute Field.

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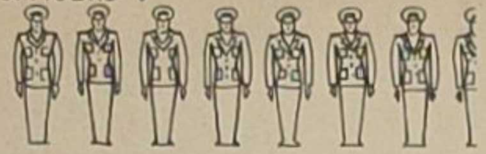
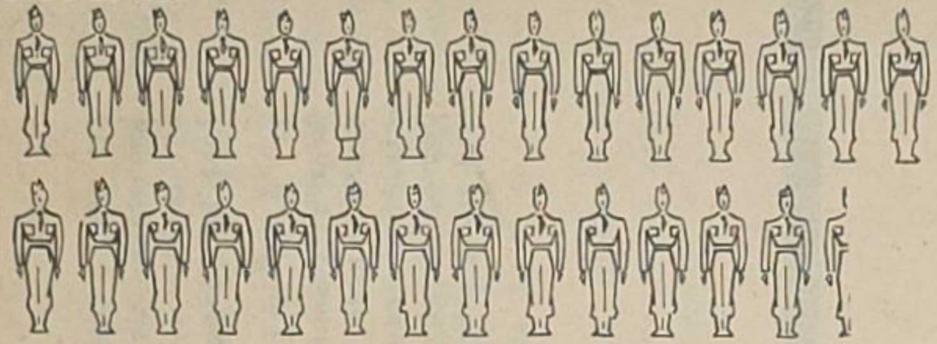
(R) means Restricted. When the insert is removed, this issue becomes unclassified. The *Weather Service Bulletin* is published by Headquarters, Weather Wing with the approval of the Director, Bureau of the Budget. Printing is accomplished by the Reproduction Division, Hq. AACS.

AAF WEATHER SERVICE

3,666 OFFICERS



14,253 ENLISTED MEN

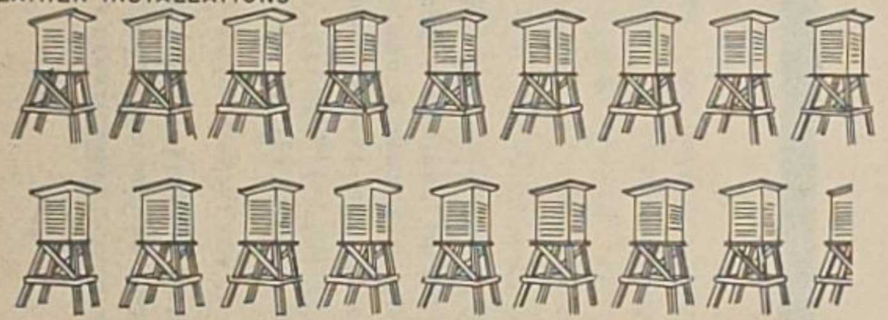


500 MEN

SERVING

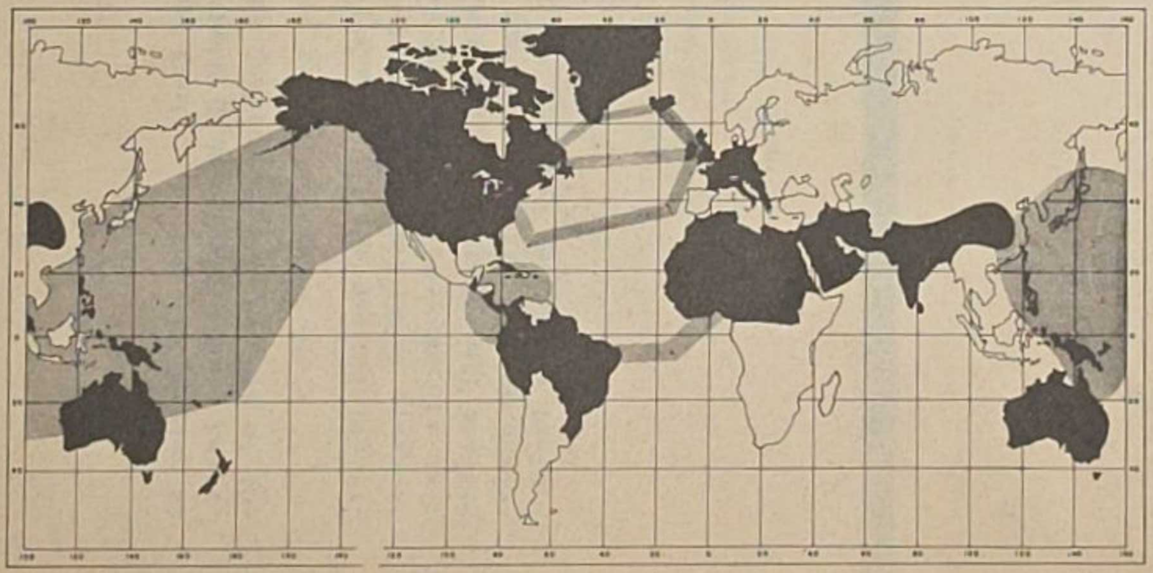
OPERATES

885 WEATHER INSTALLATIONS



50 STATIONS

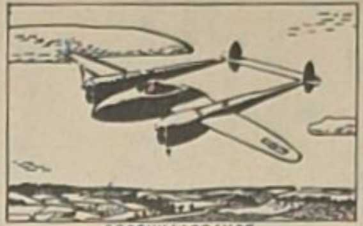
IN 58 COUNTRIES



AIR FORCES

STRAFING & ESCORT
Detailed Forecasts of Cloud Tops, Ceilings, Coverage, Types, & Locations

BOMBARDMENT
Target Ballistic Data: Winds & Weather for Both Terminals & Route



RECONNAISSANCE
Detailed Forecasts of Cloud Cover
(high-altitude photography)

TRANSPORT
Forecasts of the Winds Aloft
(long distance flights)

CONSTRUCTION
Local Climatic Data for Choice of Site:
Rainfall & Wind Analysis for Design

GROUND FORCES

ARMORED
Forecasts of Soil Trafficability

AIRBORNE & PARACHUTIST
Precise Forecasts of Turbulence, Clouds, & Visibility

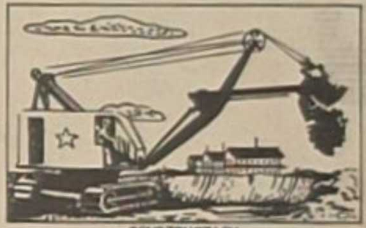
(8b)

ARTILLERY
Ballistic Data: Forecasts of Mean Density & Winds up to Great Heights

AMPHIBIOUS
Sea Swell, Surf, and Visibility Forecasts

INFANTRY
General Weather Forecasts
(air coordination: choice of equipment)

SERVICE FORCES



CONSTRUCTION
Precipitation, Temperature, Wind Forecasts & Climatic Data

TRANSPORTATION & STORAGE
General Weather Forecasts
(storage plans & timing of shipments)

CHEMICAL WARFARE
Micro-forecasts for Lowest Levels:
Lapse rate, Winds, Humidity, & Clouds