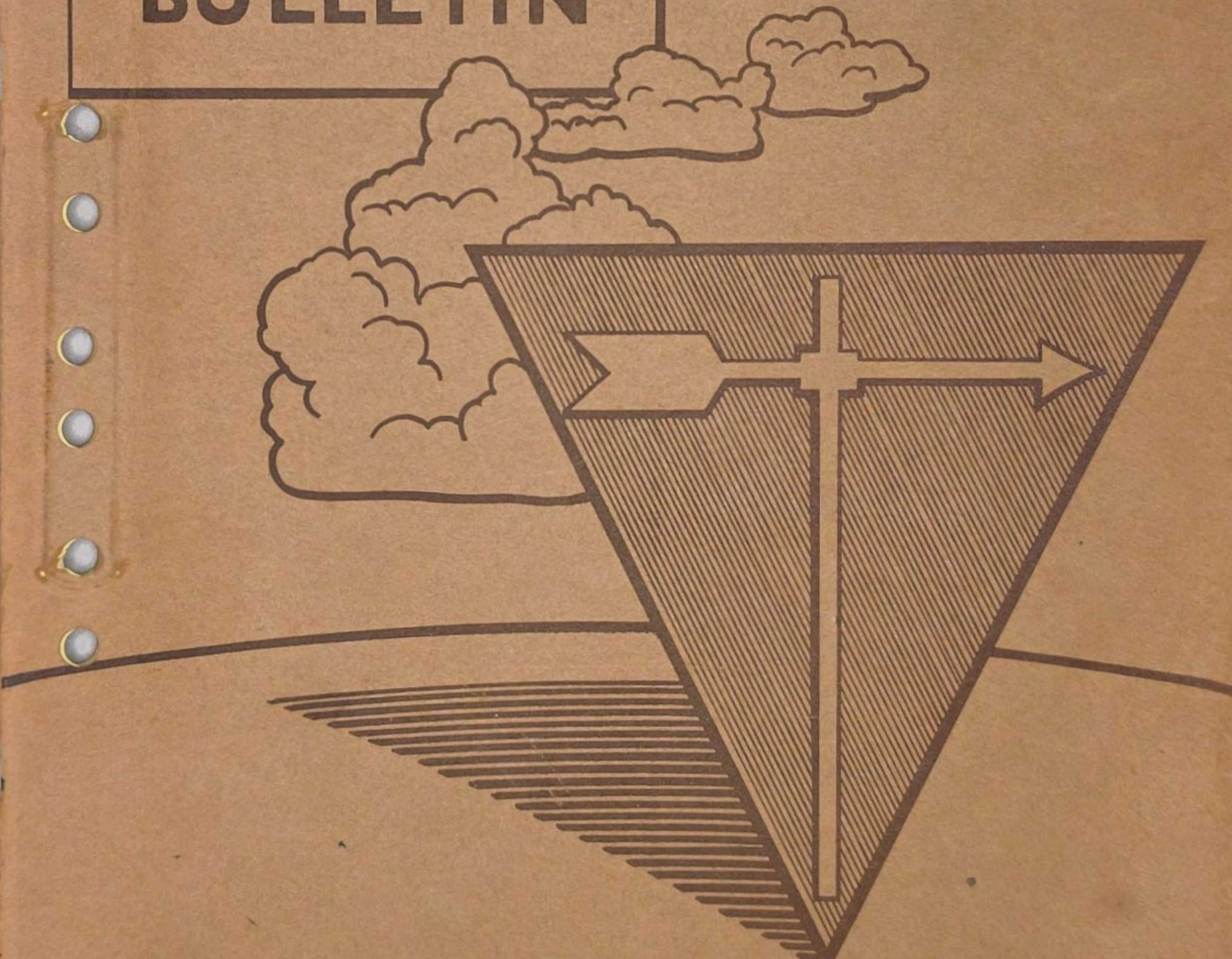
SEPTEMBER 1943 Vol.1 No1

RESTRICTED

WEATHER SERVICE BULLETIN



HEADQUARTERS WEATHER WING AAF
ASHEVILLE N.C.

RESTRICTED

The COMMANDING OFFICER *Speaks*

The Army Air Forces Weather Service operates the most comprehensive as well as the most extensive weather service the world has ever seen. The Weather Wing, operating directly under the command of the Headquarters, Army Air Forces, provides weather services not only to our own air forces, but also to all branches of the Army which request it. Ours is the first world wide weather service in history, and the duties which devolve upon us are the most varied and the most important to ourcountry's welfare ever faced by any weather service.

We have a man-sized job to do. There are thousands of maps to be drawn every day, tens of thousands of forecasts to be made, and hundreds of thousands of observations to be filed, all in the performance of our primary functions of increasing the efficiency of the Army. That job is the most difficult to do because the results of our day's work are not something tangible that we can point to and say 'I repaired that shell-torn wing' or 'I captured that prisoner'. You often do work that seems to be thrown into an empty void, and word of the effectiveness of your work seldom comes back to you. Yet your work does count. If it were not important, you would not be doing it.

Your work contributes in two different ways. The first of these is in increasing the safety and reliability of flight missions and ground operations of all sorts. It has been definitely shown by operational records that a good weather service decreases the accident rate, decreases the number of incomplete missions, and allows missions to be successfully carried out which otherwise would have been abandoned. Perhaps most important of all, a good weather service increases a pilot's confidence, eases his mind, and leaves his attention freer for other things. By keeping in mind these purposes when you forecast you will gain the confidence of the flight personnel with whom you work and thus contribute most to the safety and efficiency of air operations.

The second way in which your work helps the Army is one which is perhaps more publicized and yet less recognized. It is in enabling your commanders to take tactical and strategic advantage of weather conditions to do the most damage to the enemy -- the battle use of weather Experience in Europe and Africa, in the Aleutians and in the southwest Pacific, shows that weather changes often provide commanders with 'targets of opportunity' when the enemy can be taken at a disadvantage. We must, of course, keep in mind that the art of using weather as a weapon is just one of the many arts of warfare and must be always balanced against other considerations. However, much remains to be learned in this field, and much missionary work must be done to demonstrate conclusively to commanders how weather forecasts may be used to advantage. The attitude that 'the war does go on whatever the weather, so why bother with it' is a false and dangerous one. The war does go on, yes, but it may go badly for us if the enemy uses the weather forecasts and we fail to do so.

The problems in the battle use of weather are not problems which will be solved today or tomorrow or by any one weather officer. But they do afford a golden opportunity for the weather service and for the individual weather officer to make a contribution to victory, the scope of which can only be imagined.

The most valuable of a forecaster's services are rendered by personal contact with the officers who are using his forecasts. Regardless of your background, regardless of the length and thoroughness of your meteorological training, you will be judged first as a soldier and second as a weather expert. If you do not conduct yourself like a soldier, no amount of forecasting ability will do you much good, and your opinions and advice will be regarded lightly. The weather service must not be impaired by lack of military bearing.

Every weather officer is aware of the high qualifications of training and ability for his position. Ability and training by themselves are not enough. In addition, a weather officer must have enthusiasm for his work, and the determination and drive to use his ability and his training to the highest possible degree. Meteorology is one of those young sciences in which the hinterland of recorded knowledge is still narrow and the frontier of research and new discoveries is easily reached. Yours is the bright challenge to reach that frontier and push it forward.

The Weather Wing has established the bulletin, of which this is the first number in response to the needs of the service as I have just reviewed them. It will be a means of relaying information and experience to you that will help you in your relationship with flight personnel. It will report to you on the progress you make in the battle use of weather. It will provide you with advanced training material on the science of meteorology. It will publish the results of studies and research by weather officers and make them available throughout the service. It is your means of expression in your chosen field of effort. I urge you to contribute to that field and to this bulletin.

Personnel desiring to have papers published outside the army should submit them through channels to the Headquarters, Weather Wing, Asheville, North Carolina, where they will be reviewed by the Public Relations Office and sent on if approved for release.

ICING *on* AIRCRAFT

Icing on aircraft is a subject about which there is a great deal more opinion than there is fact. To complicate matters still more, opinions and facts are both widely divergent. The series of articles of which this is the first does not pretend to be the ultimate word on icing. It will be a summary of the generally accepted basic facts and opinions together with less familiar facts which are the outcome of recent researches.

With the overcoming of many difficulties involved in construction, operation, and navigation of aircraft, the use of this means of transportation to its fullest extent has become more and more dependent upon the reliability with which operation can be maintained regardless of weather conditions. The necessity for assurance of reliable performance is greatest during military operations because so much more is at stake then the delivery of a plane and its cargo. Furthermore, offensive warfare often demands that missions not only go forward during adverse weather but that such weather be used as an ally.

There are three major weather hazards fog, turbulence, and icing. Instrument flying has diminished the danger of the first two. Icing, however, has been the cause of misunderstanding and difficulty, because when this condition occurs both the normal vagaries of the weather and the construction and operation of the ship must be considered. Knowledge, painfully acquired by experience, has enabled a measure of safety to be assured over continental areas with adequte weather services, yet, in a recent flight of 100 bombers, 35 failed to return because of icing.

Present conditions demand that long-distance flights be made over various unexplored regions of the world, over water as well as land, at extreme altitudes, and for the most part without advance weather data. It is, therefore, of extreme importance that the pilot have a full understanding of the conditions which produce icing and how they may be avoided or combatted.

The pilot must know:-

1. What icing is.
2. What causes it.
3. Where it may be found.
4. How it may effect operation.
5. How it may be eliminated.

The term icing is applied when water in the solid state is deposited on the plane's surface. It may occur as a change from either the vapor or liquid state in the air to ice on the plane; however snow or ice crystals in the air present no danger. The forms of ice deposit may be extremely varied, but there are only two factors of prime importance, (1) the occurance of temperatures below freezing at the surface of the plane, and (w) the amount of water being deposited on the surfaces. Unfortunately only factor (1) can be determined without hazard. Indirect observations in addition to the pilots' knowledge of the fundamentals of weather must be used to determine factor (2).

Micro-Physics of Icing

Supercooled Water

The possibility of icing is most readily indicated by the presence of clouds. As air is cooled below the dew-point the excess moisture condenses out on hygroscopic muclei. Usually liquid water-drops of from 3 to 50 microns in diameter are prodwced and these remain liquid even at extremely low temperatures.

supercooling, as it is called, has been observed at temperatures below -45°C and a drop can exist apparently in this condition for an indefinite time until it is jarred or comes in contact with an ice crystal. Supercooling is also possible in rain falling through cold air. At extremely low temperatures, below about -15°C to 20°C the water vapor may be condensed out directly as ice crystals. There is, at present, no satisfactory explanation of supercooling phenomena or the identification of sublimation nuclei.

Forms of Icing

Icing occurs principally along the leading edges of wings, propellers, and tail structures. In severe icing, the deposit may extend backward along the entire upper and lower surfaces of the wings. It may also clog the air speed indicator, coat the windshield or carry away the antenna. Carburetor icing is a special type caused by the cooling of air below the dewpoint by vaporization of gasoline and expansion of air in the intake manifold.

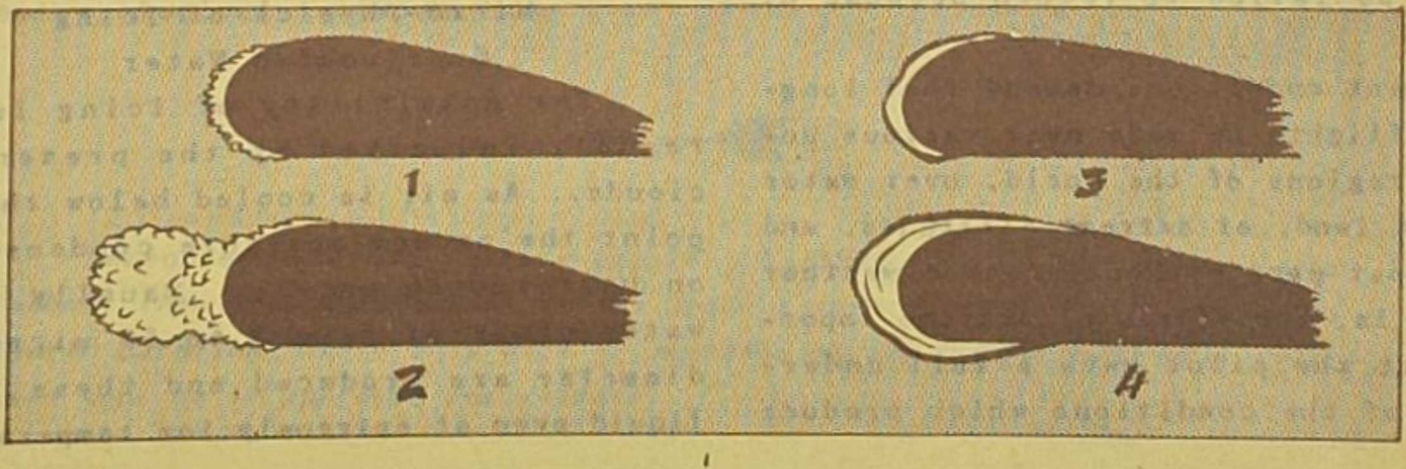
There are three types of ice as follows:

Frost:-- Frost is a crystalline deposit formed by the direct sublimation of water on the plane in the same manner as the coating is formed on a refrigerator box. On a grounded plane, it will form on all upper surfaces on cold clear nights. Although the weight of the deposit is neglibible, the numerous fine crystals of ice interfere with the smooth flow of air next to the wing, and exert a great influence on the stalling speed and drag. Frost or rough frozen snow always must be cleaned from wing and tail surfaces before take-off, because experience shows that a frost-covered plane may be impossible to get into the air, or may take-off in a dangerous, mushing stall.

In flight, frost may be deposited on a plane descending from a high level through moist, warmer air below. In such circumstances, the deposit will form all over the surfaces of the plane, and not on the leading edges alone. In middle latitudes this form of icing is seldom encountered but it is more common in arctic regions, where it is sometimes found at low altitudes or in mountain passes. Because frost, like carburetor ice, can form while the plane is flying through clear air, the pilot must be on the watch for it at all times when operating in regions where it occurs. Severe frost can greatly affect the flight characteristics of a plane, but fortunately it can usually be avoided by a short climb.

Rime:-- Rime is an opaque, whitish ice with a granular texture somewhat resembling crusted snow. (Fig. 2 (1) and 2 (2)). It has an open structure with numerous connected air chanels more or less alined with the wind direction. Its density varies between 0.1 and 0.75 and is determined mainly by the air temperature and rate of deposit of liquid water. Rime lighter than 0.1 may form but will be blown away by the wind stream, and the wing surfaces will be scoured clean.

The separate particles of rime are formed by the coalescence of several cloud droplets. Each drop partially freezes as it hits the plane and a net-work of ice needles spreads throughout its volume.



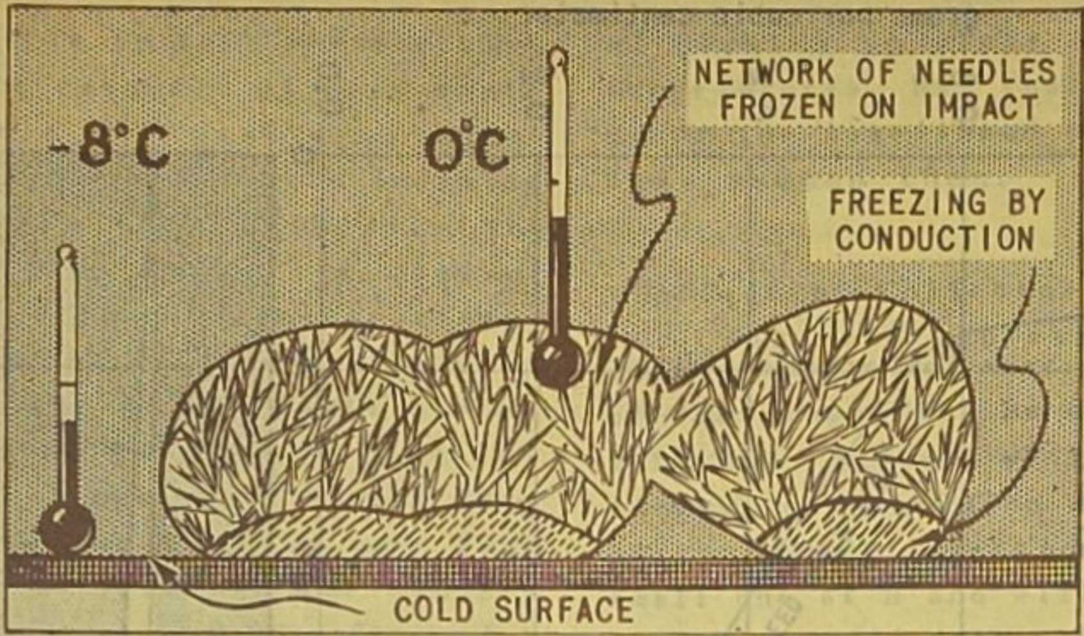


Fig. 2 (1) As each droplet highly magnified in these drawings, strikes the cold surface of the wing, part of the water freezes to form a network of fine ice needles. If droplets merge before freezing occurs, glaze will form.

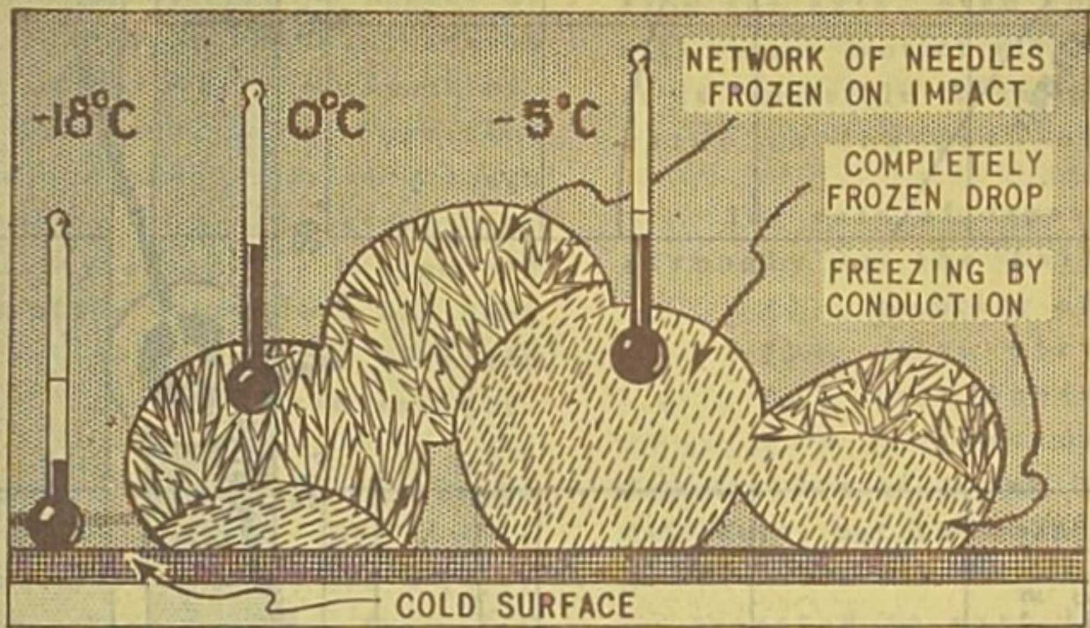


Fig. 2 (2) Following formation by impact of the ice needles, the droplet freezes solid from the wing outward. If each droplet freezes solid before another merges with it, rime is formed.

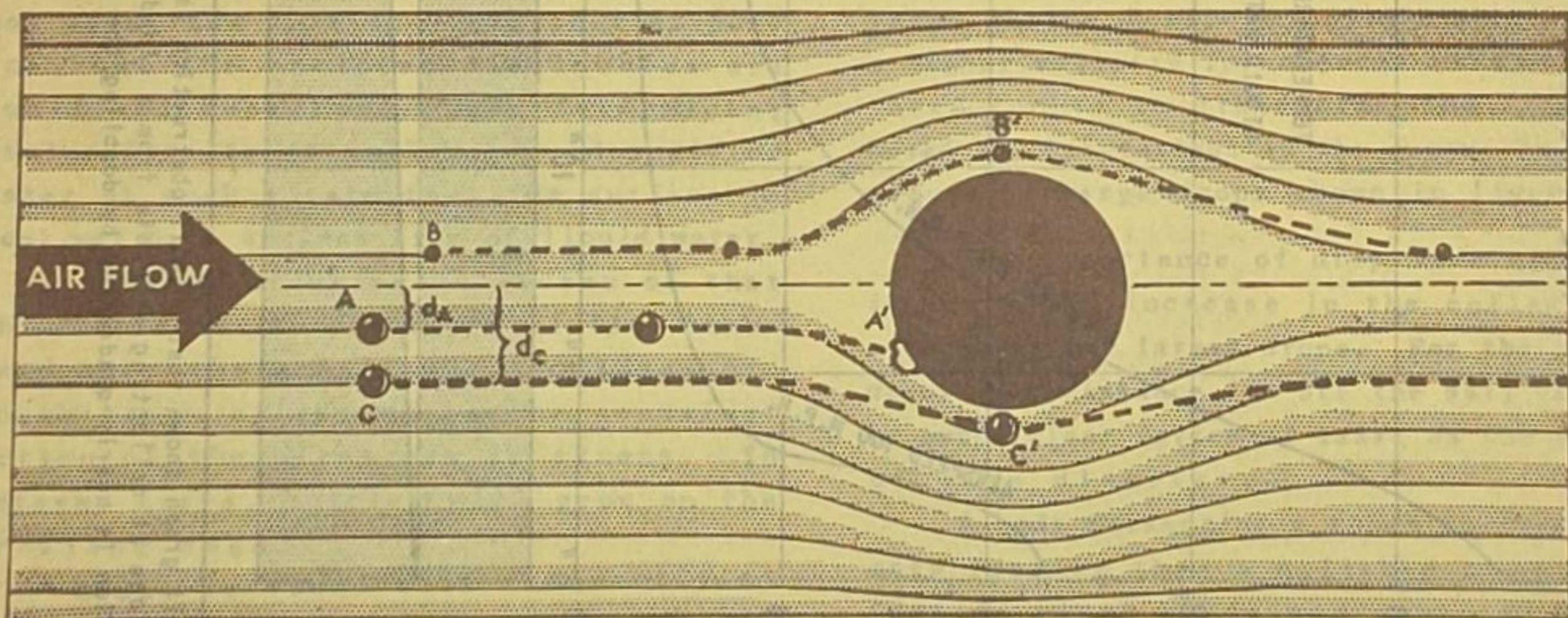
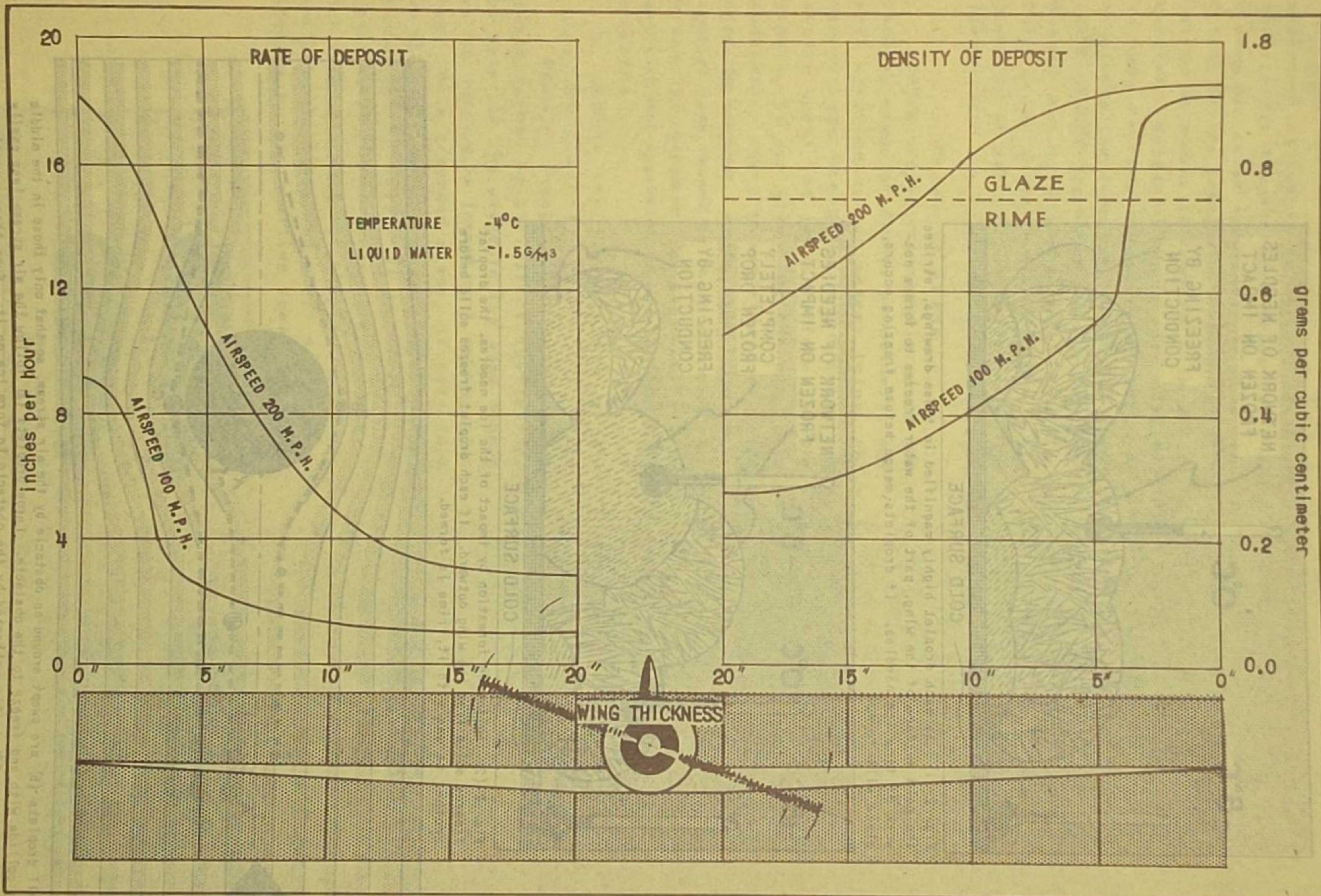


Fig 3. Small droplets (B) are swept around an obstacle by the air stream, so that only those in the middle of the path collide with and freeze to the obstacle. Large droplets (A) follow the air stream less easily and are therefore more efficiently collected by the obstacle to form ice on it. Even then, some large droplets (C) will escape.



The left graph shows that a small obstruction is more efficient than a large one at collecting droplets from a cloud. For a large wing, accretion is nearly quadrupled by doubling the airspeed.

The right graph shows that, because of higher collection efficiency, ice on a small obstruction will be more dense than on a large one, and that an increase in air speed causes a considerable increase in density.

It is not possible to tell whether rime is amorphous or composed of very small crystals, but a definite crystaline structure is absent. A second incoming drop may unite with the first. The percentage frozen at initial impact depends on the degree of supercooling. The remaining water is frozen mainly by conduction of heat to the plane and by evaporation. If, during the time required for this freezing, a second drop strikes the first, the two may join closely and an increase in the density of the deposit will result. (See figure 1.)

The size of the drop is not of major importance, for while small drops freeze more rapidly, an increase in the number of drops for equal rates of deposit reduces the time between arrivals; the amount of water striking the wing is the important factor. The surface of rime is very rough and does not conform to the substructure. Rime of low density is easily broken off by the wind and plane vibrations and does not build back on the wing. The strength and adhension of rime increase rapidly with density.

Glaze:-- Glaze (clear ice) is translucent, if not truly transparent, and is hard and amorphous. (Fig. 2 (3) and 2 (4)). It is the most important type for the pilot to consider as it is strong and adhesive and is not readily dislodged. The density may vary from 0.75 to 0.92, that of pure ice, but the enclosed air bubbles are small and separated. The determining factor for its formation is a deposit of water at such a rate that the surface is kept wet by a surface film of liquid water.

Amounts of water in excess of that which freezes immediately will flow backward over the wing and form ridges or rough teeth of ice where the scouring action of the airstream is strong. In extreme cases, icicles will grow on the trailing edge.

Glaze is found most frequently at higher temperatures. About 80 percent of all glazing conditions occur at above -8°C. This does not mean that the chances of picking up glaze decreases at low temperatures, but that all clouds (and hence the likelihood of any icing) are less common then.

Affect of Collector Size on Icing

Figure 3 represents the stream lines around a cylinder. The trajectories of the drops will be disturbed by the cylinder. Because of its larger kinetic energy, a large drop at A can maintain its original direction better than a small one at B and will be deposited at A while a small drop will be swept around the cylinder, like smoke eddying past an obstacle. At comparatively great distances from the axis, even the large drop at C will escape contact with the cylinder. Thus it is impossible to sweep out all the liquid water in the path of the obstacle.

The rate of deposit is influenced strongly by the following factors:

(1) Quantity of water suspended.
(2) Drop size.
(3) Air speed.
(4) Collector size.

Computation of these influences is very difficult, but the graph in figure 4 shows how the rate and density of deposit might be expected to vary for different wing thicknesses at velocities of 100 and 200 mph. It is interesting to note that rime would be found at the lower velocity and glaze at a higher velocity for objects greater than three inches in diameter. The data are based on observations in the unusually thick clouds of large drops shown in figure 5a.

The importance of drop size consists in the rapid increase in the collection efficiency for larger drops. For the smaller drops, the distance 'd' off the axis that can be swept clear varies at least as the square of drop diameter.

A body presenting a rough surface ices more rapidly than a polished body. Projecting rivet heads and seams will ice rapidly and disturb the air-flow so that so that the condition will spread.

Over DARKEST AFRICA

by

Peter A. Laudati, Jr.
Second Lieutenant, Air Corps

Africa, once the land of the unknown, the land of weird, strange mysteries and rites, has undergone a rapid and almost complete metamorphosis in the past few years, along a certain air route. Elephant herds that once lived peacefully in swamps are stampeded into flight by the loud drone of powerful engines. King Leo, the lion, once ruler of the land he roamed, now scampers for cover as a soaring plane wings overhead. Headhunters of the past are found peacefully earning a day's wages constructing buildings and repairing runways at air bases located right in the heart of their domain. However, there are still portions of this Dark Continent that cling to the savagery of the past. In Eastern Africa, particularly in the land of Haile Selassie, there are tribesmen who will torture a captured white man despite his nationality. Young pilots tell stories too, of narrow escapes from Arabs in North Africa or Arabia. These Arabs would either turn an American pilot over to Axis Forces for a reward or be content to torture and mutilate him. The former practice, however, has disappeared with the cleaning out of the Axis Forces from this Area, but the latter persists, much to the discomfort of the pilots concerned.

Several years ago, in the late "thirties", British Airlines established an air route through Central Africa to India. However, even though planes flew over routes where camels previously had provided the fastest means of travel, the results were not too satisfactory. Air bases were few in number, facilities were limited, communications and weather forecasting facilities were almost completely lacking, and there were no "check points" along the entire route. Pilots were forced to fly with little or no knowledge of the weather which they would encounter, and therefore it was by no means surprising that flights usually avoided this treacherous route.

The Only Practical Airway

The RAF occasionally used the route to ferry reinforcements to the Middle and Far East. Therefore, the route was in more or less sporadic use until about two years ago when Pan American Airways was given the task of flying aircraft and supplies from America to Egypt and the Middle East as well as to the distant lands of India and China. Axis occupation of Northern Africa left this route as the only practical airway to countries which the Allies had to hold at all costs.

And a real task it was. The route was far from the battlefields of North Africa, it is true, but there were the French to contend with. Fortunately, after the fall of Eritrea and Etniopa, the French throughout Central Africa joined the Allies. French possessions along the west coast of Africa still maintained their alliance with Vichy, but they presented no great problem since the regions in question could be avoided.

Weather was the principal hinderence, as weather hazards usually are present during the largest portion of the year. Although the rainy season lasts no more than four or five months in the region, other factors, such as the Haboob and the Harmattan may occur at any time of the year. People on the ground welcome the relief these storms give from the steady damp heat of the tropics; but the Haboob, with its dust storms, poor visibilities, heavy rains and occasional thunderstorms, and the Harmattan with its dust storms and dangerous thick haze spell trouble to the pilot.

Heat is a Problem

Thunderstorms often poke thier ugly anvilheads into the skies along the coastal area, and become decidedly dangerous in the mountainous regions of East Africa. The central part of Africa is comparatively free from storms, but this hazard is replaced by another refinement of nature, an excessive heat which creates temperatures of 115 degrees Fahrenheit in the cockpit of a plane flying below five thousand feet, and ground temperatures often in excess of 130 degrees in the shade. This distressing heat saps the endurance of pilots, and makes flight on this route a trying physical undertaking.

It can be seen that the establishment of this route was a real task, and the problems of weather and communications had to be solved before it could become a valuable asset to the Allies.

The advent of Pan American Airways increased air traffic considerably and with this increase came an improvement of air bases, communications and weather service facilities.

In the fall of 1942, the functions of Pan American Airways along the route were absorbed by the Air Transport Command, and air traffic began to assume extreme proportions. Air bases had to be enlarged and runways improved even more than Pan American Airways had done. This problem was handled easily enough with the native labor which was available.

Few Weather Reports

The weather service still remained a problem. Under Pan American Airways, it had been undertaken almost exclusively by civilian personnel. The service had proved to be far from satisfactory because of poor co-operation, between the territories of various nations, in exchange of weather data. Forecasters were hampered in attempting to predict the weather because of the few weather reports available from the surrounding territories. Therefore the Air Transport Command found that many weather stations had to be equipped to provide accurate weather service.

In June 1942, the 19th Weather Squadron was activated and assigned to the region. Several officers and a small number of enlisted men were already serving in the region on detached service from the 2nd and 4th Weather Regions, and these men were transferred to the 19th Weather Squadron in August 1942.

In November 1942, the 19th Weather Squadron arrived in the region and established Regional Headquarters. Forecasters and observers were sent out along the route and the Squadron, though undermanned, soon began to function.

In March 1943, another complement of weather personnel arrived. This group was large enough to handle efficiently the weather service required by the Air Transport Command. Every station in the region was soon well manned and able to operate at full capacity.

Need High Calibre Service

The Air Transport Command depends on being provided with high calibre weather service. Scheduled flights cannot be cancelled except under dire circumstances, because vital supplies and aircraft important to the war program must be delivered to far flung bases without delay. As a result, weather officers are faced with two problems; first, that of finding some flight level at which the pilot can make his trip, despite the severity of weather conditions, and second, that of giving a clear, complete picture of the state of the atmosphere to the pilot so that in an emergency he will be able to make his own decisions. Alternate airports are an almost unheard of luxury in this area. Furthermore flights are lengthy and the journey is usually completed with little fuel to spare. Thus, terminal forecasts given the pilot concerning weather conditions at the time of his arrival must have a high degree of accuracy.

Check points are few and far between in Africa, and even under contact flight conditions a pilot has little chance of being sure that he is on his course. Vast expanses of arid plains, dense jungle, and extensive desert regions provide very few identification points to aid the pilot. Winds aloft become a vital factor in the forecast, for pilots must make directional compensations for cross winds.

Radiosoneds Will Help

Forecasters are aided by the fact that the circulation of winds aloft are largely seasonal. Then too, the four radiosonde stations which are being installed in the region will be of great help to forecasters by giving them a knowledge of the pressure conditions aloft; thereby enabling them to forecast more accurately the velocities and directions of upper winds.

The weather service in Africa has to provide route forecasts for flights often exceeding a thousand miles. Planes travel to the United States by way of South America and across the Caribbean to Florida. Forecasters on the west coast of Africa must make daily route forecasts across the Atlantic to Brazil, as well as across the heart of Africa to the east. The geographical scope of forecasts is tremendous, as forecasts made in the 19th Weather Region extend from the east coast of South America to the west coast of India, and from the northern extremes of Africa to its southern portions. Since all communication is done by radio, it readily can be seen that a considerable problem is encountered in the attempt to get complete synoptic weather observations from the various stations. This is the other large problem faced by Regional Control Officers in this area.

Teletype machines are unknown in Central Africa. Radio as has been previously mentioned, is the only means for the dissemination of weather data. Collectives, including synoptic reports from stations within a particular area, are broadcast by American, British, and French weather stations. All reports must be enciphered when sent, then deciphered when received. This fact, plus the time involved in transmitting and receiving radio broadcasts, results in a considerable time lag between the time of observation and the time the report is used. Forecasters must make the best of this situation and are doing a commendable job. In fact, many weather officers now look upon this time lag as only a minor difficulty.

More Specialists on the Way.

The station coverage included in the collective broadcasts is more than satisfactory, but most weather stations can employ only a limited number of the reports included. An insufficient number of radio operators, as well as difficulty in intercepting certain broadcasts, due to problems connected with the frequencies employed, results in only the more necessary reports being copied. This situation too is rapidly being alleviated, because the Regional Control Officers of both weather and communications in this region are cooperating closely with one another. At present, additional radio operators are on their way to various stations in the 19th Region where they will spend all of their time copying weather reports. Furthermore, attempts are under way to alter the broadcast frequencies of various collectives in order to increase the number of stations able to intercept the particular broadcasts. Synoptic coverage is ample at present; nevertheless the number of observations received and plotted at each weather station is continually growing, and will continue to grow until the Regional Control Office is entirely satisfied.

It can be seen that hinderances to a perfect weather service are plentiful in this area as they are for any weather squadron serving in the field. But these have been circumvented and are being erased rapidly. So pilots are winging their way from the land of Rio over Darkest Africa, to mystical India in comparative safety having full knowledge of the weather which they will encounter; knowing how to cope with any weather hazards which might keep them from delivering their vital cargo to its final destination.

FACSIMILE *at Work*

as told by Major Thomas H. Barry

One man doing the work of three. Completed maps as soon as the forecaster arrives in the morning. This sounds like some kind of man-killing speed-up. It is a speed-up, but the men won't mind it, because it will save many weather stations the necessity for much detailed work. Its name is facsimile transmission, and it's in the Army now.

The idea of sending weather maps over a wire is not a new one, but its growth was slow until the development of commercial apparatus for transmission of news photographs showed that it could be practical. Even so, the wirephoto machines were not suitable for army duty -- they had to be made sturdier and more foolproof before they were ready for field operations. So a rugged laboratory model was made and tested. The test began in June 1942 over a circuit from the weather central in Washington, D. C. to the Army air base at Presque Isle, Maine, and was concluded six months later to the satisfaction of all concerned. The machine had operated on schedule over the 700 mile circuit, and had transmitted four synoptic maps and many auxiliary charts every day for more than six months. There were only two minor failures in that period.

At the conclusion of this equipment test, it was recommended that an operational test be made to find out how the apparatus could best be put to use in the field. The recommendation was also made that the size of the transmitted map be increased from 7 by 9 inches to 12 by 18 inches. The recommendations were approved, but since several small machines were on hand, it was decided to start the test with these and change over to larger machines when they became available. The test called for a Class A station at Mitchell Field to prepare six-hourly maps, auxiliary charts, and weather forecasts for fascimile transmission to the eight satellite fields of the First Fighter Command. At each outlying field there would be two forecasters and three observers -- the former to interpret the maps and forecasts for the operations of their own fields, the latter to make and transmit regular weather reports by teletype on Circuit A.

Maps ready for use.

This operational test is now under way, and the new facsimile machines which handle maps of 12 by 18 inches are just going into service. At the standard map scale, this covers all the United States except for a strip of the Southwest, and includes the Maritime Provinces of Canada in the northeast. If more coverage is needed, the map can be sent in two vertical sections. Each standard type map requires 20 minutes for transmission, but the smaller auxiliary charts are grouped together to save time. The maps are ready for use as they come off the machine, except that fronts, rain areas, etc., can be outlined in color by the forecaster before the map goes on display. Based on a twelve-hour day, the schedule calls for two surface maps; two sets of pressure charts at 5,000 feet and one each at 10,000 and 20,000 feet; a winds aloft map; an isentropic chart; an atmospheric cross section; a twelve-hour forecast; and a 27-hour forecast. This permits a satellite station to close down for the night and to receive a 12-hour forecast and the latest map immediately upon opening the next morning.

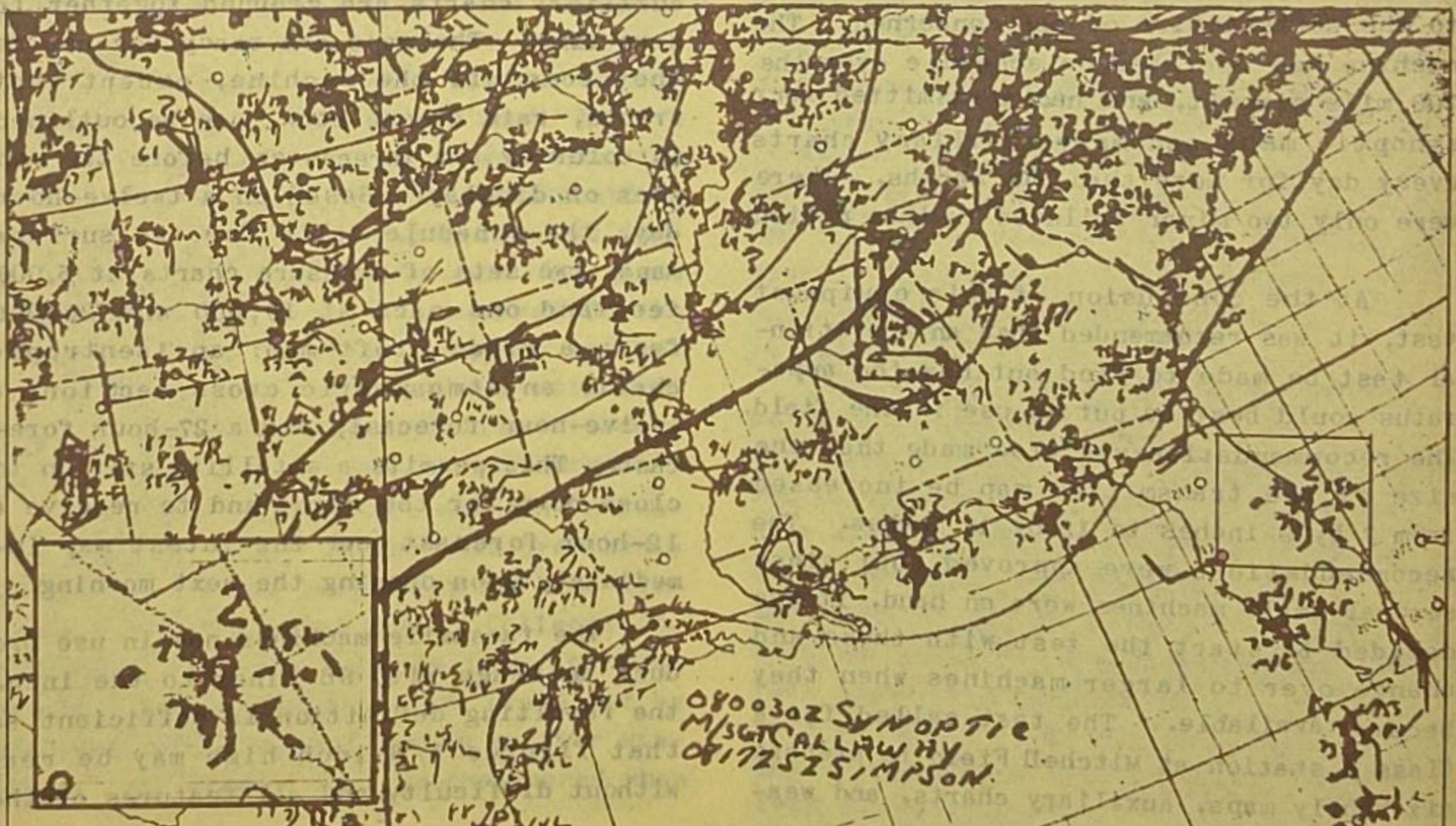
The facsimile machines now in use produce an image with 96 lines to the inch. the resulting definition is sufficient so that figures 1/8 inch high may be read without difficulty and all features of the weather map show up clearly. Figure 1 shows a section of a facsimile weather map natural size, with an enlarged insert to show the lines which make up the image. Although greater definition could be obtained, it would be at the sacrifice of speed of transmission. The present equipment is considered satisfactory and no change is contemplated for the immediate future.

Uniform Analyses.

One of the great advantages of the facsimile network, besides the saving of personnel, is the uniformity of the maps and basic analyses in all the weather stations. Whenever one of the forecasters at a satellite field disagrees with an analysis or forecast as it was transmitted, he is free to telephone, using the same wire network between scheduled transmission times, in order to consult forecasters at the central station and work out his diffences with them by direct consultation. Thus, in effect, each outlying station has the services of an expert consultant staff plus the regular forecasters.

More to Come.

What the future holds in store for facsimile only time will tell. It is becoming clear from present tests that the application of the facsimile net to the needs of a major field and its satellites is a successful one. The Army Air Forces School of Applied Tactics at Orlando, Florida, and a southeast Fighter Command are in line to get a similar set-up as soon as equipment is available. Still greater usefulness and more widespread application hinges upon the development of a satisfactory scrambler so that the signals can be transmitted with adequate security by radio. It is not too hard to conjure up visions of a gigantic weather central sending facsimile maps to every weather station in an entire region, or even throughout the world. However, such developments are not being seriously considered at the present time, both because of the communication problem in getting all the signals into the central station and because it is felt that forecasters in the field in touch with local conditions are better qualified to forecast than are the experts back home. The immediate future, therefore, will probably see only the development of small, compact nets of facsimile machines.



NEPHANALYSIS: *A Forecasting Aid*

by P. L. Schereschewsky

I. Nephanalysis & Frontanalysis

The series of articles opening in this issue will attempt to present the fundamental principles of nephanalysis in a form which will make them applicable to the field problems of the Army Air Forces weather service.

Nephanalysis is not a new and untried method of weather analysis. It has been used and developed over a period of years by Dr. Schereschewsky and his associates in France and North Africa. It is particularly well adapted to conditions which permit visual observation of clouds over a wide area, as in the course of an airplane flight, and prohibit instrumental observations, as is the case when supplies are unavailable or have been destroyed by enemy action. It is therefore being presented in the hope and expectation that it will contribute in some measure to the efficiency of the Army Air Forces weather service under difficult wartime conditions of operation.

One can hardly expect to become proficient in nephanalysis by reading a text any more than one can learn air mass analysis in ten easy lessons. It requires much practice, preferrably in a laboratory with expert supervision to correct mistakes quickly. At the present time, a thousand scattered map tables are our laboratory. To aid in self-instruction, however, any questions concerning nephanalysis directed to the Bulletin will be answered.

Nephanalysis is a new word in the vocabulary of the weather man. It has been chosen to remind the forecaster of frontanalysis and air mass analysis. Nephanalysis is a technique of weather analysis which can be used in addition to front and air mass analysis. It systematizes old and new studies of clouds and weather in order to achieve more refined and efficacious methods of weather forecasting.

Nephanalysis is based upon synoptic observation of clouds and all related phenomena: visibility, precipitations, meteors, and, chiefly, states of the sky. Synoptic analysis of these conditions and rules deduced therefrom constitute nephanalysis and provide a valuable tool in the forecasting of weather.

Nephanalysis uses principally charts upon which data derived almost exclusively from visual observations are plotted without reference to other data and concepts like temperatures, humidity, barometric pressure and its variations, cyclones, and anticyclones.

Cloud and weather observations have always been plotted on synoptic charts in order to facilitate their interpretation, the detection of fronts, location or air masses, etc. The initiators of frontanalysis have from the beginning insisted on the importance of cloud observations as an integral part of modern weather analysis.

In practice, however, frontanalysists, when tracing fronts and identifying air masses, rely chiefly on information derived from winds, pressure, temperature, dew point, and three hour pressure variations. A tendency has developed among many of them to use cloud observations only as accessory tools. Cloud observations are generally not as carefully studied as they should be and not all the information is rendered from them that might be obtained. Nevertheless, forecasts have to be written in terms of clouds and their dangers--icing conditions, thunderstorms, fogs. When fronts have been traced and air masses identified, the basis for the work of the forecaster has been established. The next step consists in determining the future positions of the fronts and in predicting their reinforcements or weakening. The last and, from the practical standpoint, the most important step in preparing a forecast consists in translating these conclusions regarding fronts into specific information in terms of weather and clouds.

This last step requires great care for several reasons:

1. One type of front, for instance a cold front, may give rise to many different times and places. As far as the forecaster of weather is concerned, therefore, there are many different types of cold front.

2. There are areas of bad weather which are located not along frontal surfaces, but in the midst of an air mass. An instance of this is thunderstorm formation in tropical Gulf maritime air. The thunderstorms and their associated clouds form a pattern or recognizable nephsystem.

Pilots are interested in weather and clouds. True, they have a general knowledge of frontanalysis and meteorology which helps them understand the forecast better. In the last analysis, however, forecast must be expressed not in technical terms such as fronts, cyclones, and air masses, but in practical terms such as rain, storm, turbulence, fog, and icing.

In practice, pilots and forecasters, in order to acquire a view of the weather and cloud distribution, supplement their charts with studies of the hourly teletype messages. This method, no matter how carefully followed, it not systematic. Nephanalysis supplies pilots and forecasters with a method of giving a systematic, logical, scientific description of weather conditions and clouds. The object of this series of articles is to make this method or at least its main features available to the forecasters of the Army Air Forces.

Nephanalysis Procedure:

In analysing the old pressure charts before the development of air mass analysis, the procedure consisted in tracing isobars, and identifying and locating cyclones and anticyclones, which are the entities typical of the pressure distribution, and finally forecasting the motion and changes of these entities.

With frontanalysis, the procedure consists in tracing fronts, and identifying and locating polar and tropical air masses, which are the entities typical of the temperature and humidity distribution, and finally, forecasting the motion and changes of these entities.

Similarly, the procedure of nephanalysis consists in tracing characteristic curves called nephcurves, and identifying and locating organized groups of clouds called nephsystems, which are the entities typical of the cloud and weather distribution, and finally forecasting the motion and changes of these entities.

Relationship between Nephsystems and other Meteorological Entities:

Nephsystems are closely connected with other meteorological entities, especially fronts and isallobaric centers. To each cyclone corresponds usually a nephsystem characteristic of the type of cyclone. When small waves appear on a long front, smaller nephsystems often also appear in each wave.

Clouds are visible traces of surfaces of air mass discontinuity; for instance, a warm front is made visible by an altostratus. Clouds are also signs of the structure of air masses; for instance, the

Continued to Page 17

ONE REPORTS FROM

Weather forecasts on aircraft clearances will be clearer and more complete than ever when the revision of Air Craft Clearance Form 23, now under way, is published.

The weather section of the clearance form, heretofore crammed into four lines, will be expanded nearly four times to fill fifteen well-arranged lines. More data will be given, and new headings will show the pilot just what information he is receiving. One of the important new additions is that the latest teletype weather report for the destination and alternate will be entered on the clearance, together with a summary of the latest weather along the route and at the point of departure. Entry of current weather reports on clearances has long been a standard practice with the airlines, but this marks its first official use in the Army to supplement the forecast.

The forecast itself is broken down on the new form into a route forecast, a terminal forecast for the destination, and, for instrument flights, a terminal forecast for the alternate. The forecasts will contain the same elements as heretofore, and symbols and abbreviations may be used. A typewritten entry is preferred but will probably not be required by the new regulations. As always, the forecast will be for the estimated flight time plus two hours. There is no provision for automatic expiration of the clearance authority after a given lapse of time, however. It is therefore essential that the forecaster enter the time of the forecast so that the pilot may be reminded when it is growing old.

The forecast of winds aloft occupies a separate line with its own heading on the new form. A forecast of winds aloft will be made at altitudes requested by the pilot. It will be written out in whole figures, not encoded in the PIBAL code.

A column of boxes is provided on the right side of the weather blank for altimeter settings at the local station, the destination, and the alternate. The boxes for the classification of the weather conditions as C, N, or X have been eliminated; each leg of the flight will be classified by the operations officer on the basis of the weather forecast.

The whole tone of the new clearance sheet is one of increased safety and smooth control of flight operations and and matches the lower level of flight experience as new fliers take to the sky in increasing numbers. Other safety features are included besides the increased space devoted to weather. The pilot, for instance, will specify the check points over which he will report his position by radio, so that traffic control can be more adequately maintained.

The revamping of the clearance form was initiated by Lt. Col. Ralph J. Moore, Chief of the domestic section of the Flight Control Domestic Wing, Flight Control Command. Major D. M. Swisher has been carrying the ball on the revision, studying over the many recommended changes and coordinating them with other interested parties, including the Weather Wing. The proposed revision was presented to the conference of Regional Control Officers in Asheville late in June and received their unqualified approval. Captain Doyle C. Tandy of the Weather Wing A-3 staff represented Army Weather Service in this work.

Major Swisher hopes that the new clearnace form will be a factor in reducing the accident rate. "Many accidents are caused by insufficient preparation before take-off," he said. "We hope to curb those accidents by making sure that the pilot gets all the information he needs to make his flight in safety."

masses, rely chiefly on information derived from winds, pressure, temperature, dew point, and three hour pressure variations.

sonnel officers in the field of the latest policies and decisions, which affect personnel matters. Any suggestions as to matters to be discussed will be welcome.

This series of articles will begin with a subject which is always of interest to commisssioned officers; namely, promotions. No attempt will be made to discuss the manifold ramifications of the promotion system, which is complicated at best, but some phases of general interest only will be touched upon.

It might be well to lay the foundation for this discussion by outlining the two fundamental systems of temporary promotions under which an officer in the Army Air Forces may at present be promoted. I use the word "temporary" advisedly, as all peace-time systems of permanent promotions were suspended for the duration by paragraph 1, W. D. Circular 161, 1942 series, except for Regular Army Officers. The two systems are (1) promotions in the AUS, and (2) promotions in the AUS (AC).

Promotions in the AUS entitle the officer to exercise the authority of his rank throughout the Army. The qualifications necessary to make an officer eligible for a promotion in the AUS are set forth in W. D. Circular 161, 1942 series, as amended by Circular 290, and 417, same series, and Circular 15, Circular 28, and Circular 157, 1943 series. In general, an officer must have served 6 months in the AUS grade (except for Second Lieutenant, Lieutenant Colonel, and Colonel); must be occupying a position vacancy for the higher grade; and must be recommended for promotion by his immediate superior. The recommendation must be approved by all commanders in the chain of command.

It might be well to point out here that an officer cannot be promoted from a grade in the AUS (AC) to a higher grade in the AUS. For example, Lt. X, a 1st Lieutenant, AUS (AC) cannot be promoted to Captain AUS. He must be

charts with studies of the hourly teletype messages. This method, no matter how care-

AUS. However, he can be promoted to Captain AUS (AC), provided he is eligible under that system.

The point now arises as to what constitutes eligibility under the AUS (AC) system of promotion. Qualifications for promotion in the AUS (AC) are listed in AAF Regulation 35-18, the latest revision of which is dated May 21, 1943. The salient provisions for eligibility are six months in grade, AUS, AUS (AC), or permanent, except 2nd Lieutenants, who may be promoted at any time their commanding officer considers them eligible and there is a position vacancy. It will be noted that a promotion in the AUS (AC) entitles the officer to exercise command in the Army Air Forces only. When any officer receives a promotion, he should read carefully the special order which announces his promotion and to determine whether he holds his grade in the AUS or the AUS (AC). Numerous instances have arisen in which an officer thought he held his grade in the AUS (AC) when he held it in the AUS, and vice versa. As a result, promotion forms are not being filled out properly. Perhaps the confusion exists because, even though an officer may have been recommended for promotion in the AUS (AC), higher headquarters may decide that he is eligible for promotion in the AUS and may so promote him.

Another point that seems to be lost sight of in the field is the fact that, by directive from Hq., Army Air Forces, all officers who hold grades in the AUS (AC) should be recommended for promotion in the AUS as soon as they are eligible for such promotion. The only limitation on the above directive is that officers so recommended must be considered qualified for general duty throughout the army in that grade.

The above has been an attempt to clarify some misconceptions which, experience has shown, have existed in the minds of officers regarding promotions. It is hope that the objective has been accomplished

ONE

REPORTS FROM THE REGIONS

Region X

We nearly had a blank column this month. A note from the 15th saved it at the last minute. The headquarters office can't write reports from the regions, so we're just running a heading and hoping you will fill in under it in time for the next issue, you domestic regions, and for the November issue in the case of the foreign regions.

What do we want for this column? Not how Sgt. Slank made a name in Algiers nor how Cpl. Undine observed the ceiling in a back room in Unamit, nor even what Sgt. MacFry used to fill the spare tire of the jeep. Personals are out, by orders from higher up. We are running a technical magazine, not a camp newspaper. What we do want, in addition to feature articles and research papers, is -- short notes on peculiar weather phenomena -- how a particular bug in an anemometer set-up was licked -- suggestions on station arrangement -- successful substitutions for GI equipment under emergency circumstances -- notes on training programs being undertaken in the region -- anything you think the other fellow would like to know about in the way of efficient service and operation.

15th Weather Region

Weather men of the Fifteenth Weather Region, Australia and the Southwest Pacific, handle some of the toughest weather problems that could be thrown at a man. They do it by going right up to meet the problems where they are found -- in the air. They find it is good for efficiency.

Weather observers and forecasters alike are assigned as regular crew members on bombing and reconnaissance missions over enemy territory. They watch the unfolding of their own forecasts, find out at first hand what mistakes they made and why, and bring back accurate reports to help in future forecasts. Far from being considered so much dead weight by the other crew members, the weather men are respected as hardworking and essential members of the combat team.

Compared to the value of the information the weather personnel take on these flights, the over-all risks are small. When the planes do get in a scrap, though, the "met" men are right in it with the others and hold up their end. For confirmation of this, catch a glimpse of the Air Medal ribbons now worn by M/Sgt Mack Glasier from Watervliet, N. Y., and Sgt Edwin N. Palmer from Elmira Heights, N. Y. Both of them had a chance to take a close look at the enemy as well as at the weather.

★-★-★

Nephanalysis & Frontanalysis

Continued from Page 14

Complementary use of nephanalysis and frontanalysis may even be carried one step further, especially overseas where good weather stations are scarce. Frontanalysis as a refined modern method requires many stations making frequent observations. Good observers and meteorological instruments may be lacking; consequently, there are too few well equipped stations and frontanalysis is made difficult. Instability of cold air mass may be made visible by cumulus congestus. It is therefore not surprising that fronts and nephsystems are closely associated. This explians how, from the practical standpoint of weather analysis and forecasting, frontanalysis and nephanalysis help and supplement each other greatly.

As nephanalysis requires only cloud and weather observations and no instruments are needed, many more observing station can be improvized and established very rapidly, thus filling the gap between the few modern stations. As far as observers are concerned, experience will show that almost illiterate people know how to use their eyes well enough for cloud and weather observations although they would be unable to operate modern meteorological instruments. This is probably the greatest contribution nephanalysis can bring during war times.

Clouds, if observed carefully, enable the experienced observer to read the sky and identify air masses: for instance, an altocumulus preceding a cold front is distinguishable from the same species of altocumulus located ahead of a warm front; there are various and typical types of stratocumulus; a cirrus preceding a warm front with instability can be distinguished from a cirrus preceding a warm front without instability, etc. This is why we advocate more thorough study of cloud forms by local observers, as well as by synoptic forecasters.

notes on the Conference of

REGIONAL CONTROL OFFICERS

1. The new tables of organization for weather squadrons takes additional recognition of the amount of training required to produce capable weather personnel. The lowest two grades of enlisted personnel do not appear at all on the table of organization as now approved. This does not mean that weather squadrons henceforth will have no privates or privates first class, but it does mean that every private or private first class has a corporal's stripes waiting for him as soon as his Commanding Officers believes him ready for promotion.

2. Observers graduating from school will start out on precisely the same basis as those undergoing in-station training. Whereas in the past, many observers graduating from school have been promoted before being assigned to station duties, from now on promotions will not be made until the observer-graduates have been assigned to weather squadrons and tried out in actual duty. Men who took their training in the weather stations will have an equal chance for promotion.

3. It has long been recognized that weather officers graduating from the universities and from Grand Rapids would benefit by familiarization training in a well-run weather station before being assigned to duty in the field. The only reason that this has not been done has been the pressing demand from the field for forecasters and still more forecasters. The acute shortage of personnel, however, will be alleviated by Autumn and plans are now being made which call for the class of aviation cadet forecasters scheduled to graduate in December to spend a period of "interneship" either in some of the large continental weather stations or else in similated foreign stations in training areas. Approximately three months will be spent in learning the ins and outs of weather station operation and administration. Chanute Field has been mentioned as a possible site for one of these special training projects.

4. Some people, though certainly not the examinees, think that the forecaster entrance examinations have been too easy. At any rate, it is in the books that examinations will become a great deal stiffer before long, and that a larger proportion of those admitted to the forecaster training courses may find themselves flunking out. However, the fact that the entrance examination will be more rigid will not affect the number of men admitted to the course nor the quotas for each region. The object of the tougher examination is not to limit the number of trainees, but to make sure that the best qualified men are the ones to get the training.

5. Everybody knows by now that the Army is not growing as fast as it once did. One immediate effect of this is that "basic" soldiers available for the lowest grades of specialized training will be fewer and further between. While this will benefit the weather service by gradually raising the level of experience as the men we already have advance and accumulate experience; on the other hand, it will be found that experienced personnel may be called upon to do the more elementary jobs simply because "refills" of inexperienced basics will not be available. It might even come to the point where men with forecaster training will have to spot their own maps, just as they did in some of the early days of the Army Weather Service.

6. Observers who aspire to be selected for isolated duty in the Arctic will have to be physically perfect speciments in order to be selected for these assignments. *(continued on Page 20)*

ABSTRACT

TEST ON ANTI-ICING & DE-ICING EQUIPMENT
at the Massachusetts Institute of Technology

Electrically Heated Antenna

Following early calculations and experimental determinations of the power necessary to prevent ice formation on an antenna wire, a new antenna wire was tested and its power requirements detemmined. The antenna was composed of stranded copper wire woven over a lead sheath through which ran a nickel heater wire insulated with glass wool. Durability tests indicated satisfactory performance, but the power requirements of up to 40 watts per foot for ice removal were found beyond the capabilities of present aircraft electrical systems. Also, changes were found necessary to adjust the voltage requirements of the antenna to those found in aircraft installations.

Electrically Heated Antenna Mast

Tests were made on a section of a typical antenna mast covered with a heatable layer of conducting rubber. Under simulated icing conditions it was found that no more power was required to keep the mast free of ice when there was a large amount of moisture than with a small amount. However, the power requirements increased rapidly as the temperatures fell. Hence, like almost all of the electrical systems of de-icing, the limits of practicability are set by the aircraft electrical supply and the outside air temperature. Adaption of the antenna's voltage requirements to present aircraft installations was also found necessary.

Surface Coatings on Propellers

A number of lacquers, "Kilfrost Airscrew Paste", and one type of grease, have been tested on a small metal propeller operating under simulated icing conditions. Weathering tests were made by operating the propeller in a spray at a temperature above the freezing point. The results showed that the lacquers had no significant effect on icing, while "Kilfrost" possessed excellent de-icing properties for about 20 minutes but was subject to weathering. In general, "Kilfrost" was about as good as Vaseline.

Shear Concentration Propeller De-icer

After passing through several experimental stages, a new type of propeller de-icer is nearing practical application. The latest model of this de-icer consists of two thin sheets of rubber over the leading edge of a propeller blade. One sheet is cemented directly to the propeller blade, and the second sheet is cemented on top of it so as to form a series of closed rectangular pockets. A small hole in each pocket communicates with the low pressure area over the back of the propeller blade and serves to keep the pocket fully deflated, preventing the outer sheet of rubber from fluttering. The inside of each pocket is lubricated with powdered graphite

When ice forms on the de-icer to a sufficient thickness, the centrifugal force exerted on the ice by the rotation of the propeller causes ice and rubber together to creep towards the propeller tip. Uneven stresses develop at the edges of the pockets, and as soon as a crack appears, all the shear stress between the ice and the rubber becomes concentrated at the axial edge of the piece of ice. The rubber stretches and peels away from the ice, clearing the propeller.

In practice, this de-icer has been found to go into action when ice accumulates to a thickness of about 1/8 inch. Further development is needed to increase its resistance to abrasion and deterioration, but in finished form it is expected to provide positive protection with no attention from the pilot, and to be inexpensive to construct and maintain.

The Use of Water Repellent Surface in Connection with De-icing

Feathers, certain leaves, etc., found in nature, owe their water repellent properties to very fine non-wetting fibers or protuberances which hold the water droplets at a distance by the force of surface tension. Such a surface may be constructed artificially by dusting a tacky lacquered surface with aluminum sterate powder.

Tests of the anti-icing properties of such a surface were made. It was found that under direct bombardment by water droplets moving at high speed the surface soon lost its non-wetting properties. However, it offered good protection to the tops and bottoms of wings and other parts not subject to direct bombardment of water droplets. In test cases, the re-freezing of run-off from the leading edge of a wing on its other portions were markedly reduced. Observation showed that water droplets were blown off the non-wetting surface before they had a chance to freeze.

De-icing of Windshield with Scraper

It has been observed that ice and frost can be readily removed from a flat glass surface with a safety razor blade. Experiments have been started with an ordinary automobile windshield wiper equipped with two razor blades which made a 45° angle with the glass, fixed to the wiper arm instead of the usual wiper blade. Tests were not conclusive because the wiper motor did not quite have adequate power and stalled after several minutes.

It appeared that ice could be removed in this way and while the scraper was in operation the glass was kept clean.

It is planned to test a more powerful wiper.

CONFERENCE NOTES

(continued from Page 18)

The Army Air Forces are training explorers on a scale never before attempted; but in order to give this training program the best possible chances of success, every physical defect which might incapacitate a man at a lonely isolated station must be eliminated. Even wearing glasses is considered a disqualifying defect by the doctors who examine the volunteers for Arctic duty. Because a great many of those volunteering and being sent to training centers here-tofore have not made the grade physically, future volunteers will not be transferred from their weather squadrons until they have passed their final physical examinations, but will be carried on detached service when first sent to the Arctic training centers. Other steps which can help to cut down the number of men rejected at the training center would be to use the equivalent of Form 63 physical examination as a screening examination. In too many instances, it has been pointed out that the screening examination given by local flight surgeons were perfunctory and passed over many disqualifying defects. Other points which have been stressed is that personnel selected for duty at isolated stations must be mentally stable and able to get along easily with other people under the most trying circumstances. These rigid requirements have been proven fully justified by the high morale and low rate of rejection among personnel finally accepted.

REVIEW

HINTS ON OCEANIC FORECASTING

Practical Aids In Weather Map Analysis

by Commander W. M. Lockhart

There was a time when Army weather forecasters were concerned almost exclusively with weather forecasts over continental areas. This is no longer true. With Army-operated air routes extending across great oceans, and the expanding use of land based bombing planes to attack targets far out at sea or across narrower expanses of water, Army forecasters must consider many of the problems heretofore thought exclusively the headaches of Naval aerologists. The pamphlet by Commander Lockhart, "Practical Aids in Weather Map Analysis", while principally concerned with synoptic patterns of cyclones in oceanic areas, is therefore of timely interest to a large number of Army forecasters.

The first part of this pamphlet summarizes some of the principal characteristics of various types of cyclones such as a wave between two westerly currents, a wave with anti-cyclonic curved isobars in the cold sectors, etc. There follows a long section devoted to the warm type, occluded cyclone which emphasizes those characteristics which can be detected with a comparatively sparse network of stations, or even by successive observations at a single station. It assumes that the student is already familiar with the generalized pattern of air circulation within such a cyclone, but points out many details and shows how they may be used as clues to the type and stage of development of a storm.

The cold type occluded cyclone is then discussed in much the same manner but at less length.

Certain general rules are then discussed which help the forecaster to follow the progress of an occlusion. A summary of the principal weather characteristics of a cyclone, and some general observations on typical storm patterns complete the pamphlet.

The principal value of this publication lies in the manner in which it focuses the attention, in an analytical fashion, upon many common characteristics of storms which might otherwise be neglected by the forecaster as being purely incidental to a particular storm, and of no significance in the problem of weather analysis. It is a booklet which any forecaster who keeps his eyes peeled could write for himself; but in order to write it he would have to sit down and think analytically about the things he had studied and seen. This discipline of the mind, and practice in generalizing from particular observations, is the most important benefit which would accrue to a careful student of this work. The pamphlet contains many statements which, while made in a general fashion, should be applied only to oceanic areas. For instance, he speaks of the familiar wave type of cyclone as occurring very infrequently between southeast and nortwesterly air currents, whereas this occurrence is actually typical of certain continental locations. In discussing a retrograde wave, he neglects the necessity for cyclonic shear between the warm and cold air masses. In the same vein he stresses the importance of the warm type occluded cyclone, the one most common over oceanic areas, as being the most common type regardless of continental or maritime location.

Commander Lockhart's discussion of the warm and cold types of occluded cyclone is limited, although he does not specifically say so, to that familiar but illusive phenomenon the "typical storm". Although his statements are valuable as generalities, like all generalities they are more frequently breached than observed. Such statements as the area of precipitation will vary only slightly from the figure of 300 miles in advance of the surface front, must of course be regarded with caution.

All in all, this booklet should be regarded as excellent "skull practice", and review material to keep the forecaster from looking too narrowly at the immediate stage of forecasting problems, but the student should make it a point to take reasoned exception to many of Commander Lockhart's statements, and to think through to the answers for himself.

AN ARTIST LOOKS AT WEATHER

"Clouds, Air and Wind"

by Eric Sloane

"Clouds, Air and Wind" is Hollywood gone berserk with the weather. By a sensational style of approach, Mr. Sloane has attempted to simplify the matter of weather to its little A B Cs and has emerged with some very striking airbrush paintings of clouds and a great many misstatements and misconceptions about them. Such "boners" as the statement that the centrifugal force of the earth's rotation accounts for the high average height of clouds at the equator, puts this book beyond the pale of any legitimate use in serious meteorological instruction. Other misstatements of fact and perpetuations of popular misconceptions about the weather are too many to detail in a short review.

The first half of the book is devoted to the appearance and description of cloud types, and is illustrated by some of the best drawings of clouds which have yet been published, although the Hollywood influence is strongly evident in the posing, a la "National Geographic", of late model airplanes in the foreground of each picture.

The second half of the book is a pepped-up, blitz course in meteorology which "explains everything" in a "layman's terms". Instead of the magnificently simple illustrations of the first section, Mr. Sloane has chosen to use the jumbled "believe it or not" type of cartoon which shows everything about everything all on one page. Again Hollywood gets the best of it. A cold front is represented as being the entirety of a summer storm; a winter storm is represented as having a warm front too, but there is no representation of cyclonic structure and no illustrations of the relationship between fronts.

Regardless of the mistakes and shortcomings of this book, it does prove conclusively that meteorological pedants have as much to learn from Hollywood as the latter has to find out about science. Instructors in meteorology have struggled along for too long with inadequate blackboard diagrams and poorly sketched posters. Meteorology is interesting to meteorologists, and there are magnificent opportunities for making it interesting to other people, particularly to flyers. Mr. Sloane has taken some important steps in that direction, and some of his techniques may well be copied by others with better technical training. It is to be hoped that Mr. Sloane will go back to school and eventually emerge with an understanding of meteorology to match his artistic sensibilities, and that he will reject the confusing multiple cartoon for some simpler means of presenting his material. In the meantime, meteorologists and meteorological instructors will find his book interesting but not worthy of serious use.

THE WEATHER OFFICER'S BIBLE?

Technical Order No. 00-25-27

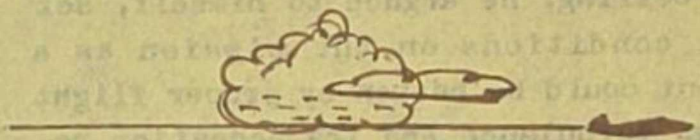
Originally planned as a technical manual, the manuscript of this technical order was first published by the directorate of Weather in November, 1942 under the title "The Organization, Administration and Operation of the Weather Service, Weather Stations and Sections". After thorough coordination with all branches of the weather service, it was published in its present form by the Air Service Command.

The present version is restricted to those items of the original pamphlet which bear directly on the administration and operation of a weather station. It omits the historical data and the reference lists which featured the original publication. Beyond these omissions, there has been little change except for some dressing up of the text and illustrations and the addition of some humorous sketches to liven it up.

The need for the factual material presented in this order is obvious. The primary responsibilities of a station weather officer are those which have to do with the conduct of an efficient weather service. In addition he, as a detachment commander, is called upon to do much of the administrative paper work which normally devolves upon the junior officers of a company, the first sergeant, and the company clerks. Knowing the way through all this paper work is a profession in itself, and a guide to proper procedure is imperative if the weather officer is to be free to devote his attention to his primary duties. It is also to be hoped that this technical order will help to establish uniformity in administrative and operational procedure.

More than one of the Regional Control Officers has expressed himself as believing that much more uniformity in the physical layout of weather stations should be an immediate goal. The layouts and photographs in this technical order will probably not be those finally adopted, but at least they will be a leaven to keep the idea working.

This edition of the publication is probably not the final one as suggestions for revisions have been coming in, and more will doubtless be necessary in the future. There are bound to be mistakes and oversights in every work of this kind until it has had a chance to work out in practice over a period of time. It is hoped that this coordination period will not be long for the Weather Station Handbook, as it is already second only to Army Regulations as the "bible" of many a weather officer.



NEW ANGLE FOR PILOTS

Technical Order 30-100D-1

"Instrument Flying Technique in Weather", the Army's latest and most complete work on the subject, marks a complete break from previous training literature on weather. The criticism too often levelled at previous technical manuals is that they attempt to make every pilot into a professional meteorologist in a small way. Pilots often didn't care about becoming meteorologists. But they do want to know about weather as it affects their airplane and their flying technique. Hence the value of the present booklet.

Different not only in scope but also in style, the new booklet opens with a brief tale about an ordinary flight that went wrong. While fictional, the tale has a true-to-life flavor and a genuine "hangar flying" atmosphere of an airman's story told to airmen. Every flier will recognize the personal element in the mistakes which Scratchy, the hero, makes; their consequences; and his reactions.

The second chapter contains some meaty thought about the part which weather really plays in flying. The hero, fool for luck, is hospitalized after a crash landing. Under the beneficent pen of the author, he becomes a model of self-analysis. Instead of being convinced that it was that terrible beast "the weather" that beat him and going ahead with a heightened distrust of every instrument weather report and every cloud mass, Scratchy admits his own mistakes and decides to reason out just how weather, combined with his error, put him in the hospital. He comes to the decision that there are only two real hazards of weather which concern the pilot in the air -- turbulence, and ice accretion. Fog and low ceiling, he argued to himself, set certain conditions on the mission as a whole, but could be beaten by proper flight planning; turbulence and ice accretion require certain flight techniques.

The next two chapters describe the hazards of turbulence and ice accretion in detail and the flight techniques effective in avoiding or overcoming them. The following six chapters are concerned with the weather conditions which produce turbulence and icing conditions, and describe the peculiarities of squalls, thunderstorms, and the various kinds of fronts. No attempt is made to "palm off" on the pilot a lesson on the synoptic theory of cyclones or the like.

On the whole, this publication is a most valuable one, and one which should result in better understanding of the salient facts about the weather which are important for a pilot to know. Throughout its length the booklet keeps the pilot's point of view and treats primarily with the pilot's problems. It taps a wealth of experience not previously available to most young pilots. The series of technical orders, of which this is the fourth, is by title devoted to instrument flying, but it should not be thought that its application is limited to this scope. In fact, it should be read by every forecaster who is dealing directly with pilots.

SOME ALLIED PROBLEMS

Technical Orders 30-100A-1, B-1, C-1, E-1, and F-1.

If there were no such thing as weather, there would be no such thing as instrument flying. Although specialized flight instruments are useful in some types of planes under contact weather conditions, the real incentive for the development of these instruments and the flight techniques used with them was the necessity for controlling an aircraft out of sight of the ground.

This means that the problems of weather and those of instrument flying are very closely associated in a pilot's mind. When he comes into the weather office, he is often thinking of the weather in terms of instrument procedures. If the weather officer is to attain his maximum usefulness, it is therefore necessary for him to become familiar with the principles of instrument flight, approach, and landing procedures, so that he may understand what is going on in the pilot's mind and how the weather affects his problems.

T. O. 30-100D-1 is reviewed elsewhere in this section. The rest of this set of technical orders is devoted to the theory and technique of instrument flying, instrument approaches, and instrument landings. Basic and advanced instrument flying, including instrument approaches on the standard type radio range, are covered in the first two of the series. The third is an instructors' guide for instrument flying trainers. The fourth is the weather guide, and the fifth and sixth are devoted to the instrument approach and landing procedures for apparatus now in use here in the United States and allied countries.

These manuals, with the probable exception of 30-100C-1, are recommended reading for all weather personnel who are or hope to be working closely with pilots. If possible, this should be coupled with some Link trainer exercises. It will then become plain why a pilot is often more interested in the amount of ceiling than in the acceleration of a cold front.