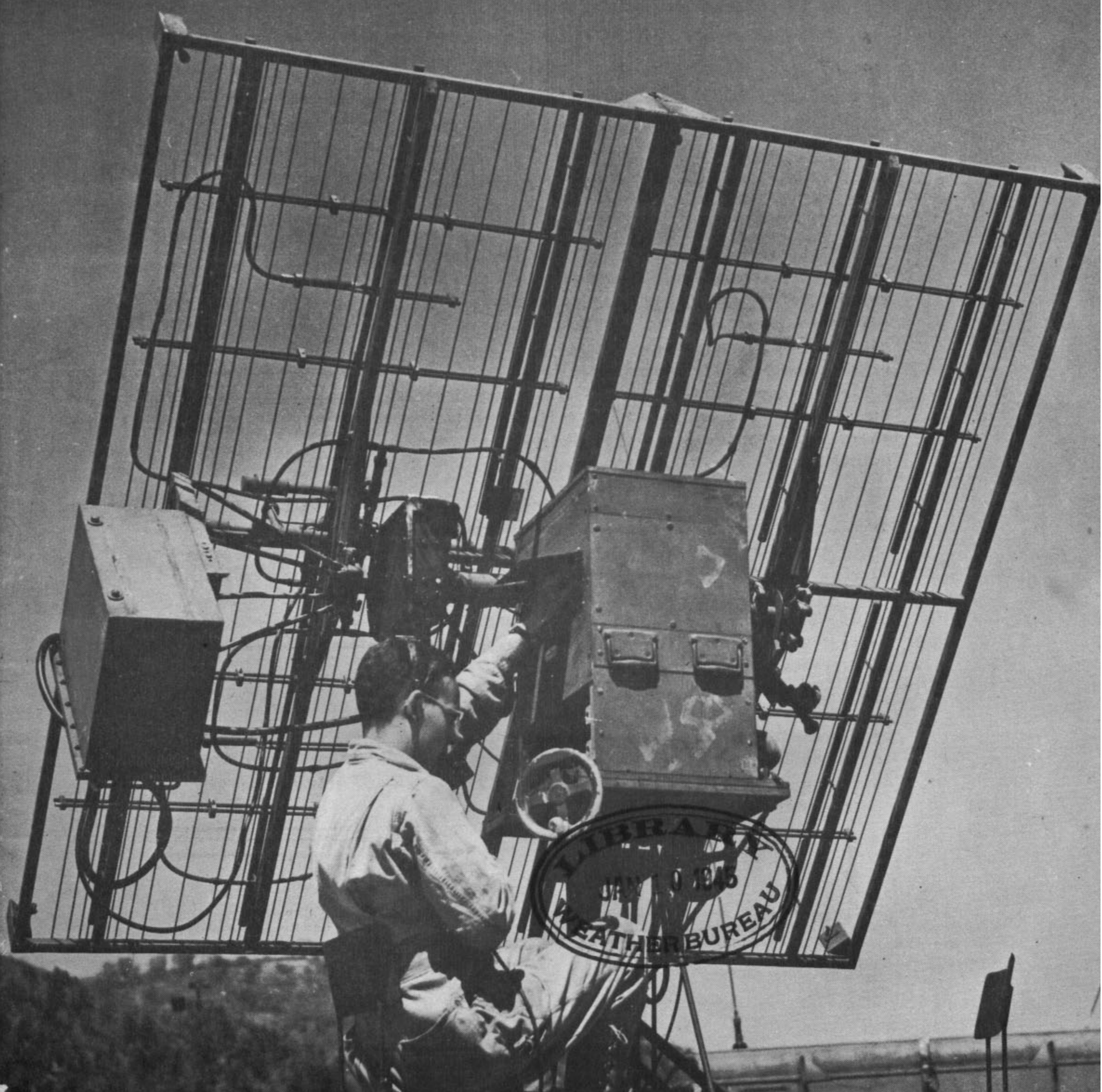
RESTRICTED

WEATHER SERVICE Bulletin

ARMY AIR FORCES HEADQUARTERS WEATHER WING

DECEMBER 1944 ASHEVILLE, N.C. VOL. 2 NO. 6



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UPPER-AIR CATALOGUE

*Every original aerological record, whether Pibal, Raob, Aircraft Report, or Rawin, which is taken by the world-wide observation network of U. S. military and civil weather agencies is being collected in the nation's capital. Operational reports, staff studies, and research information are drawn regularly from data in this file, which often provides the only facts available about the climate aloft in certain regions. The vital nature of demands made upon the file lends an extraordinary urgency to the various directives which control the collection of aerological records. (Weather Wing Letter 80-1 and its amendments apply to AAF installations in the domestic weather regions.)**

The Joint Meteorological Committee expresses official interest in this matter with the following statement:

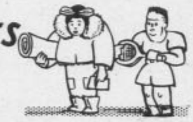
"The aerological information now obtainable through the widespread system of pilot balloon and radiosonde stations in various parts of the world offers great opportunity for improvement in the accuracy of upper air charts, for research studies in atmospheric circulation and forecasting, and for purposes of air navigation. In order to avoid the loss of this opportunity, and to make full use of the many thousands of aerological soundings now obtained each month, the Army, Navy, and Weather Bureau have made provision for collecting these records in Washington, where they are being analyzed and prepared for issue in the form best suited for the uses mentioned above.

"The science of meteorology should profit greatly from the results of this work, and every meteorologist has an interest in seeing that the daily upper-air data are made available as a contribution to our meteorological resources. The organizations concerned have issued instructions that available records shall be forwarded through official channels to the respective headquarters in Washington for transmission to the central analysis and computing unit, where they will be made available for official use.

"Anyone who hears at any time of available records that have not been sent in to Washington for use in this work can do a real service to the Nation and to the Science by bringing to the attention of those concerned the importance and irreplaceability of these original aerological records and reports."

**It is believed that some misunderstanding may exist about the Rawin data desired for the Washington file. The original ascent data sheets, including the final coded (not enciphered) reports, are required.*

CUSTOM-TAILORED FORECASTS



By S/SGT. DAVID V. KENNEDY

This is a staff weather station. Our flight clearances may be for 90 mm. practice shells. We forecast inches of mud as well as inches of rain. Our route forecasts may apply to the 18 terminals of the local golf course. In fact, we give the answers in a continuous quiz session.

FOR BAUMANOMETER

The telephone at the side of the map table rings: an isobar about to be taken on an ocean trip is dropped suddenly on the 35th parallel.

"Base Weather. Forecaster on duty speaking."

"Er - this's Sergeant Myers at the station hospital lab. What's the sea-level pressure? Can we have it in millimeters?"

"Yes. Will ring you back in a few minutes."

The tethered isobar floats patiently in the Atlantic. Map analysis fills our leisure between phone calls, you see.

FOR PLEASURE

"This is Miss Hudson, RCAF, Ops. We are thinking about going on a picnic tomorrow. Do you think that the ground will be too damp to lie upon?"

The lady got an answer, but we would have liked to add the suggestion that blankets provide comfort against any damp ground.

FOR ENGINEERS

"Say, Sergeant, this is Colonel Dews. How much rain are we going to have within the next six hours? What will be the depth of the mud in inches? We want to do a little road laying."

"Well, that's a tough question, Colonel. The porosity of the soil must be taken into account; and, well, many other factors. I don't know if I can give an answer."

"Just a general idea. What would you say it will be offhand?"

"We can give you an estimate of the rainfall, but the mud... All I can say is that it will pretty muddy tomorrow. Maybe three to four inches."

"Fine! That's fine! We'll put the job off then. Thanks a lot, Sergeant."

FOR ARTILLERY

"Can you give us a forecast of cloud conditions up to 20,000 feet? We'd like to fire off some of the 90 mm. guns tomorrow."

"You mean you want a forecast of the ceiling height?"

"Yes, that's right. And the cloud thickness, too."

"How accurate do you want the ceiling?"

"To the nearest hundred feet, if we can get it."

They got it, all right, but we were 500 feet off.

FOR REUNION

"I'm going home next week. What's the weather going to be like on Thursday?"

"That's five days off, Captain. If I could answer that one I'd be a colonel at the Weather Wing."

"O.K. so you *are* a colonel. Now, how about it?"

Inspection of the five-day mean pressure chart and zonal indices was used to produce a forecast that proved satisfactory.

FOR AACS

"This is Major Schultz. We have a bit of a problem here. I want to put up a radio tower, but the construction can't be started until we know that the wind speeds for the next twelve hours won't rise above 5 miles per hour. What is your forecast for the wind conditions?"

"Does that mean, sir, that if the wind becomes say, eight miles per hour that the whole job will be ruined?"

"Absolutely! Not only will the project be ruined if the winds rise above 5 miles per hour, but if they get to 15 miles per hour, the men will be blown from the tower. I don't want that to happen today."

Even a thermal effect can cause winds of 10 to 15 miles per hour in our locality. Actually, conditions were unusually calm at that time, because a col dominated the entire island.

So the major was assured that the tower could be put up. Had he requested such winds during the next three months, however, we could not have given him any encouragement. As a matter of record, the wind velocities rose to 12 miles per hour within a few hours after the tower job was completed.

FOR EXERCISE

Sometimes the questioner appears in person.

"Well, Sergeant. What's your guess for today?"

The question implied that there was a lack of quantitativeness about the science of meteorology. The impression had to be corrected for the good of the Service. Launching into a description of air trajectory methods, advection, and tropical air mass fog, we gave him the works.

The questioner, a pilot, passed his palm over his brow. "In other words, Sergeant, it doesn't look too good for tomorrow, eh?"

"Well, sir, that depends. Where did you wish to fly?"

"Oh, I'm not thinking of flying. I just wanted to know whether the fog will lift enough tomorrow for me to play a few rounds of golf."

"If you get out there at 0930, the fog will lift so that you may make the third hole. But between the third and fourth hole, ceiling and visibility will definitely become zero zero."

With a suspicious eye fixed on the enforced sobriety of my countenance, the would-be golfer muttered his thanks and backed toward the door.

FOR KEEPS

It's rare that a forecast can be given in a jocular vein. There was no kidding when a man on outpost duty was striken with acute appendicitis. The pilots who volunteered to go in on skis to his rescue needed quick and accurate weather advice.

Then there was the time we were asked to forecast the frequency of icebergs in an ocean area where several fliers had crash-landed. Their lives hung in a balance that depended on weather, and the scales swung down: no plane or boat was able to reach them, through or over the ice floes.

FOR RANK

The heat is on when the Commanding General asks for weather information: One rainy day the CG in person asked for the exact time when precipitation would cease.

We guessed at the effects of our forecast on the military problem which the general must be pondering: all the fatal consequences of a miss loomed forebodingly. Finally we gave birth to a forecast. "Rain will stop at 1430 local time, sir."

As the CG left the office, we heard him calling to someone down the corridor. "My forecaster says it will stop raining at 1430 local. What does your man say about it?"

"My man says not before 1700," a familiar voice, that of the Canadian Admiral, said in reply.

The fate of minions---our neck or the Canadian weatherman's---hung in the balance as 1410, and even 1420, passed. And still it rained. At 1425 a warm front went by our station and the precip stopped. Don't ask how we did it, just pass the salt tablets!

Please Colonel Merewether, can you send us the Delphian Oracle as a Technical Consultant?

WEATHER COMMUNICATIONS

A series of handbooks being published by AACS answers a long standing need in the field for a comprehensive statement of weather-circuit operating schedules, as well as for the complete contents of all weather transmissions carried on AACS circuits.

The AACS Weather Transmission Handbook, *being prepared for each of the areas encompassed by the eight AACS Wings, contains complete manuals of operations (manops) for all weather circuits in the particular area, and a detailed breakdown of every weather collective.*

The AACS Weather Transmission Handbook for Alaska, *covering the 11th and 16th Weather Regions, and a handbook for the continental United States have been distributed.*

Procedures to be followed in transmitting weather data on landline teletype, radioteletype, and radiotelegraph will be treated in AACS Manual 1-15, Operations, Weather Transmission Operating Procedure, *scheduled for general release by the end of the year. This publication will supersede the present procedure instructions in* AACS Manual of Operations.

SECURITY CHECK

A handbook for Weather Intelligence Officers, to guide them in interpreting the Weather Service applications of official regulations and publications, has been prepared by the Weather Wing's Intelligence Division.

Squadron activities are expected to develop further precepts for successful operation of Weather Service Intelligence. Because this future experience will pérmit the refinement of many methods and procedures, the handbook has been bound in loose-leaf.

The Station Weather Officer necessarily performs certain Intelligence functions. He should not feel backward about seeking advice and assistance from the Weather Intelligence Officer in his Region. Chapter III, Part A, "Security," of the handbook has an appendix which is reproduced here for the benefit of the Station Weather Officer.

Does each man know and understand the provisions of Intelligence regulations which are pertinent to his duty, as they are pointed out by the station weather officer? (AR 380-5, AAF Regulation 105-1, FM 30-25, the Espionage Act, and Intelligence memorandums, bulletins, and letters).

Continuous supervision and instruction should be maintained to counteract the growth of laxity and carelessness in matters of Security. Especially, newly assigned personnel ought to be oriented to their Security duties from the first.

Where is the nearest Intelligence Office?

It should be notified in cases of suspected sabotage, and about individuals who spread malicious rumors and propaganda.

WEATHER

Is each map, or other document which contains classified information, marked and handled in the way appropriate for the information of highest classification which it contains?

(1) The directives specifying classification of weather information from various world areas should be understood, complied with, and be available for reference. (2) It is important to display, conceal, or store classified information properly; and to release it only to officially-authorized individuals. (3) When the reason for classification no longer exists, material ought to be declassified.

Are the codes, ciphers, and procedures in use carefully confined to those of War Department origin?

Is the station marked "Restricted" when such notice is required?

In regard to foreign regions,

Are aircraft-clearance forecasts properly classified?

Are instructions for obtaining emergency information in the clear widespread and explicit?

Is AAF Letter 55-3 used to guide the encoding of messages which describe aircraft movements?

SAFEGUARDS

Is the station adequately protected from fire and other dangers?

(1) Hydrogen shelter marked with warning. (2) Fire extinguisher handy and serviceable. (3) All inflammable liquids and materials removed to safety when not in use. (4) Adequate warning system in effect for fire, air raid, gas, or armed attack. (5) Knowledge by each man of his specific duties in every type of warning. (6) Sufficient precautions for station and equipment against high winds, flood, and the like.

Is the safe which contains classified matter an adequate security device?

(1) Fireproof and three-way combination. (2) Combination changed every six months, or as specified in theatre, or when someone who knows the combination is transferred. (3) Card attached to the inside of each door or drawer opening to the exterior; a card which lists the names, addresses, and telephone numbers of persons to be notified in the event that the safe is discovered open and unguarded. The same data should be given about each one who knows the combination, and the date on which the combination was last changed.

Is a register kept of Secret and Confidential document movements?

Record (1) incoming and outgoing Secret and Confidential letters, and (2) withdrawal of Secret and Confidential material from the safe, assigned to the person responsible.

Simple Navigation of Aircraft: Part III

Part I of this series discussed two elementary but sound methods for navigating flights, Pilotage and Dead Reckoning. A somewhat more complex procedure, Celestial Navigation, is applicable to longer routes and to many special conditions of weather and terrain. The discussion below touches only the main principles of celestial methods; those who want a more detailed understanding can consult the standard text, "Air Navigation," by P.V.H. Weems.

This installment is particularly appropriate as background for the intriguing contribution, "Oceanic Fixes" which follows on page 6.

An important problem facing every navigator, obtaining frequent fixes of position, is complicated by the presence of an undercast, night's obscurity, poor visibility, or flight over extensive water surfaces and unmarked terrain. These difficult situations were chosen for mention here because each one can be met by reference to heavenly bodies.

To demonstrate briefly the theory underlying Celestial Navigation, consider that astronomy provides us with tables (e.g. in the *Air Almanac*), which for a given date and time will describe the relative positions of Earth and particular stars. This relation is given in implicit terms of a *Geographical Position* (GP), which is the point on Earth directly below whatever stellar body is considered.

When a navigator "shoots" a star, he measures its angular *altitude* above the horizon with a sextant. As shown by figure 1, this measured angle will partly determine his position, locating him along the circumference of a circle on the earth's surface, drawn with the star's Geographical Position as center. Everywhere along this "circle of position" the sextant reading is the same, but Dead Reckoning restricts the possibilities to a relatively short arc. This arc of position is plotted with GP as center and a radius equal to (90^o - altitude) in a scale of latitude degrees, for reasons shown in figure 5. Two such plots which intersect, taken from different stars of course, will fix the aircraft at a pinpoint.

Unfortunately, either the distances

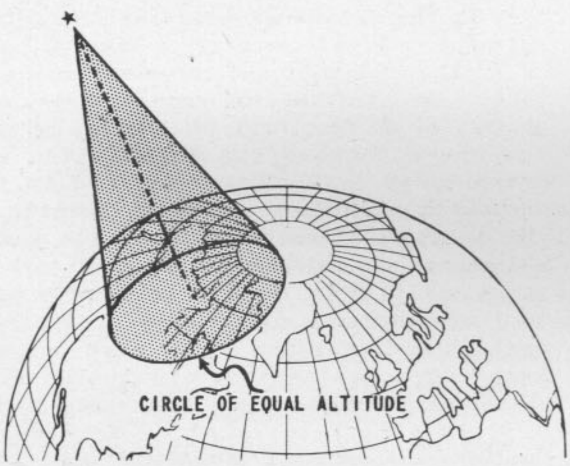


Figure 1: *A Circle of Equal Altitude.* A sextant reading of star altitude locates the observer as being somewhere on the circumference of a circle drawn with the star's Geographical Position as center. Its radius is equal to (90^o- altitude), for reasons demonstrated in figure 5.

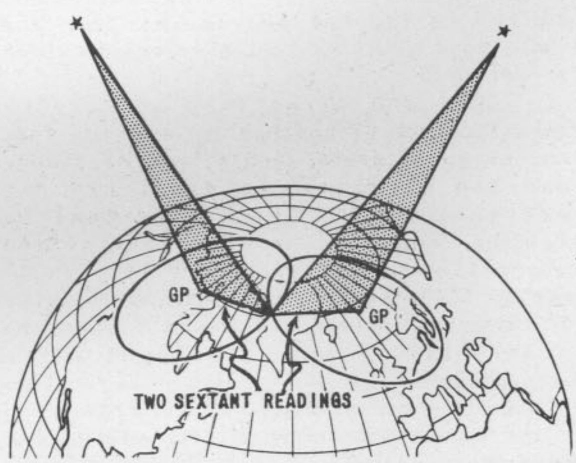


Figure 2: Two celestial observations will fix the aircraft at one intersection of two Circles of Equal Altitude; the other point is always absurd. This direct method is modified in practice; sextant observations are used to *correct* altitudes derived from the Dead Reckoning Position.

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GCT	☉ SUN GHA	Dec.	♈ GHA	VENUS 3.5 GHA	Dec.	MARS 0.2 GHA	Dec.	JUPITER 2.1 GHA	Dec.	☽ MOON GHA	Dec.	☾ Par.	
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		
0 00	176 25	S14 08	140 56	211 23	S21 39	72 15	N 24 32	356 08	N15 11	326 41	N 6 35		
10	178 55		143 26	213 52		74 45		358 39		329 07	33		
20	181 25		145 57	216 22		77 15		1 09		331 32	31		
30	183 55 ·	·	148 27	218 52 ·	·	79 45 ·	·	3 39 ·	·	333 58 ·	30		East
40	186 25		150 57	221 22		82 16		6 10		336 24	28		
50	188 55		153 28	223 52		84 46		8 40		338 49	26		
1 00	191 25	S14 07	155 58	226 22	S21 38	87 16	N24 32	11 11	N15 11	341 15	N 6 25		

or the angles involved in such a direct measurement are too great to permit real accuracy. Instead, an indirect approach to the same solution has proven to be more exact.

An assumption is made that the Dead Reckoning location of the aircraft is correct. Then a computation is performed to see what altitude of a reference star follows from that supposition. Finally, an observation of the star's actual altitude at the plane's real position reveals the necessary correction of Dead Reckoning: displacement of one nautical mile is associated with an altitude differential of one minute.

COMPUTING ALTITUDE

The computed altitude is obtained by examination of the "Astronomical Triangle" (fig 3), which is drawn with the following apexes: X, the Dead Reckoning fix; B, the North Pole; and A, the Geographical Position of the reference star. The star's GP is located by information obtained from astronomical tables, which give the *Declination* (90°-AB) and the *Greenwich Hour Angle* (longitude of GP): see the "American Air Almanac" page reproduced above.

With this data and the Dead Reckoning Position, it is possible to determine the Astronomical Triangle for the situation. AB comes from the Declination by subtraction. BX is simply (90°-Dead Reckoning latitude). The included angle, ABX, is the difference between the Greenwich Hour Angle and the longitude of the Dead Reckoning position.

Once the Astronomical Triangle has been drawn, the angular value of side AX can be measured in terms of latitude degrees. The reasoning of figure 5. certifies that this value contributes to a fix: it is the distance of the aircraft from a known point, GP, based on an assumption that the Dead Reckoning position is correct.

CORRECTING COMPUTED ALTITUDE

However, if the observed altitude is different from the computed altitude (say 15' greater), the aircraft is actually somewhere on a concentric circle of different radius (15' or 15 nautical miles shorter) than the original Circle of Position found as shown in figure 4.

Since the radii of these circles is usually very great, and the extent of a particular navigation chart relatively small, the slightly-curved arcs which theoretically ought to be drawn are actually entered as straight "Lines of Position, (LOP)." An LOP is always drawn perpendicular to the azimuth line from GP, so as to secure the best possible approximation to its arc. The intersection of two or more lines of position is needed to determine a pinpoint fix.

(continued to page 7)

Figure 3: *The Astronomical Triangle* is used to compute the star altitude consistent with the Dead Reckoning Position, X ; the side AX is equal to (90°-altitude). This side can be measured after reference to tables has permitted the plotting of side AB, angle ABX, and side BX.

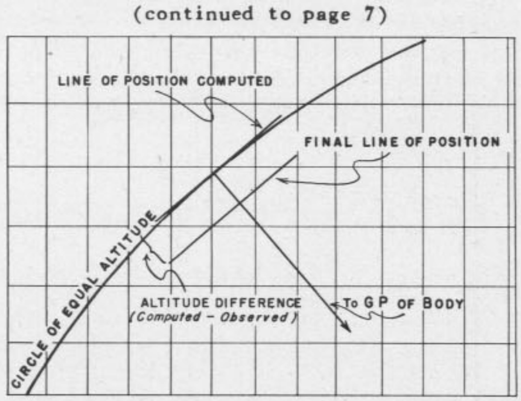


Figure 4: The side AX is used to plot an Arc of Position (more conveniently, a Line of Position), but this plot has relied on the accuracy of Dead Reckoning. This line must therefore be adjusted to agree with an actual observation of star altitude, one mile for each minute of discrepancy.

OCEANIC FIXES

By Lt. HERBERT W. MUELLER

The most effective yet simple method for computing wind velocities on oceanic flights calls for sighting whitecaps through a driftmeter. While the total wind vector can be so obtained with precision and dispatch, large water bodies are often covered with a solid undercast over great areas. Radio altimetry can then be put into use for wind determination; except that this procedure requires a real delay enroute if the full wind vector has to be found. However, this paper will describe a combination of celestial and radio altimeter methods which will establish reliable fixes above a cloud layer without additions to the flying time. C-54 Weather Ship experience certifies its value.

Wind finding by radio (absolute) altimetry is explained on page 6 of the October *Weather Service Bulletin*. Briefly, the aircraft should be flown in a double drift procedure along an isobaric surface: that is, by maintaining a constant reading of the pressure altimeter. The gradient of absolute altitude measures one component of the wind on each leg. Unfortunately, the slope of isobaric surfaces is slight, and each leg must be protracted to at least 20 minutes of flight (meaning a loss of 12 minutes in progress on course). In practice, the determination is confined to the component of wind perpendicular to the course (that which produces drift), because it can be found without a change in heading (figure 1).

Knowledge of the drift in effect is of prime value: that information is used in computing the True Heading appropriate for maintenance of the True Course. Yet drift alone is not enough data for defining the time enroute (tailwind) or a fix.

Reference to several stars will suffice for locating a ship at night, according to the methods of celestial navigation described in the preceding article. But in daylight hours of oceanic flight, the sun is usually the only marker which is both visible and determinate. Students of trigonometry know that one point of reference will yield only a *Line of Position* (Sun Line in this case) rather than a "pinpoint fix." However, as shown in the example below, it is possible to consider the intersection of the two Lines of Position, drift and Sun Line, and so to secure both fixes and Air Plot winds.

Now for the example (figure 2):

A B-17 is en route from Newfoundland to Scotland over a status undercast; no more than scattered cirrus prevails aloft. After an hour of flight, the navigator radios to shore a request for a fix, and assists by transmitting regular signals. The Radio Direction Finding network plots several bearings taken on the plane by several of its stations, evaluates them, and then sends the navigator his actual position.

From this known point, the navigator keeps track of his deviations from the True Course when they occur by measuring drift with the absolute altimeter. The angle so obtained, kept as a weighted average through frequent altimeter obs, is laid off from the True Heading, with the fix as apex. The line so drawn is a reliable locus of position.

Celestial Navigation, resorted to at hourly intervals, places the aircraft at points along the True Course (measures the tailwind additions to True Air Speed, that is). A Line of Position taken on the Sun,

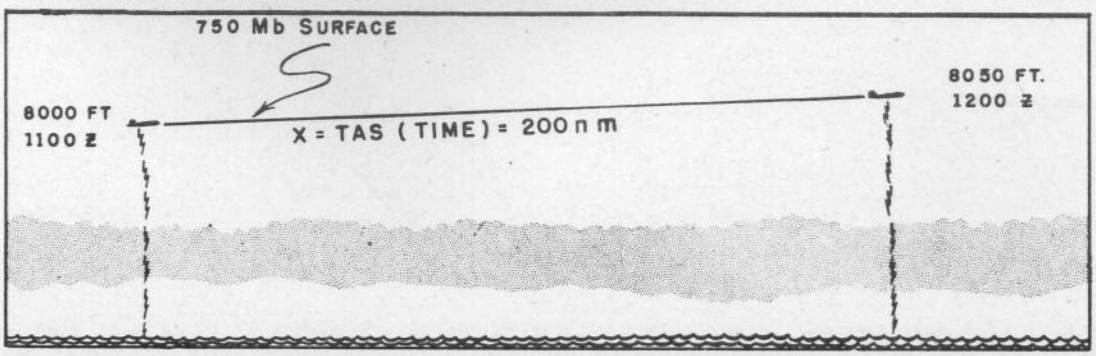


Figure 1: The standard atmosphere height of the 750mb surface is 8,088 ft, so the altimeter corrections are -88 ft at 1100 and -38 ft at 1200. This data substituted in the formula: $c = \frac{21.47\ (D_2 - D_1)}{x \sin \phi}$ reveals that the geostrophic *crosswind* at flight level is about 11 knots.

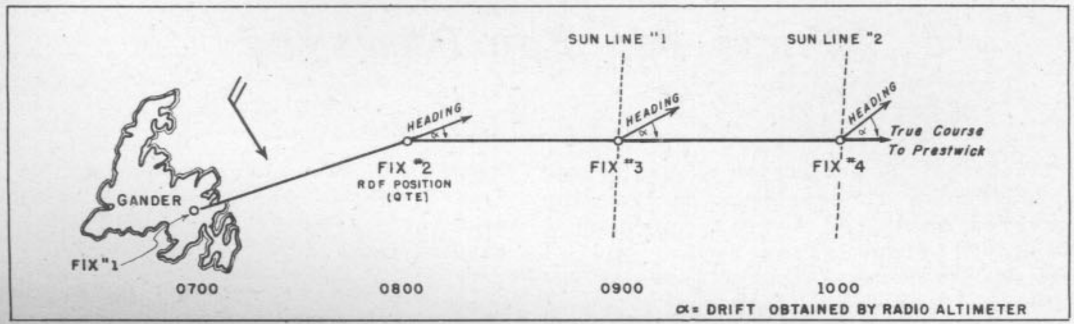


Figure 2: Frequent crosswind computations permit adjustment of the heading to keep the plane on a known course. Where this course intersects a Sun Line (of position), a pinpoint fix is determined.

if it intersects the True Course at more than 15o, is a second linear locus.

Resort to the vector diagram of

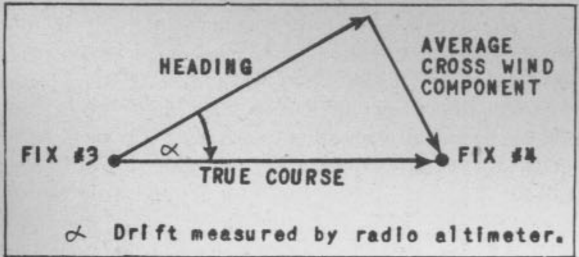


Figure 3

figure 3, or to the handy E-6B computer, will produce the average wind velocity for the period between fixes, which must be converted from odd periods of time to one hour before interpretation is feasible.

Only one aspect of absolute altimetry's application to navigation and meteorology has been brought out here. Eighth Weather has been testing and developing such new techniques, especially in its "laboratory" of C-54 Weather Ship flights across the North Atlantic, for improvement of the ever-difficult ocean analysis.

(continued from page 5)

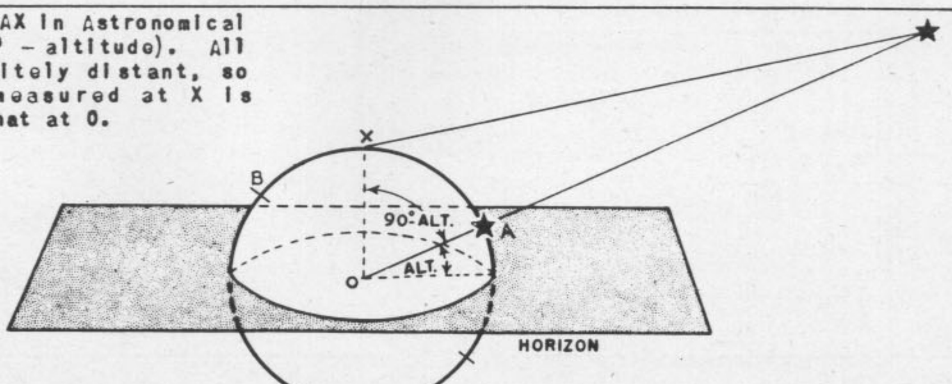
To determine a number of LOP by celestial means, it is necessary to take nearly simultaneous sextant observations of the same number of heavenly bodies. But during the daytime, the sun is ordinarily the only heavenly body visible. Celestial navigation will then give only a single line of position, a *Sun Line.* This information may sometimes be all the navigator needs from the stars. "Oceanic Fixes" (see above) discusses such a case. Under similar circumstances, one of these recourses can be followed:

1. *Cross a sun line with other sun lines.* At local noon the azimuth of the sun changes very rapidly, especially in low latitudes. One sun line can be taken a half hour before noon, a different one at noon, and another a half hour after noon. Then when all three lines are "moved up" to a single reference time (with Ground Speed, time elapsed, and True Course), a reliable fix is obtained at their intersection.

2. *Cross a sun line with a coast line.* When the plane is crossing some terrestrial line which happens to be barren of pilotage fixes, the intersection of a sun line taken while crossing it and the shore line itself is a fix.

3. *Cross a sun line with a moon line.* Sometimes the moon, Venus, or Jupiter is visible in daytime to permit intersecting two circles of equal altitude.

Figure 5: Side AX in Astronomical Triangles is (90° – altitude). All stars are infinitely distant, so the altitude measured at X is about equal to that at O.



FIRST AID FOR BRIEFERS

Lantern-slide projection should become a larger factor in briefing and training activities with the introduction of a reel-and-film apparatus by Lt. Virgil O'Connor. The preparation of drawings for projection now can be a rapid and economic process. Further, images are so much brighter than those of projection by reflection (Epediascope and Delineascope) that complete darkening of the room is unnecessary. An instructor is enabled to enter synoptic details in chalk *during the briefing session*, over the permanent features of map or cross-section thrown on a blackboard by the new projection technique.

O'Connor's device is a frame and reel combination that holds a roll of tracing material (paper, film, or non-moistureproof Cellophane). This unit replaces the glass slides and carrier in any standard projector.

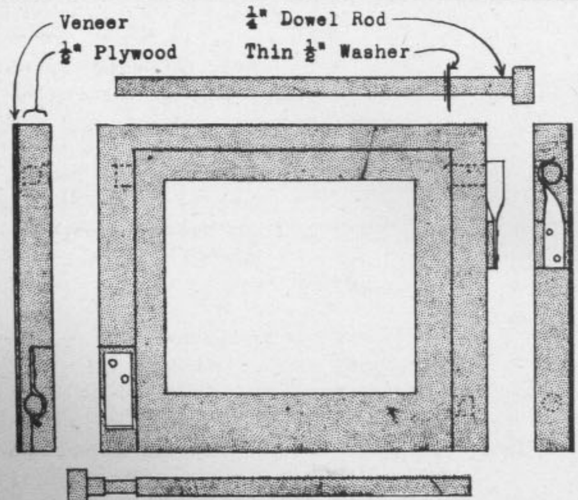
Tracing film (frosted acetate sheets, put out under such trade names as *Tracofilm* and *Vinylite*) can be marked with pencil, ink, typewriter, colored crayon, or lithography; and erasure is easy. A whole series can be projected continuously, because as many as 12 drawings have been placed on one roll. The thickness of the film should not exceed 0.003 inch. Although there is no authority for requisition of this item by weathermen, Air Corps Supply can make special requisition. Many Army agencies, including Army Map Service and the Corps of Engineers, use it as tracing paper.

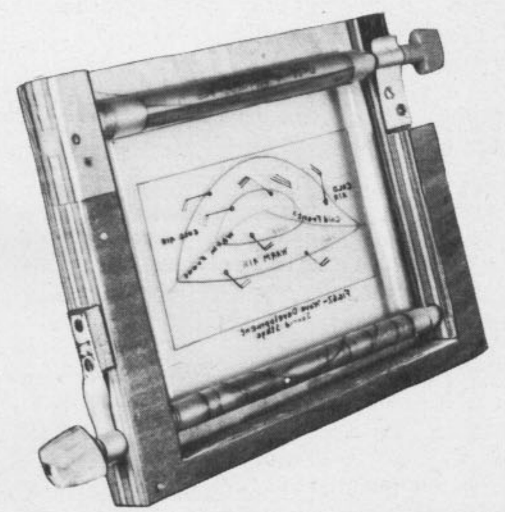
Non-moistureproof Cellophane is better when drawings are to be projected on a blackboard.

This plan was followed in making a frame for use in a lantern which carries 3 x 4 inch glass slides:

The reel frame was constructed of 1/2 in. plywood, 5 1/2 x 4 5/8 in., and a thin piece of veneer of the same width and length. A block (5 1/2 x 4 1/4 in.) cut out of the plywood forms the *rear* opening. (This plywood block was saved for use as a backing when one is drawing on the film after it has been rolled on the frame.) The veneer was fitted over the *front* of the reel, after having a 3 1/2 x 3 in. rectangular opening cut into it for framing each image. Other details are given in the plan drawing.

The bottom reel can be removed by slipping it out from under the spring at the lower, right-hand corner of the photograph. It is most convenient to wind the roll on the lower reel during use, and then to remove both reel and film for storage. To this end, several spare reels should be produced when the frame is made.





STRATUS RESEARCH

*A low, thin layer of stratus or stratocumulus is a flying hazard in the summer at many coastal airports in the United States. At San Francisco and Oakland, stratus occurs on an average of 25 days in the month of July, and is frequent from the middle of May to early in October. This cloud deck is often regarded as a California phenomenon because of its great frequency there, but **a similar** stratus is often reported from East, Gulf, and West Coast stations.*

Classical forecasting procedures are frequently inadequate for this problem. After a period in which stratus has been following an orthodox pattern (arriving early at night and dissipating the following forenoon), the sky may remain clear throughout the night and until 0900 LST, when stratus may form and continue all day without any change taking place in the surface map. Extensive research is in progress at several centers in California, under the joint auspices of Army, Navy, and Weather Bureau, to develop satisfactory stratus forecasting techniques.

from

REPORT ON THE PROGRESS OF THE STRATUS RESEARCH PROGRAM AT BURBANK
(Available as Weather Division Report 796)
by K.C. Fink, U.S. Weather Bureau

Part I

West Coast valley stratus is principally advective: the clouds are normally observed offshore first, and over coastal stations before appearance in the inland valley. Reports from island stations 15-20 miles offshore indicate that stratus frequently does not dissipate there, even when the sky clears before noon inland. Then there seems to be an unlimited reservoir of stratus at sea, which only awaits favorable circumstances to advance onshore.

Yet pure advection is sometimes overshadowed by a topographic effect in California. When a strong onshore gradient exists, marine air is forced against the 5,000-10,000 foot coastal mountains, pushing up against the prevailing inversion. This marine air rising against the orographic dam may lift the inversion from its characteristic height of 1,000 feet to the height of the lowest mountain passes with surprising rapidity. This theory is supported by some concurrent reports of higher stratus tops from Mt. Wilson inland than from Catalina Island on the coast.

In such a situation, the time interval between stratus appearance over the coast and over inland stations may be shortened considerably. In a few cases the sequence of formation has even been reversed: stratus formed inland first.

Experience reveals that isobars parallel to the coast, producing onshore flow in the frictional layer, are correlatable to stratus formation. The *strength* of the onshore gradient seems to be less important.

Fronts usually strengthen the onshore gradient just mentioned, although there are wide variations in their effects depending on location, orientation, and strength. In general, any front south of the Oregon border on the 1630 PST map must be given careful consideration. Even when dew points are in the low 40's in the afternoon, stratus may form before morning when an active frontal circulation suddenly produces an appropriate pressure field.

The relative frequency of fronts in spring produces the greatest variations in stratus activity and the highest stratus ceilings in that season. The pressure field stagnates as summer approaches: stratus formations become more regular, have lower ceilings, and rarely reach high stations on the coastal section. In the fall and winter, the Great Basin High is semi-permanent, shutting off airflow from the sea and advective stratus.

Advection of subsiding air from the Pacific High with prevailing northwest winds along the California Coast is a fundamental influence on stratus. The coastal outline is such that upwelling is produced by this flow, accentuating the subsidence inversion. The part which radiation plays in stratus formation has not been demonstrated clearly, but *purely* radiation fogs are ordinarily a winter phenomenon only. There is empirical evidence that a deep, moist current will always inhibit stratus formation over the ocean, indicating a significant role for radiation.

EMPIRICAL RULES

If the gradient wind at 1730 PST is definitely offshore, there is no risk of stratus development over land, unless the pressure field is reversed within six hours. Conversely, a strong marine flow is a primary indication of stratus formation, doubtful only when other evidence is definitely contradictory.

Most frequently, it is a southwest wind aloft (below 10,000 feet) that is associated with stratus over land. On the other hand, flow from between north and east is enough in itself to justify a "no stratus" forecast. Northwesterly winds (force 3 or more) are unfavorable, but not definitively so. South or southeast winds aloft are usually moist currents in which there is considerable cumulus development at intermediate levels, and the presence of high moisture aloft is associated with variable and patchy stratus or none at all.

A favorable thermodynamic structure shows a dry adiabatic lapse rate and high moisture content between the surface and some level as high as 2,000 feet, above which there exists a sharp inversion and comparatively dry air. Airlines takeoff and landing APOBs, particularly those in the late afternoon, are excellent sources for pertinent thermodynamic information.

Once the forecaster has decided whether stratus will develop, he must determine the time of formation and ceiling height. A careful study of "24 hour comparisons" is fruitful in these particulars: pressure field, extent of stratus, time of development, ceiling, afternoon temperatures and dew points, upper winds, and visibility.

Dissipation of stratus is much simpler to forecast than its development. The processes active in clearing away stratus decks are insolational heating, divergence in the lower levels, and turbulent mixing with drier air aloft. Insolational heating is by far the most important of these considerations, and fortunately, the easiest to deal with. (Forecasting school lectures demonstrated how to predict the surface temperature which would "burn off" the stratus deck by producing, with an unstable lapse rate, a high-enough temperature at the inversion base to destroy saturation there).

Convergence occurs with the approach of fronts, particularly over Nevada. In such cases the clearing will be delayed by from 1 to 6 hours, or perhaps the stratus will persist both day and night.

On the other hand, significant divergence frequently occurs in the lower levels following the passage of a cold front or with the eastward movement of a Nevadan Low. The onshore flow preceding a front, which maintained a packing of marine air against the coastal range and consequently persistent stratus, drops off as the front passes. Then the marine air against the dam settles, destroying the cloud deck *after dark* when convective heating no longer counteracts subsidence.

Many factors must be considered together in forecasting the development and dissipation of stratus. Although the clearly-defined situations can be handled decisively, sometimes variables are present which support conflicting conclusions. Then careful judgment and valuable experience are not even certain to produce a satisfactory forecast with current methods.

RESEARCH PROGRESS

by Morris Neiburger and Lts. Charles Beer, Luna Leopold, and J.M. Setterberg

Part II

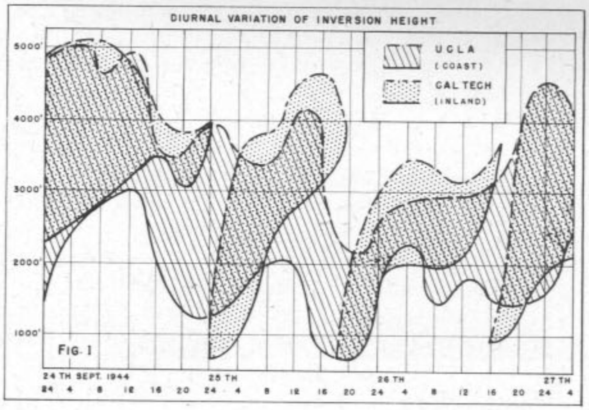
The atmosphere over Southern California has been probed repeatedly during the past summer, as part of the Stratus Research Project. Thousands of regular and special APOBs, RAWINs, RAOBs, PIBALs, RABALs, and captive balloon soundings have been gathered and are being analyzed at the present time. Certain preliminary conclusions from these data are presented in this article, although the final report of the project will not be ready before 1945.

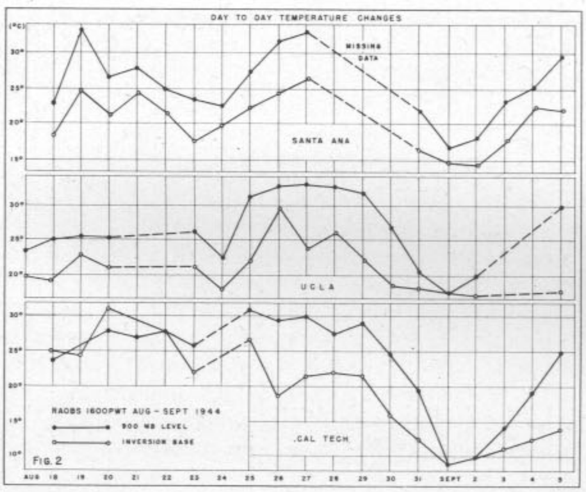
INVERSION HEIGHT

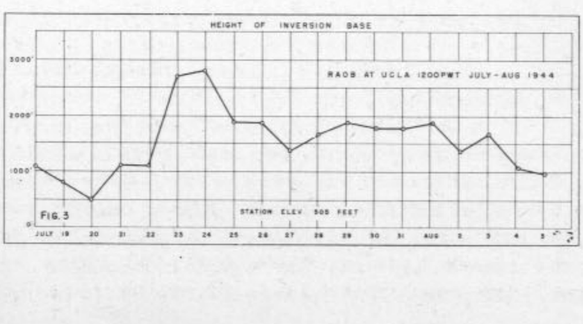
The height of the characteristic inversion has been found to vary considerably, diurnally as well as from day to day. Fluctuations of the top were more irregular than those of the base. Maximum heights were most frequently observed in the morning (on 31 of 56 days at U.C.L.A., max occurred between 0800 and 1400 PWT), and minima most often in the evening (on 33 of

58 days at U.C.L.A., between 2000 and 0200 PWT). Inland, the inversion tends to be wiped out by daytime heating, and to be replaced at night by a new inversion at or near the ground.

The average daily inversion height shows general trends, with periods of several days when it is low, followed by periods of higher values for several days (figure 1). Furthermore, stations under study regularly show a heating or cooling through a deep layer that is practically simultaneous (figure 2). But little or no correlation with height was found in strength of the thermal low or in upper wind flow.







INVERSION STRENGTH

The strength of the inversion seems to have a diurnal period quite out of phase with the height. The maximum difference in altitude between base and top occurred at 0400 PWT in 11 cases out of a 16 day sample, and the minimum difference at 1200 PWT in 10 cases out of a 19 day sample (at U.C.L.A.). Preliminary analysis suggests that subsidence is the principal cause of variation in inversion strength when heating is in progress, although subsidence is no definite indication in periods of cooling.

Stratus formation usually occurred progressively later as the distance normal to the coast was increased: anytime between sunset and shortly after sunrise. Dissipation showed an opposite trend, earlier onshore and later over the ocean: anytime in day or night, but predominantly between 0800 and 1400 PWT. The ceiling during formation was usually 100-200 feet lower than the inversion base, while the ceiling during dissipation approached the inversion base height closely.

An experimental device (unavailable to the Weather Service at present), a "cloud top indicator," was tested by comparison with raobs; placing the stratus top within 100 feet of the inversion base about 90% of the time.

Relative humidity indicated by the electric hygrometer in 84 stratus layers was:

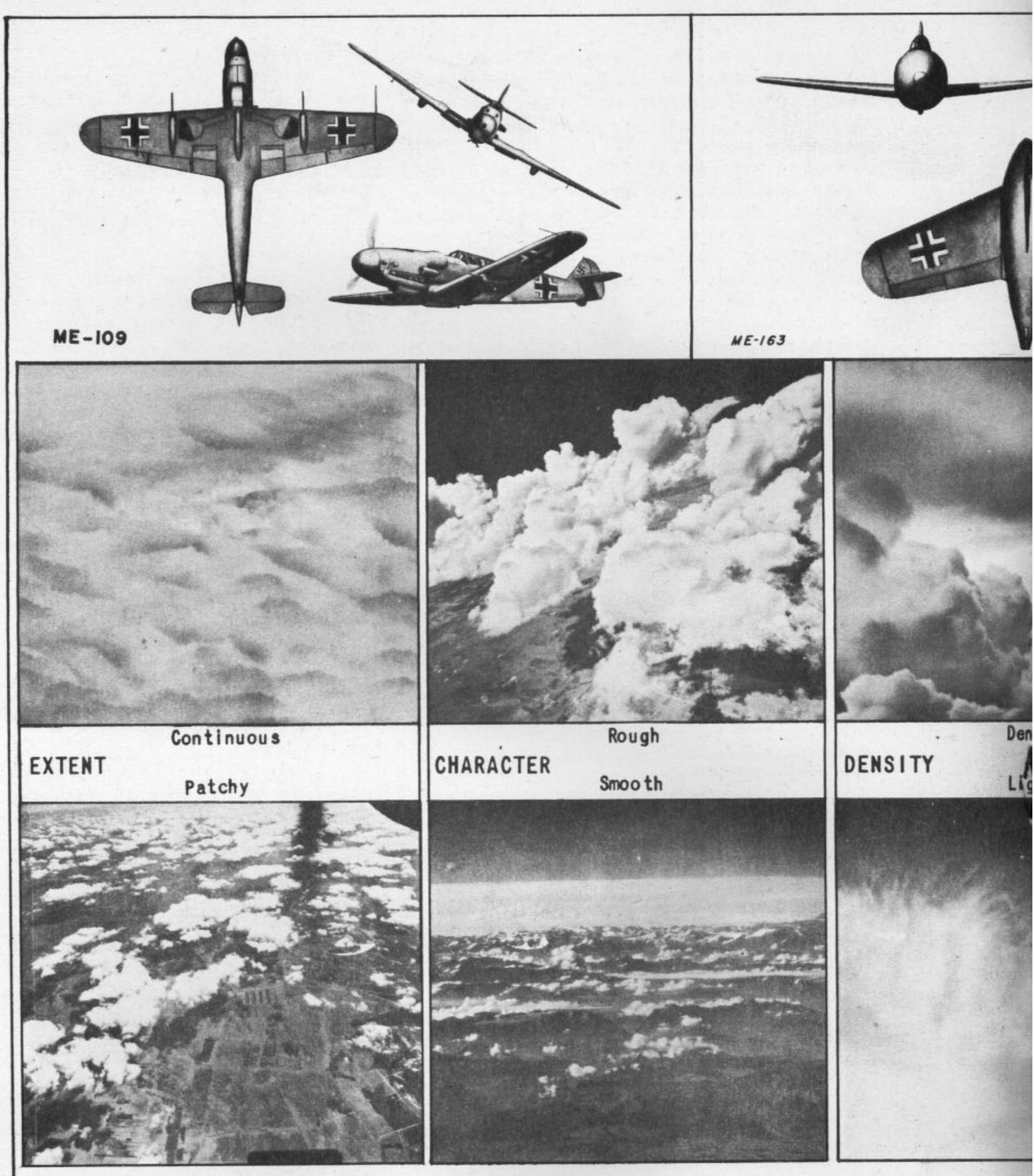
100%	in	2	cases
96 - 99%	in	6	"
85 - 95%	in	55	"
76 - 84%	in	21	"

No cases below 76%

The sea breeze, merging with a valley wind, occurs at all stations in the Los Angeles Basin as far inland as 70 miles. This flow is directed perpendicular to the coast near the shoreline, but runs along the valleys farther inland. The wind at U.C.L.A. usually backs with height up to 2,000 feet, indicating that thermal effects and accelerations predominate over frictional forces.

The preliminary conclusions given above will be supplemented by additional study of the wealth of data already collected. Sea surface temperatures, radiation, mixing ratios, humidities, and many other variables will be considered.

Attention is invited to:
"Temperature Changes During Formation and Dissipation of West Coast Stratus" by Morris Neiburger---*Weather Bureau Research Paper #19.*



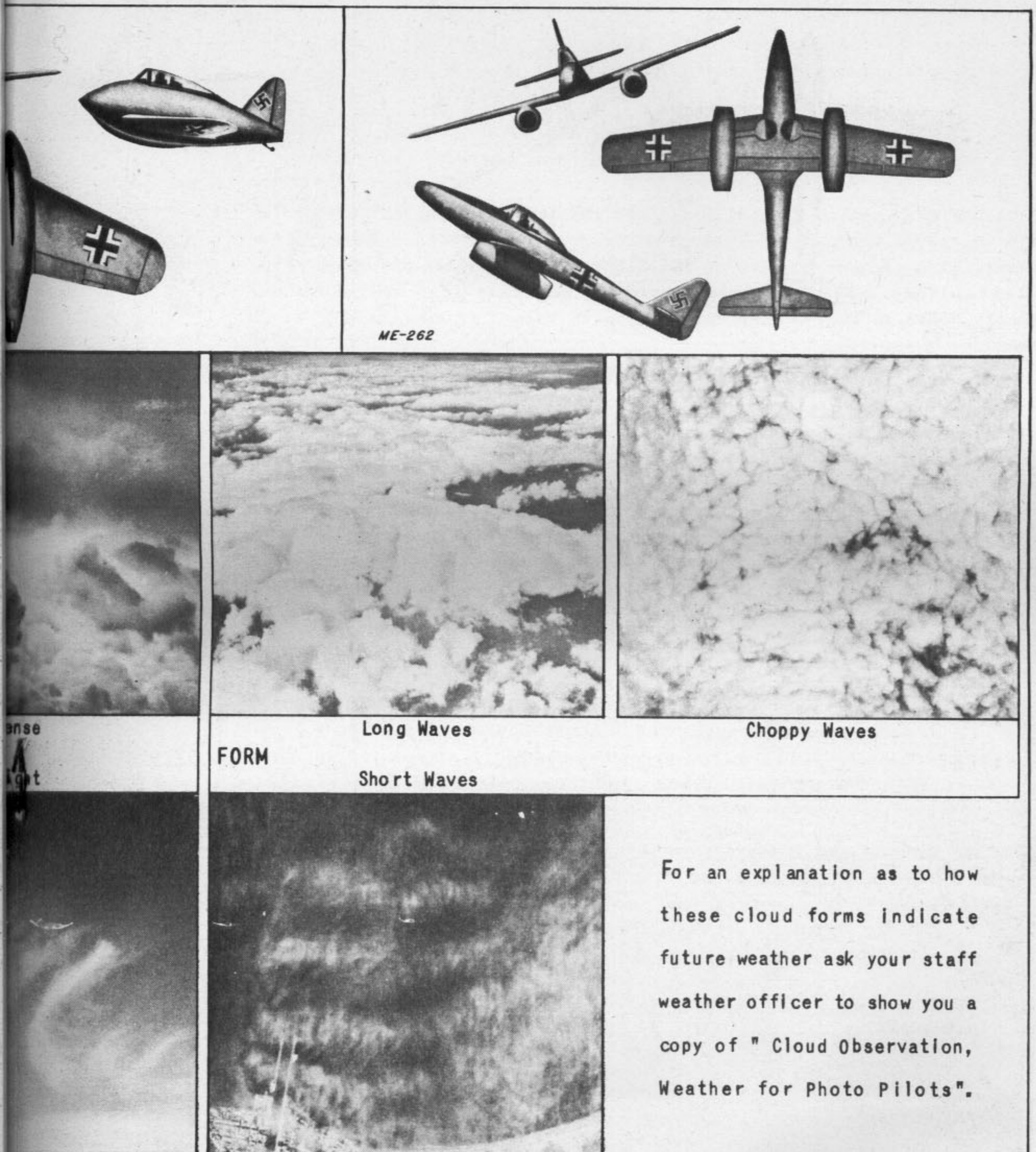
Prepared by 12th Weather from MAPRW Photos

METRO ALLURE

by LT. M. B. STRELITZ

Pilot reports of cloud formations became far more reliable when this supplementary PIREP sheet was prepared by detachments of the 12th Weather Squadron. These aerial photographs, taken by P-38's on photo reconnaissance in the theater of operations, have introduced to aircrews a new understanding of cloud characteristics from the perspective of a combat mission. *The form shown is only one of the "window dressing" devices used to entice 15th Air Force flyers into weather consciousness.*

A "battle progress" map, kept up-to-the-minute with late reports, makes the weather station a focal point of interest. Recent models of Nazi interceptors, naturally a subject for profound concern, are pictured in several weather publications. This chart, for example, presents two jet-propelled Messerschmitts *with top speeds (for 40*



Reproduced by 516 Corps Field Survey Coy. R.E. Oct 1944.

minutes) in excess of 500 mph.

Nephanalysis of the synoptic situation is not confused by professional weather symbols: a base map is covered by two Plexiglas sheets, one outlining high cloud cover and the other defining low cloudiness. Weather expectancies are pointed out by another European map; one which has the various climatological areas, in terms of bombing days per month, colored in over geographical boundaries.

The importance of PIREPS in weather planning is a most significant message for emphasis to flyers, because only their care and willingness in taking obs assures that this information will be reliable. All PIREPS regularly are plotted on transparent overlays for prominent display.

These details are part of an effort to get crews into the weather station, where they can see Weather's part in planning missions. The forecaster is instructed to answer any questions in non-technical terms, to show why he expects the weather he is forecasting, and to use photographs and diagrams to illustrate his points.

isallobaric centers

By Lts. JAMES MORRIS & PAUL CRISCILLIS

A new forecasting aid has come into general use among AAF meteorologists in recent months, the Pressure-Change Correlations*. Briefly, the presence of a pronounced 24-hour isallobaric center at levels above 5 km. indicates that an isallobaric center of opposite sign will be found directly below on the surface chart 24 hours later, *if certain conditions exist.*

This relationship, which Bice and Stephens applied to North American conditions, was evaluated during four summer months at the Wing Weather Station from an unorthodox point of view: to determine whether an *unconditional* interpretation could be given to the Correlations. If this proposition was to prove unworkable, the limitations appropriate for summer months would be sought out. Surface charts were compared with 20,000 foot charts between May and August of this year: every 20,000 foot isallobaric center of 5 mb. or more was checked for pressure changes at the surface 24 hours later.

The investigation summary given below demonstrates that a *blind* expectation of Correlation fulfillment would have been disappointed 41% of the time. In view of the fact that Bice and Stephens declare that the Correlations work in certain situations only, this result of the study may appear to be needless insistence. But the fact remains that many field forecasters *do* attempt to use the pressure-change relationships in *every* situation, and are scornful when their prognostic pressures fail to verify.

PRESSURE-CHANGE CORRELATIONS BETWEEN SURFACE AND 20,000 FEET

Number of isallobaric centers considered		307
Positive steering when no surface systems were involved		107
Excellent centers	33	
Fair centers	32	
Poor centers	42	
Lack of steering when no surface systems were involved		97
Excellent centers	23	
Fair centers	27	
Poor centers	47	
Excellent steering for Highs		11
Excellent centers	6	
Fair centers	4	
Poor centers	1	
Excellent steering for Lows		17
Excellent centers	8	
Fair centers	3	
Poor centers	6	
Fair steering for Highs		13
Excellent centers	2	
Fair centers	5	
Poor centers	6	
Fair steering for Lows		14
Excellent centers	9	
Fair centers	3	
Poor centers	2	
Negative steering for Highs		18
Excellent centers	8	
Fair centers	7	
Poor centers	3	
Negative steering for Lows		12
Excellent centers	4	
Fair centers	2	
Poor centers	6	
Wave developments associated with isallobaric maxima aloft		9
Excellent centers	6	
Fair centers	2	
Poor centers	1	
Wave developments associated with isallobaric minima aloft		6
Excellent centers	1	
Fair centers	4	
Poor centers	1	

**Correlations of Isallobaric Patterns in the High Atmosphere with those at the Surface*, by E.G. Bice and G.T. Stephens, distributed to all stations. This study calls for the use of 13 km isallobars in summer situations, but the 20,000 foot chart is preferred in the field for its greater density of raobs, and for that reason was used in the Wing Weather Station analysis.

Seven conditions are imposed on use of the Pressure-Change Correlations at this station; some of them as indicated in the Bice-Stephens paper, others as developed in the field.

1) Isallobaric centers must be at least five mb. in strength before they can be considered.

2) Centers must be associated with surface systems; that is, a distinct High or Low must be within a reasonable 24-hour distance of the center. The foregoing table shows that isallobaric centers dissociated from distinct surface systems have no forecastable effect on the surface pressure pattern: 107 cases correlated properly and 97 cases correlated negatively.

3) Centers must not be used unless the proper surface systems are being *steered* into the centers by the 20,000 foot winds.

4) Centers on the 20,000 foot chart must not be used unless 13 or 16 km. charts show tendencies of a similar sign and magnitude. Thus if a plus five mb. tendency is found at 20,000 feet and a minus four mb. tendency is found at 16 km., the first center must not be used.

The correlations are based on the concept of an atmosphere moving in the same general direction at all levels during the 24 hours after that direction first had been established at high levels. Only then would a broad southerly flow at 16 km. reflect downward to the surface within 24 hours. If, on the other hand, rises occur at 20,000 feet when falls are observed at 13 km., the direction of flow must be from different directions at these levels and the assumed reflective process is not occurring.

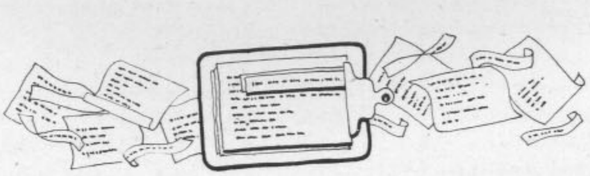
5) Centers over warm Highs and cold Lows must be regarded skeptically, because the depth of these systems frequently establishes centers which are worthless insofar as the correlations are concerned. For example, the warm-core Pacific High pushing inland on the Pacific Coast will usually cause a positive isallobaric center to appear on the 20,000 foot chart, but such a center obviously is not the precursor of a surface Low in 24 hours.

6) If centers are dependent on a single raob report, the 20,000 foot pressure must be hydrostatically consistent with the other data on that ascent.

7) Experience has shown that the correlations should be used as one argument, rather than as a basic assumption in locating future positions of pressure systems. Often, other forecasting methods will give the *direction* of motion, and the pressure-change correlations the *extent* of motion.

In summary, let us consider a practical example, supposing that a + 12 mb. center exists at 20,000 feet over Chicago on today's chart.

The Pressure-Change Correlations will work only if there is a Low within a reasonable 24-hour motion, only if the Low will be steered toward the center by the winds at 20,000 feet, only if substantial rises are observed at higher levels, only if the pressure-rise is real, and only if the isallobaric center is not produced by a warm high. Should each of these conditions be satisfied, the Low can be placed at Chicago in 24 hours.



CLOUD PHOTOS

Clouds are a most dramatic weather feature, the target for many ambitious camera wielders. Yet both Headquarters AAF and the Weather Wing lack suitable photographs of many standard cloud types, to say nothing of special phenomena. This paradox exists because, on one hand, photographers lack the meteorological training to select worth-while cloud compositions, and on the other hand, weathermen generally get lost in a fog of apertures, exposures, film speeds, and what not. Sky conditions which are priceless subjects may be fleeting: far too transient to allow a team of experts to get themselves and their equipment together.

Even superior photographic technique applied to such a routine weather situation as *cumulus humilis* against clear skies cannot add to anybody's understanding. But recognition that a certain cloud scene has instructive, research, or forecasting value may be associated with an equally futile effort when photographic principles are disregarded.

METRO CONSIDERATIONS

Certainly, choice of that photographic subject which will be most profitable for meteorological purposes is a difficult problem. The following notes will be of assistance:

It is always useful to have a fixed object in the scene (trees, buildings, horizon), to provide a frame of reference for scale and orientation. When clouds lie close to the zenith, a treetop, a telephone pole, or a tower can be interjected into the composition for this purpose.

If there are several levels of clouds, shoot a part of the sky where many levels appear. Furthermore, when clouds are widely scattered throughout the sky, two photographs in opposite directions may be profitable.

There is an obvious advantage in arranging for a simultaneous photograph of a cloud condition from above and below. Various examples are mountain-and-valley shots, air-and-ground coordination, and "photographic Apobs." This latter technique (frequent exposures during an airplane ascent) is being used by the Stratus Research Project: a similar approach to other local forecasting problems might be profitable.

Cloud shots expected to have practical worth should be correlatable with other weather data. This recommendation implies that each negative be labelled fully with information which fixes the scene in space and time.

Certain unusual states of the sky: Benard Circulation Cells, Helmholtz Waves, cirrocumulus, and "hurricane cirrus" for examples, are particularly desirable as scientific subjects for photography. Often a sequence of pictures showing the life cycle of these phenomena would be especially effective.

The preceding suggestions are not meant to minimize the importance of recording the standard cloud types and situations: good photographs of even weather fundamentals are scarce. Here again, a *sequence* of photos, showing for example the approach of a warm front, would be particularly useful.

PHOTOGRAPHIC CONSIDERATIONS

General information about the mechanics of picture-taking can be obtained from many books and from experienced individuals. It is even possible that a cameraman will sometimes be on hand at the right time to cooperate in making a valuable record of a sky condition. But much will have to be learned through trial and error, diminished by the hints which follow:

The use of small film sizes often yields disappointing results. Under field conditions, and especially in the tropics, scratches and stains on the negative cannot be avoided entirely. These blemishes assume major importance when the original has to be enlarged greatly to bring out cloud details. A border-line film size is, then, 4 by 5 inches (K20 camera, for instance). Such exposures can be enlarged to a convenient 8 by 10 inch size without magnifying the flaws considerably.

Black-and-white film does not "see" the same contrast between certain colors that the human eye can discern. Unfortunately, film does least well in distinguishing blue from white---the distinction most important for good cloud photos. The white areas in a picture are caused by the incidence of high-energy light rays: white, which is the sum of all colors; or blue, which has so much more energy than other colors that its photographic effect is akin to white's. So---when you see a brilliant *cumulus congestus*, sharply outlined against a blue sky, realize that there isn't much difference as far as your camera is concerned.

There is a device for dramatizing slight contrasts between a cloud and its background, the filter. When this device of colored glass is placed over the camera opening, only light of that color can enter and affect the film. If a yellow, orange, or red filter is used, much troublesome blue light is kept from the film. Clouds are able to transmit energy of filter-color wavelengths into the camera without hindrance, while the blue sky can get very little energy past the filter at all. The cloud would print white, and the sky black, in an extreme case.

Leaden clouds in a dull, gray sky require a very "exclusive" filter, a red one. Even then, an overcast is darkened very little by use of a filter. When the contrast seems good, on the other hand, a yellow, one might do. But be resigned to suffer setbacks---experience is the only sure instructor in the selection of filters.

Whenever a filter of any color is used, the exposure interval (suggested by a photometer or a table) must be increased by some "filter factor." This need is obvious, because a filter removes much of the light energy which otherwise would react with the film. The closer a filter color is to the red (low-energy) end of the spectrum, the more energy it keeps from the film, and hence the larger its filter factor must be.

Over exposure is a common fault with cloud photographers who remember the filter factor, but who forget another consideration: the exposure time recommended by a photometer (or by terrestrial experience) is calibrated for objects on the ground, the light from which is diminished by many dull spots. Clouds don't have comparable shadows; they reflect a maximum of light into the camera. On this account, the exposure interval for cloud pictures must be divided by a certain number, independently of other corrections. Most often, a divisor of two is appropriate, but sometimes even four when the clouds are very white and bright.

Since clouds are always photographed with the aim to bring out certain minor details, sensitive paper that is both "glossy" and appropriate to the negative should be used. The glossy print also is more suitable for the purpose of a publication editor; that is, when he cannot obtain the original negative.

The technician performing the developing and printing operation should be informed that the cloud details are the most important features of the photograph. Usually, a desirable clarity in the sky can be accomplished at the trifling expense of a grayed and dulled landscape.

Complete labels on cloud pictures are very valuable. Comparison with other weather data can be achieved if the following data has been recorded: location of the exposure (altitude and map coordinates), date, time, and orientation. It is advisable to enter this information, or at least a remark about the general synoptic environment, directly on the original film.

Since size of aperture, exposure interval, type of film, and filter color are important variables in taking a satisfactory photograph, a systematic improvement in future shots would be gained by recording the values adopted for each picture---permitting leisurely analysis of the reasons underlying success or failure.

The Public Relations Officer of this headquarters will appreciate the receipt of cloud-photograph negatives in duplicate. One of these will be sent to Washington, for the use by the Assistant Chief of Air Staff for Intelligence.

FILTER FACTORS

Film		Filter	
AAF Class	AAF Type	"K-2" (Yellow)	"A" (Red)
A	II	2	5
(Super-	III	2	6.5
Sensitive	IV	2	5.5
Panchromatic	V	2	6.5
	VI	2	6
C	II	2	6
(Regular	III	1.5	6
Panchromatic)	IV	2	7
	V	2	8
L	II	2	6
(Hi-speed	III	1.5	5
Panchromatic	IV	2	7
	V	2	5.5
K	Use with red filter. Photometers are not calibrated for infra-red rays. Manufacturer recommends an aperture of f5.6 and an exposure of 1/25 second.		
N (Extra Hi-speed Panchromatic).	V	2	7

SHORT RANGE VERIFICATION

Statistical evaluation of Short Range Verification's first full year, 4 October 1943 to 3 October 1944, has been completed recently. This is the first summary which includes substantial returns from the last class of weather officers, assigned to the field in the first part of June. Every region except the Fourth increased its number of participants heavily since week 42.

SUMMARY OF RESULTS BY REGIONS

Regions	Forecasters Participating	Distribution of Grades (%) A	B	C	D	X
Fourth	720	15	35	37	9	4
Second	277	9	38	35	12	6
First	485	8	31	43	14	4
Twenty-fifth	352	12	27	42	16	3
Twenty-fourth	202	10	25	46	15	4
Average		10	30	40	15	5
Twenty-third	380	9	28	38	19	6
Third	727	6	25	42	20	7

The premier hundred forecasters in the S.R.V. listing for weeks 1-52 are named below in the order of their standing, determined on the basis of the "S" score. The "R" value is determined solely by the number of forecasts submitted, and indicates the reliability of the results.

STANDING OF FORECASTERS

NATIONAL RANKING	NAME	RANK	REGION	STATION	"R" VALUE	"S" SCORE	REGIONAL RANKING
1	Jordan, H. J.	MSg	4	Smyrna AF	93	394	1
2	Melhorn, W. N.	2Lt	4	Bluethenthal	92	578	2
3	Auslander H.	SSg	23	Sedalia AF	91	587	1
4	Clarke, R. F.	TSg	23	Kansas City	92	622	2
5	Hirschfeld, W. P.	TSg	25	Ft. Dix AB	91	629	1
6	Katz, Y. H.	MSg	1	Stockton FD	91	653	1
7	Law, E. A.	2Lt	2	Patterson FD	73	654	1
8	Brouns R. C.	2Lt	2	Fargo AP	65	681	2
9	Hoffman, R. E.	2Lt	4	Jacksonvl AF	89	685	3
10	Lutz, G. H.	2Lt	4	Brookley FD	82	689	4
11	Kautz, E. D.	MSg	1	Salinas AB	91	699	2
12	Harris, E. W.	Sgt	4	Florence AF	83	702	5
13	Sherman, W. G.	2Lt	4	Courtland AF	82	729	6
14	Levin, W.	2Lt	25	Pittsburgh AP	50	734	2
15.	Andrew, E. R.	2Lt	2	Patterson FD	70	738	3
16	Bossenmaier, W. S.	2Lt	4	Boca Raton AF	74	741	7
17	Brumbach, J. J.	2Lt	25	Baltimore AF	79	745	3
18	Taft, H. E.	2Lt	3	Tulsa	86	753	1
19	Holladay, C. B.	2Lt	3	De Ridder AB	82	755	2
20	Lee, G. M.	MSg	24	McChord Fd	91	760	1
21	Goldman, J. G.	TSg	4	Birmingham AF	92	762	8
22	Johnson, P. A.	1Lt	1	Bakersfield	91	762	3
23	Koller, C. R.	2Lt	4	Sarasota AF	88	764	9
24	Koss, H. D.	TSg	2	George Fd	89	765	4
25	Jones, M. V.	MSg	4	Sarasota AF	91	766	10
26	Goodman, I.	2Lt	25	Rome, AF	88	768	4
26	Kleyensteuber, C. J.	TSg	1	U C L A	92	768	4
28	Hoffman, C. E.	1Lt	2	Chanute FD	92	770	5
29	Tomchek, E. J.	MSg	4	Maxwell FD	94	771	11
29.	Criscillis, P. A.	2Lt	4	Asheville WXWG	91	771	11

31	Davison, W. R.	SSg	23	Malden AF	91	773	3
31	Peterson, B. J.	TSg	24	Ellensburg AF	89	773	2
33	Reed, C. K.	1Lt	23	Rosecrans FD	91	775	4
34	Musa, R. C.	2Lt	4	Brookley FD	81	776	13
34	Dorsch, R. G.	2Lt	2	Patterson FD	60	776	6
34	Pipp, W. B.	2Lt	23	Peterson FD	79	776	5
37	Wetzel, W. E.	2Lt	25	Bolling FD	90	779	5
37	Shannon, Jr., J. G.	1Lt	3	Pyote AF	90	779	3
39	Gans, W. L.	SSg	25	Olmsted FD	88	780	6
40	Onsager, G. G.	TSg	24	Redmond AF	92	784	3
41	Jackson, J. E.	2Lt	4	Winston Salem	86	785	14
42	Lawless, K. R.	2Lt	4	Morris FD	92	790	15
43	Ace, E. R.	2Lt	1	Coolidge AF	85	791	5
44	Smania, L. P.	TSg	4	Boca Raton AF	89	793	16
45	Williams, J. T.	2Lt	3	Galveston AF	71	795	4
45	Gaugh, F. G.	Sgt	4	Boca Raton AF	60	795	17
45	MacMillan, A. J.	Cpt	1	Pasadena	75	795	6
48	Worthman, P. E.	Cpt	4	Asheville	92	798	18
49	Welch, A. E.	MSg	4	Memphis AP	95	802	19
50	Williamson, G. A.	1Lt	4	Maxwell FD	94	804	20
51	Coleman, R. H.	2Lt	25	Ft Dix AB	86	805	7
51	Simpson, D. L.	2Lt	4	Asheville	89	805	21
53	Grasso, C. H.	2Lt	4	Asheville	82	806	22
53	Gillespie, L. V.	Cpt	1	Long Beach	92	806	7
55	Shreve, E. W.	2Lt	3	Dalhart AF	80	808	5
56	Cable, D. A.	TSg	4	Sarasota AF	89	810	23
57	Webb, F. E.	1Lt	4	Chatham AF	92	812	24
57	Heggie, G. D.	1Lt	23	Peterson FD	92	812	6
59	Harms, R. W.	2Lt	4	Courtland AF	92	815	25
59	Luck, E. C.	Cpt	4	Sarasota AF	87	815	25
61	Smith, H. F.	2Lt	4	Venice AF	79	816	27
61	Rankin, A. R.	2Lt	24	McChord FD	25	816	4
63	Begg, E. L.	SSg	23	Lowry FD	85	817	7
63	Strum, A.	TSg	1	Mather FD	86	817	8
65	Coulter, G. G.	MSg	1	Los Angeles	93	818	9
65	Leonard, E. W.	2Lt	4	Maxwell FD	59	818	28
67	Anderson, E. E.	2Lt	4	Asheville WXWG	83	820	29
68	Toyll, M.	MSg	4	Jacksonville AF	89	821	30
68	Moler, W. F.	TSg	23	Smoky Hill AF	91	821	8
70	Parker, R. L	CWO	4	Maxwell FD	92	822	31
70	Mazer, J. L	2Lt	4	Courtland AF	79	822	31
70	Solomon, M. L.	SSg	24	Portland AB	90	822	5
70	Riegel, M. R.	2Lt	25	Richmond AB	57	822	8
74	Parrish, R. H.	MSg	4	Winston Salem	93	823	33
75	McCrabb, H. S.	1Lt	3	Perrin FD	92	824	6
75	Kaminski, H. S.	TSg	4	Daniel FD	93	824	34
77	Sheperd, K. R.	2Lt	4	Venice AF	83	825	35
78	Sullivan, R. B.	2Lt	25	Olmsted FD	66	826	9
78	McCarthy, W. J.	Cpt	2	Patterson FD	85	826	7
78	Minor, C. E.	2Lt	1	Gardner FD	88	826	10
81	Purcell, M. A.	2Lt	23	Casper AB	79	827	9
81	Herman, P. B.	2Lt	4	Buckingham AF	80	827	36
81	Horrigan, S. F.	2Lt	24	McChord FD	55	827	6
84	Bluhm, W. C.	SSg	25	Pittsburgh AP	88	828	10
84	Berger, R.	SSg	23	Buckley FD	88	828	10
84	Ruzicka, R. R.	SSg	2	Scott FD	87	828	8
84	Wagner, I.	TSg	4	Wm. Northrn FD	88	828	37
88	Kuz, J.	2Lt	1	Salinas AB	62	829	11
88	McCroden, T. J.	2Lt	3	Kirtland FD	88	829	7
88	Anderson, W. E.	2Lt	24	Gore FD	75	829	7
91	Vanderzee, C. E.	1Lt	23	Lincoln	91	830	11
92	McGovern, F. J.	1Lt	24	Medford AF	85	831	8
92	Trainer, J. R.	2Lt	4	Sarasota AF	70	831	38
92	Leight, W. G.	1Lt	3	Ardmore AF	90	831	8
95	Fry, H. E.	2Lt	23	Peterson FD	87	832	12
95	Sorrentino, F. C.	2Lt	2	Chanute FD	82	832	9
95	Toporoff, C.	TSg	23	Sedalia AF	91	832	12
95	Dale, A. C.	2Lt	4	Nashville AP	90	832	39
95	Nickles, P. M.	2Lt	4	Boca Raton AF	74	832	39
100	Schimberg, H. E.	TSg	23	Rosecrans FD	89	833	14
100	Olsen, J. W.	1Lt	4	Asheville WXWG	59	833	41

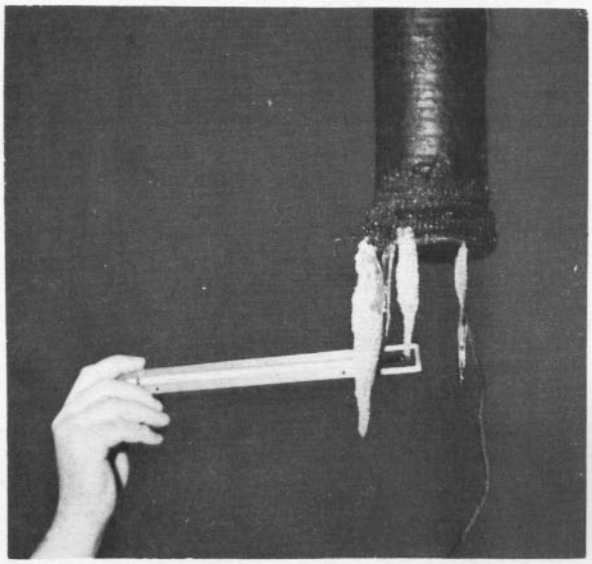
Headquarters Notes

HOT ICE

by Weather Central Staff
11th Weather Region

Water froze at + $53^{\circ}F$. in the mouth of a hose used for transfer of high octane gasoline, one rainy day this Fall at Elmendorf Field, Alaska. Icicles were formed at the hose coupling by cooling effects of gasoline evaporation, which froze the rain water trickling down outside. Apparently, about a pint of fuel was trapped in the pipe above the final valve, from whence it leaked down inside the hose and evaporated.

Some of the icicles were coated with a rime of hydrocarbon-hydrate nature; others were plain ice. When one of the rime-covered icicles was broken off and heated, it melted rapidly and gave off a strong oder of gasoline. The resulting liquid burned with the blue and yellow flames characteristic of gasoline.



Throughout the forenoon when the icicles were being observed, the weather station next door reported 49/49 for temperature and dew point, along with R-F- and winds of 5 mph. As soon as the fog lifted, the icicles began to melt away and soon disappeared.

While the cooling effect of gasoline vaporization is well known, the case observed is rather unusual. It is certainly an object lesson for emphasizing the dangers of carburetor icing at temperatures well above freezing.

AMS PROGRESS REPORT

The president of the American Meteorological Society, Dr. C.-G. Rossby, expressed concern about possible errors in the distribution of AMS publications to its military members, in a recent letter. This headquarters was asked to inform AAF members of the Society that every effort will be made to correct any mistakes as soon as notification is sent to:

Secretary, A.M.S.,
Blue Hill Observatory
Milton 86, Massachusetts

New members are entitled to receive the last five issues of the *AMS Bulletin* for 1944, the first two issues of the *Journal of Meteorology* (to be dated 1944 although they may not reach the field before 1945), and a complete set of the *Bulletin* and the *Journal* for 1945.

Major Harry Wexler, Drs. Jakob Bjerknes, Jorgen Holmboe, C-G. Rossby, and Sverre Petterssen, and John Bellamy have contributed scientific papers for the 1944 issues of the *Journal*.

There are now 295 professional members, reportedly, of which 137 are Army forecasters. Most of the AAF members are from domestic regions, with applications from foreign regions just beginning to arrive. Emphasis is being placed upon corporate memberships: a special committee is working to enlist the support of principal airlines. The Florence and Daniel Guggenheim Foundation has made a $5,000 grant to the Society, and the United Air Lines has contributed $1,000. Other grants are pending.

The AMS will hold its annual meeting in Kansas City, 24-26 January 1945. The reorganization plan and postwar program will be considered, and there will be symposiums on the various techniques of upper-air analysis, on the desirability of "canned analyses," and on special problems of postwar airways.

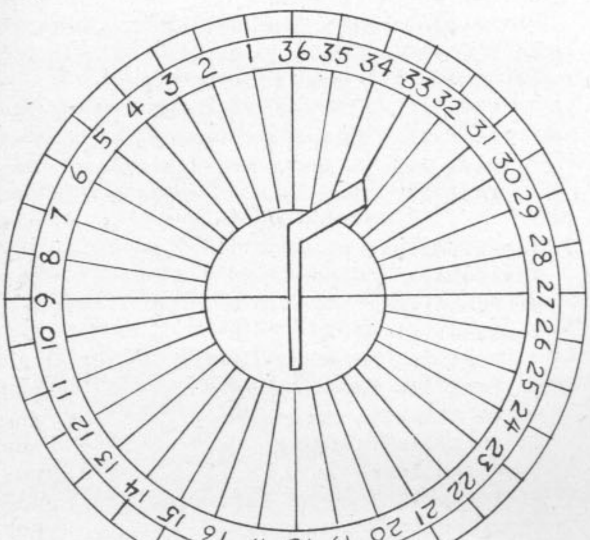
A committee has been formed to delineate the further meteorological training of returning veterans provided by recent legislation. The AMS will prepare a pamphlet describing opportunities in professional meteorology and allied fields, in conjunction with the War Manpower Commission.

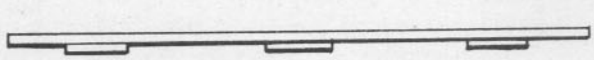
ACCURATE WINDS ALOFT

Now that electronic devices for determining the winds aloft more accurately and reliably than before are used by many regularly-reporting stations (Rawins), the free-hand sketching of upper-wind vectors often introduces errors which nullify the use of such equipment.

On the other hand, complaint that use of an ordinary protractor is too slow and messy was justified. But Sergeant Sergei Fomenko has developed a clever gadget which assists the wind plotter to enter accurate, clear-looking vectors very rapidly. It cannot be requisitioned, but every observer will find no trouble in making his own.

The device is a disc of transparent but stiff material, Plexiglas for example. The disc has been marked off in ten-degree protractor divisions, *counterclockwise* from 0^{o}. In the circle's center, an opening has been cut in the shape of a wind-aloft arrow, *pointing toward* 180^{o}. Then when a report of say 40^{o} is read, the observer need only orient the "protractor" so that the reported direction points North, and then follow the central opening with his pen. As can be seen, this procedure is one reading and at least one motion shorter than usually required.





On the reverse side, that which faces the map beneath, three or four flat discs of Plexiglas have been attached as "legs," meant to keep the disc off the chart and thus to avoid smearing during the hasty motions of rapid plotting.

W.E.T. MANUALS

The location of the Weather Equipment Technician Manuals which have the following serial numbers is not known: 11, 32, 36, 71, 72, 119, 123, 124, 245, 246, and 282.

If the holders of these manuals wish to receive future amendments and appendices to the W.E.T. Manual, they should submit their complete mailing addresses to:

Commanding Officer
AAF Weather Wing
Asheville, N.C.
ATT: A-4

so that necessary additions to the mailing list can be made.

TYPOS: DID YOU CATCH THEM?

Typographical slips have been noticed in past issues of the *Weather Service Bulletin.*

In "Apobs without Aerographs" by Major Arthur F. Gustafson, August issue, the paragraph on page 8 labelled "h." should advise plotting the results obtained in "g." instead of those in "f."

In the same edition, "Flying the North Atlantic" declares that absolute altimetry can give the wind component perpendicular to an *isobar*, of all things, when of course the word *heading* has been written by the author.

"Projectile Navigation," August issue again, implies that meteorological factors are the only imponderables in the prediction of shell trajectories; overlooking ballistic factors. The same story inverts one term in the equation of state, which should be $\rho = K\ P/T$. And finally, Starr's Diagram is *not* convenient for checking the consistency of artillery forecasts, because it treats the 10,000 foot level only. The tables appended to Weather Division Report 735, or WRC 10-1 are recommended.

"Simple Navigation of Aircraft:Part I" in the *Bulletin* for October explains its figure 3 by saying that "simple arithmetic calls for a 2.5^{o} change of heading..." While 2.5^{o} is the correct change of *course* and not *heading*, it is more important to observe that the heading must be altered by 7.5^{o}.

Page 11 of November's *Bulletin*, in Major Wallace Howell's "Daytime Visibility," the fourth equation in column one should be:

$$-c = -\frac{B_g - B_h}{B_h} -$$

The sixth equation should be: $\frac{B_g}{B_h} - 1 = \frac{B_g - B_h}{B_h} = \frac{2 - R}{2} e^{-ax}$

Equation seven, corrected is: $c = \frac{2-R}{2}\left(e^{-ad}\right) d_g$

INDEX, "WEATHER SERVICE BULLETIN," VOLS. I AND II

The Weather Service Bulletin was issued irregularly from September 1943 to July 1944 (5 issues). Volume designation on the "Jan & Feb 1944" issue is in error; should be "Vol.1, No.3." Monthly issue began August 1944: Vol.2 completed with No. 6, Dec 1944.

RAWIN Reporting Stations

STATION	IDENTIFICATION Letters	IDENTIFICATION Numbers	CIRCUIT HEADING Skj C	CIRCUIT HEADING Skj O
Boise, Idaho	DQB	681	PB 11	
Chanute Fld, Ill.	DNU	531	PB 2	
Dyersburg, Tenn.	DZB		PB 5	
El Paso, Texas	EO	270	PB 9	
Fort Sill, Okla.	DFG		PB 8	
Fairfield, Calif.	DFA		PB 35	
Galveston, Texas *	DGJ			
Grenier Fld, N.H.	DUR		PB 1	
Hunter Fld (Savannah), Ga.	DCH	207	PB 3	
Los Angeles, Calif.	LA	295	PB 9	
Medford, Ore.	MF	597	PB 11	
Maxwell Fld, Ala. *	DXW			
Orlando, Fla.	DOA	205	PB 31	PB 9881
Patterson Field, Ohio	DPK		PB 2	
Pittsburgh, Pa.	PT	520	PB 2	
Portland, Me.	GFW	606	PB 30	
Pope Fld, (Ft. Bragg), N.C.	DGP	303	PB 3	
Presque Isle, Me.	DZQ	771	PB 30	PB DZQ
Richmond, Va.	RW	401	PB 3	
Salina, Kan.	DSN		PB 7	
San Diego, Calif.	SQ	290	PB 9	
Seattle, Wash.	SA	793	PB 10	
Spring Lake, N.J.	DSL		PB 30	
Watson Lake, Yukon T.	UQH	953	PB 9880-2	
Adak, Alaska	NCI	992	PB 34	PB 318 9
Amchitka, Alaska	CH	005	PB 34	PB 318 9
Annette, Is., Ketchikan, Alaska	UKG	048	PB 34	PB 302
Ft. Morrow, Alaska	ZG	017	PB 34	PB 318 9
Shemya, Near Is., Alaska	PF	549	PB 34	PB 318 9
Yakutat, Alaska	UVY	963	PB 34	PB 302
Ascencion Island	UCD	717	PB 31	PB WYI
Belem, Brazil	ULW	513	PB 31	PB WYI
Cayenne, Fr. Guiana	URD	874	PB 31	PB WYI
Gander Lake, Nwfld	UQX	803		PB DZQ
Goose Bay, Labrador	YR	816		PB DZQ
Kindley Fld, Bermuda		925		PB WZT
Lagens, Azores	GP	343		PB WYQY
Meeks Fld, Keflavik, Iceland	VT	581		PB DZQ
Narsarssuak, Greenland	JY	589		PB DZQ
San Juan, Porto Rico	UIG	014		PB WYI

*Stations which expect to operate by 20 December 1944

THE DECEMBER COVER

The Bulletin's *front cover this month pictures the SCR-658, RDF equipment for determining the winds aloft. The observer is able to follow a free balloon-transmitter combination very accurately by adjusting the azimuth and elevation of the "bedspring antennae". His adjustments are guided by reference to an oscilloscope, which indicates when the antennae are pointed toward the transmitter. A colleague records pressure data regularly sent from the transmitter aloft, used for determining the balloon height at which RDF readings are taken.*

The article RAWIN, *which appeared in the September* Bulletin, *discusses electronic wind-finding devices more thoroughly.*

We, the Officers and Men of Headquarters, AAF Weather Wing, send Christmas and New Year's Greetings to Weather personnel in the field who during the past year have continued their untiring efforts in continued support of their country's war effort. We join with you, wherever you may be: in a theater of operations, in lonely outposts of many continents, on remote islands of the seven seas, or in the zone of the interior, in the hope that the year 1945 will bring peace to an embattled world.

CONTENTS

(R) means Restricted

A popular feature with the hundreds of daily visitors to the Air Power show at Pittsburgh's Buhl Planetarium is the display which dramatizes the Weather Service. For most visitors it is the first lesson in the strategic part played by the Weather Service in determining Allied war plans.

Weather's display is built around an out-sized surface map of North America. Keyed to the map is a series of striking photographs illustrating what goes into a weather observation and a weather forecast. An entire side wall is used to demonstrate radiosonde and upper air analysis.

As the Air Power Show moves from city to city under the Air Technical Service Command's sponsorship, the story of the Weather Service will be brought home to thousands who otherwise might never hear of Weather's world-wide operations.