FLYING SAFETY

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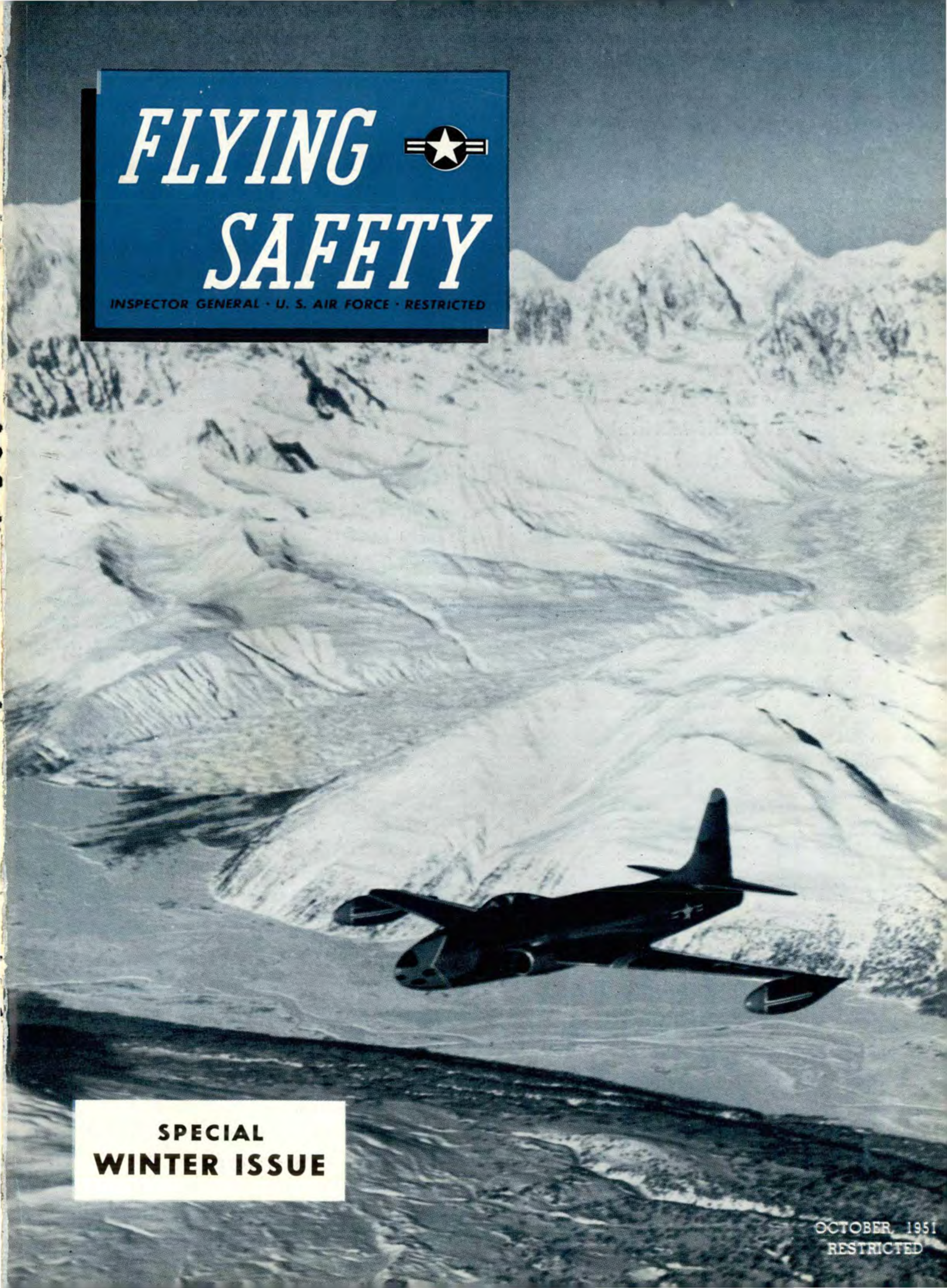

SPECIAL WINTER ISSUE

OCTOBER, 1951

RESTRICTED

IN THIS ISSUE:

Given the choice, most pilots would probably choose summer over winter weather for flying. There are many reasons for this, but most of them would boil down to something connected with safety. All the summer accident hazards are still around in the winter plus the additional ones of ice, snow, sleet and just plain cold weather. It stands to reason then, that more thorough preparation, greater alertness and caution, and special techniques are necessary for successful winter operation. All of these points are emphasized in the articles contained in this issue of Flying Safety. The fact remains, though, that it's up to you to take the precautions which will prevent winter accidents. And you can do it, too.

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NEXT MONTH:

We don't know for sure just what will be in the November issue of Flying Safety. At this point, it could turn out to be just as much of a surprise to us as it will be to you. One article we hope to get to you is on flying the B-47. It seems that it's difficult to decide whether a bomber pilot or a fighter pilot makes the conversion to B-47's more rapidly and efficiently. This airplane may start up the old controversy between drivers of "big friends and little friends" all over again, though from a different angle. Regardless, there are certain safety points and techniques in flying this bomber which handles like a fighter; they should make a good article. Another possible feature involves the flying safety side of the cadet training program. Did you know that the cadet program boasts a safety record which is considerably better than the Air Force average? Doesn't seem right, but it is. And there are reasons for it, too. We'll try to tell you about them next month.

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HELP WANTED:

Did you find anything in the September issue of Flying Safety that you especially liked or disliked? If you did, why not write and tell us about it. Maybe we could give you more of that particular type of thing if you liked it; or less if you disliked it. Anyway, let us know what you think of the magazine—drop an informal letter, a postcard will do, to the Editor, Flying Safety Magazine, Directorate of Flight Safety Research, Norton Air Force Base, San Bernardino, Calif. While we're on this writing subject, if you have an idea for an article or if something is going on at your base that you believe warrants publicity in Flying Safety magazine, let us know about it. Maybe you'd like to try your hand at writing something for us—we'll see that you get the credit and if any polishing or editing is necessary, we'll take care of it.

FLYING SAFETY

RESTRICTED

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Winter Weather

We live in a big country with almost every winter weather extreme. Here are some long-range "area forecasts."

MOST ALL USAF PILOTS have received a pretty thorough general training in meteorology—either in school, reading official publications or from actually experiencing weather conditions through flying. Yet, when the average pilot is faced with flying missions during the winter season he is prone to spend little more time studying the weather maps and analyzing the forecasts.

Ordinarily, when the pilot does think specifically of winter it brings to mind only two hazards—icing and widespread areas of poor visibilities and low ceilings. He just doesn't stop to pause and evaluate his weather knowledge of winter flight conditions until the season has arrived. And the month of October, although still early for the development of widespread and persistent storm conditions, is a good time for the pilot to take stock of his past winter flying experience and hash over his weather knowledge.

For this review a good start would be to bone up on general ZI weather trends for the worst four months of winter flying weather.

THE NORTHEAST —

October and the autumn season is associated with increasingly frequent outbreaks of Continental Polar air from north and central Canada. Waves develop on the polar fronts and move northeastward along the Atlantic coast and cause fog and precipitation along the coastal states. Frequently these disturbances will cause low ceilings and poor visibilities for as long as 48 hours. It is well to remember that regardless of the cause, (either a wave or a high pressure system) winds with easterly components generally cause overcast and rain or drizzle conditions since they cause advection of moist air from the ocean.

October is the worst month of the year relative to risk of ground fog formation in the sunrise period. A combination radiation-advection fog is also fairly prominent during the fall season in the New Jersey-Long Island areas between midnight and the hour after sunrise. Fog in the La Guardia-Mitchel areas on a clear night is usually involved with a wind from the SSW or SW.

As a result of cold front passages in the NE section, the weather conditions generally improve rapidly with visibilities of six miles or more. Approaching warm fronts or warm frontal passages often produce low ceilings and visibilities of less than one mile. Flying hazards are reduced mainly to these factors. Icing conditions are not prevalent until later in the winter season.

A common occurrence during the winter proper is what is called a "Northeaster," which is a storm with typical warm frontal characteristics that persists for 2-3 days. The wind blows steadily from the east or northeast and precipitation is continuous in the form of drizzle or wet snow. The clouds are usually very low.

THE SOUTHEAST —

In this area, the autumn and winter seasons are perhaps the least important. It has been noted that a major percentage of adverse weather conditions that do affect this area during the winter months is due to the formations of thunderstorms in the western Gulf of Mexico and southeastern Texas. Late October and the month of November mark the beginning of the penetration of Continental polar air and by the time it reaches this area the air is modified to the extent that cold frontal passages are infrequent.

Restrictions to flying develop after passage of weak cold fronts due to the fact that they become stationary through Alabama, Georgia and the Carolinas and consequently the development of waves along the front

The Northeast states experience all types of winter weather. Fog along the coast is common in October. The Southeast section of

the United States is least affected by winter, while the northern Middlewest suffers extremely low temperatures, snow and ice.

produces weather for a period of several days. During the winter season, an average of approximately 25 cold fronts pass through this area with poor flying conditions existing 12-24 hours before the frontal passage and ending 4-6 hours afterward.

Wave formations originating in this area or in southeastern Texas produce the poorest flying conditions for the longest period of time, 2-3 days. A situation of this type covers such an extensive area that although a few scattered terminals remain open, it presents a difficult problem to flying because the weather is very general and finding an alternate airfield is almost impossible. Perhaps the greatest hazards are fog and low stratus conditions. However, through the mountainous sections, icing definitely is a very important hazard to all aircraft.

THE MIDDLE WEST —

Fall weather in the Middlewest is more generally satisfactory than any other season since weather fronts begin to move with more regularity than in the summertime. A marked change occurs, however, during late October or early November. Precipitation becomes more common and low ceilings and poor visibilities predominate in the area to create the poorest flying weather of the ZI, with the Great Lakes region exposed to the highest frequency of fog and low ceilings in a normal year.

The chief cause of low ceilings and rain is a low pressure system or frontal wave either in southeastern or southwestern Kansas with resultant overrunning warm, moist, tropical air. In October a polar high pressure system brings bad weather on the eastern side. The air blowing over the Lakes becomes unstable and this instability is strong enough occasionally to set off small thunderstorms. Icing (after October) presents the big hazard to flying and with the average height of the freezing level down to about 9,000 feet over the Alleghenies, conditions are favorable for lightning strikes on IFR flights through these squall conditions.

THE NORTHWEST —

In this region, October and early November are almost certain to bring the first real foul weather of winter, although the frequency of bad weather around Seattle might range from 21 per cent to as low as three per cent in any one year. Dark, rainy weather characterizes frequent occluded fronts moving in from the Pacific with fog generally associated with the postfrontal periods. Average height of the freezing level is down to about 8,000 feet MSL in the Seattle area. The peak of the winter fog season is not reached in the Spokane and Walla Walla areas until December and January. Storm activity is most frequent during December.

THE SOUTHWEST—

Along the extreme southwestern area the rainy season becomes established by early November with total fall about double that of October, but with the frequency of the rain very low when compared with the eastern part of the country. On the whole, the California coast sees a high percentage of fog and low ceilings during the month. The Frisco Bay area has a sharp increase in fog and at Los Angeles the frequency of fog is almost equal to that of December which is the worst month of the year.

The Las Vegas region generally has fine weather during autumn but the rest of the Plateau Region is exposed to the first winter types of frontal and air-mass weather. Average height of the freezing level is down to about 8,500 in the northern section and 10,000 in the southern section which puts most flights in the icing zone. Most persistent bad weather in mid-winter (December) is generally found in the interior valleys of California.

Better flying weather during the winter season prevails around the east slope of the Rocky Mountains due to the prevalence of strong downslope winds from westerly quadrants.

READING WINTER WEATHER—

All pilots should be able to read a weather map intelligently. It displays much information in a pictorial manner and a brief survey of it guided by a forecaster will show in a few moments what it would take hours to describe.

While it is not expected that every pilot should become an expert weather forecaster, he should learn and know some of the principles that the weatherman uses to arrive at a forecast. In this way the pilot will know the limitation of the forecast and will build confidence in his own decisions on the safest and most efficient method of flying difficult weather situations.

FORECASTING PROCEDURE—

There are three main steps for the pilot to follow in arriving at a decision:

- Get and keep in mind a complete picture of the current weather situation.
- Move the picture forward in space and time to cover the route of the flight.
- Consider the changes that will occur during the time in flight.

If the forecast interval is short (3 to 6 hours), it is often possible to use the past history to determine the amount of weather motion that will take place.

In addition to reading the weather forecasts, a sharp pilot will study the synoptic situation on the weather map noting especially the frontal weather, where the most dangerous icing is usually found. The two factors needed in order to get icing are temperatures near or below freezing and the presence of moisture.

Since the rate of ice accretion depends on the size of water drops, if the pilot can keep his plane out of freezing rain and out of turbulence above the freezing level, he can avoid the worst icing.

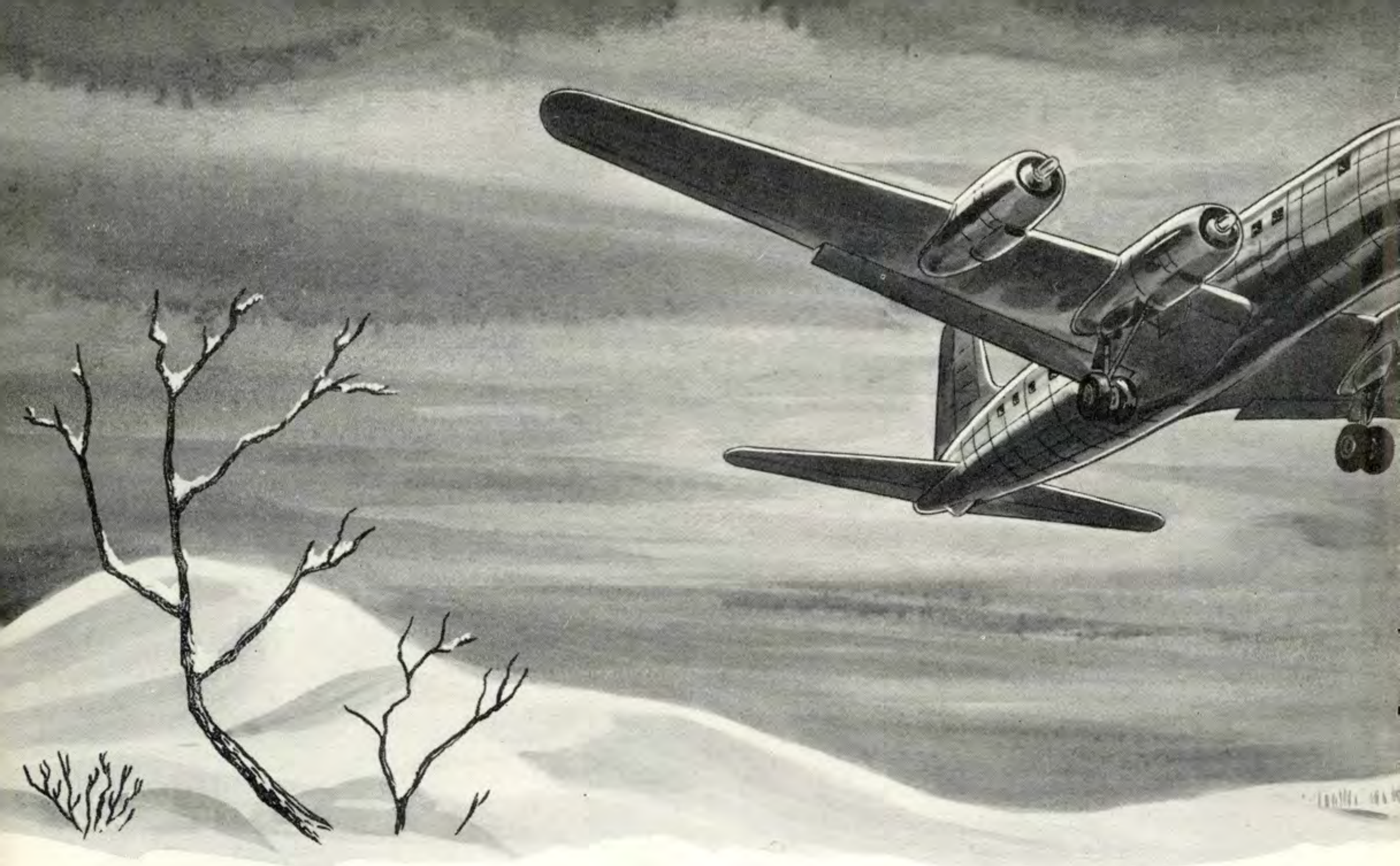
Usually, heavier turbulence is found in conjunction with the cold front, while freezing rain is most often found in the cold air under the warm front. If possible, the pilot should avoid flying through water clouds above the freezing level.

On teletype sequences the freezing level for each station making radiosonde observations is easily found. This level is added to the individual sequence as part of the remarks and is written as RAFRZ 134MSL RH 92. This would read as "Radiosonde freezing level 13,400′ Mean Sea Level, Relative Humidity 92 per cent." Here, in addition to the height of the zero isotherm, the probability of clouds at this level is shown by the relative humidity; a high humidity means cloudiness and a low humidity means clear skies.

With the change of air masses associated with frontal passages over various stations or in flying through a front, the freezing level may change radically within a short period of time or over a short distance. This may usually be checked by finding the freezing level within

Occluded fronts moving in from the Pacific bring dark, rainy weather to the Northwest. Icing levels drop below mountain peaks.

Fog and low ceilings along the Southwest coastal areas represent hazard to flying. Inland, this area has relatively good weather.



each air mass over stations and considering the past movement of fronts and the approximate point at which the plane will fly out of one air mass and into another.

Low ceilings and visibilities over the country can be forecast, but again a good pilot will study the weather maps and sequences of the area in which he will be flying. Two conditions ordinarily cause most of this condition. The first is the presence of a slow-moving warm or occluded front with precipitation ahead of it. This will bring the ceiling down and lower the visibility until zero-zero conditions will often prevail over a wide area.

This condition then builds up over a long period and will be found becoming progressively worse on successive weather maps and sequences. Advection fog is the second weather factor and such fog is formed when warm moist air moves over a colder surface, or when air is lifted by prevailing winds up the slopes of mountains. This fog may persist during the day, but usually will become low stratus with ceilings of 100′ to 500′ during the day and, with sufficient heating, may break in the afternoon and form again about sunset. Forecasting this formation and dissipation may be tricky and a pilot should be sure of an alternate which will remain open before flying into a doubtful area.

Radiation fog should also be expected on clear nights with light winds but is usually more localized than the above conditions.

Another danger which may have been forgotten during the summer is the effect on a pressure altimeter of the changes in reading caused by flights into areas of different pressures or flights into cold air.

In flying from higher toward lower pressures, remember that the altimeter will read too high causing an altimeter reading which shows a higher altitude level than that of the plane.

A clear and thoroughly understood picture of the weather before takeoff plus a good grounding in the basic principles of weather forecasting and interpretation are of life-saving benefit to all pilots flying during the winter season.

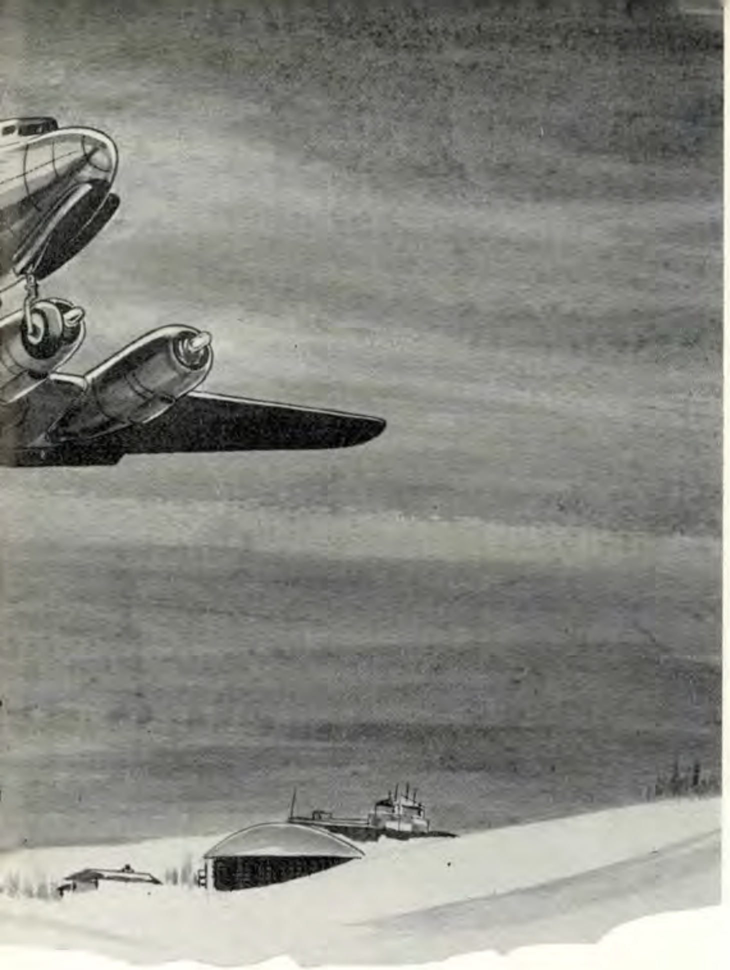
THE WORST FOUR MONTHS —

The Far Northwest has the poorest flying weather for the month of October which brings fogs and low ceilings. In the Seattle area, for example, visibility averages between 0 and 1 mile 37 per cent of the time during the hours of 0300 to 0900, but only 4 per cent during the hours of 1200 to 1800 PST. Poor flying weather also prevails along the California coast with the chances of heavy fog and low ceilings greater than any other month. In the middlewest plains states, October brings a few active cold fronts, one or two active lows and a tendency toward ground fog formation during the sunrise period. The average height of the freezing level comes down to about 12,000 feet.

Besides general rain and low ceilings, the central east coast during October has alternating regimes of stable, fog-laden air when highs become stranded off the coast.

NOVEMBER —

This month may be regarded as the first winter flying month, bringing widespread developments of fog and



low ceilings, severe changes in wind at all levels and ice or snow-covered runways. On the credit side may be found only the absence of thunderstorm conditions and temperature restrictions to takeoff loads. Dark, rainy weather is typical throughout all of the northwest. Interior areas see almost as much wet-foggy weather as the coastal section. West of the Cascades, November brings the worst flying weather of the year with heavy snowfall in the Cascades. The average height of the freezing level is down to about 7,000 feet toward the end of the month.

The southwest rainy season is generally well established by early November. The Las Vegas area has the finest weather in November but the rest of the Plateau Region is exposed to the first winter types of frontal and airmass weather. Average height of the freezing level is down to about 8,500 in the northern section and 10,000 in the southern section which puts most IFR flights in the icing zone.

Around the Great Lakes the instability effect is stronger in November as cold masses of Canadian air move in across the warmer waters. The entire area has frequent blankets of stratocumulus clouds with snow squalls in the South Bend section.

Unlike the west coast, the east coast has a more gradual approach to the bad weather peak of mid-winter which comes in late December and January. For November there are two factors to make this month worse than October: (1) Lack of good alternate fields within a given area and (2) lowering of the freezing level to around 5,000 feet.

DECEMBER —

Much like the "Equinoctal Storm," the Old Maid's tale of the mariner and the farmer, aviation has been developing a legend built around the "Christmas Week Storm." Actually, there is just as much chance of such storms in early December or in January—it's just remembered longer.

With major storms possible anywhere in the country, December brings the worst flying weather of the year to the northwest and the northeast. The eastern storms are more likely to create widespread low ceilings and fog. The best weather for the month is usually found along the east slope of the Rockies where strong downslope winds prevail for a week or more at a time.

Most persistent bad weather is generally found in the interior valleys of California where fog is often continuous for days at a time, interrupted only briefly by slight lifting during the afternoons.

JANUARY —

Considering the winter as a whole, January is the worst flying weather month of the year. Airmass contrasts between ocean and continent are at a maximum. storm developments reach their peak of frequency and intensity, and cold ground surfaces provide ideal conditions for fog formation.

This month finds a continuation of the December pattern throughout the entire northwest. The east slope of the Rockies has the best flying weather due to the strong westerly downslope winds. January is the wettest month along most of the California coast and finds fog concentrated more heavily in the central valleys making alternates hard to find. Nellis Air Force Base or Edwards Air Force Base are practically 100 per cent assurance as alternates.

The worst flying weather is found around the Great Lakes and east coast areas. Frequency of this bad weather, however, varies from year to year. A high proportion of low ceiling and visibility occurs in connection with warm fronts lying to the south of the areas over the Carolinas or just off the coast. When a Hatteras low and warm front move northward up the coast, a typical sequence of weather at all stations starts with steady dry snow, changes to wet snow, then to sleet, freezing rain and finally to rain or drizzle and fog.

One helpful forecasting rule is to remember that winter warm fronts are nearly always retarded when approaching the New York-Boston area.

There are a number of winter flying rules based upon the combined experience of pilots and weathermen. Supplement them with a little common sense and you'll find them helpful in flying winter weather.

Approximately 85-90 per cent of weather is flyable providing the flight is planned properly. Always check closely on the weather, not just along the flight path but the area into which the flight will go.

WHEN THE S

YOU NEED SNOW to go skiing. You need it to build a snowman or to have a snowball fight. And it sometimes makes a beautiful scene of what was ordinarily a rather drab sight. But you don't need snow to go flying. Only thing is that sometimes you've got it. It can't be ignored, because that could lead to disaster.

Wintertime snow demands respect from pilots. Flying and ground operations can't be considered normal when snow is on the ground. There are certain rules and modifications to the usual procedures which must be followed. Some of the winter rules are products of common sense, but most of them are results of someone's rough experiences.

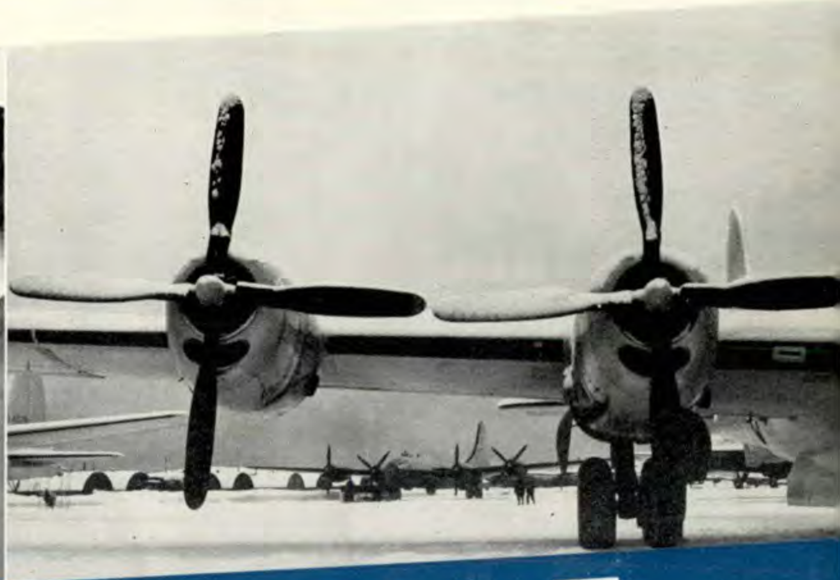
Even though you may be stationed in the sunny south and are not expecting any snow this winter, a knowledge of winter operating procedures is important. Many accidents last year and the year before, although they occurred at northern bases, involved pilots stationed in the south. It is usually too late to brief yourself adequately on cold weather operations after you have been ordered to make a flight to a winter-zone air base. Blowing snow, glare, slippery surfaces, slush, snowbanks and numerous other wintertime phenomena await the unwary operator of a plane, be he ground crewman or pilot. Every winter, many aircraft accidents are caused by ice or snow on runways, ramps and taxiways.

Attempting to taxi on surfaces covered with ice, slush or snow, contributes to a large share of winter accidents. Slippery surfaces greatly reduce the effectiveness of brakes in steering or stopping. You should taxi slowly, use extreme caution, and if you think you might damage your plane taxiing or parking, call for a tug. That's why they're there.

Remember that it has always been a pilot's prerogative to refuse to taxi under unsafe conditions. Once a skid starts on an icy ramp, there isn't much you can do to stop it. Don't let a skid start. Also, give yourself twice as much room to maneuver your plane as you do when there is no ice or snow. All of these things might take a little longer, but not as long as an accident board inquiry.

Another accident type resulting from winter surface conditions is caused by applying excessive power to pull the plane out of deep snow, ruts or slush, and nosing up. Here again, don't do it. Get a tow or let it sit.

Snowbanks piled up beside runways, across the ends of runways, along taxi strips and on ramps have taken their toll of AF planes every winter. Sheared or damaged gears, bashed-in fuselages, rudders, elevators, stabilizers, props, wingtips and flaps bear witness to the solidness of man-made snowbanks. A particularly hazardous condition is the leaving of snowbanks across the ends of runways, since they are extremely difficult to see from the final approach. If the runway length is critical and you are attempting to land as short as possible, be especially alert for a snowbank across the approach end



NOWS COME

When snow covers runways and taxi-strips, you can't go on using the same old ground rules you used last summer. You might end up on your nose—or worse.

of the runway. Also, a snowbank across the far end of the runway creates a sad state of affairs if you are unable to stop on the runway. It is a lot less serious to run off the runway into soft snow than it is to run into a wall of hard-packed snow and ice.

When taxiing close to snowbanks, be particularly careful in making turns or in swinging the tail around. When you swing around to run up the engines before taking the runway for takeoff, for instance, check carefully to make absolutely certain that there is sufficient clearance behind you.

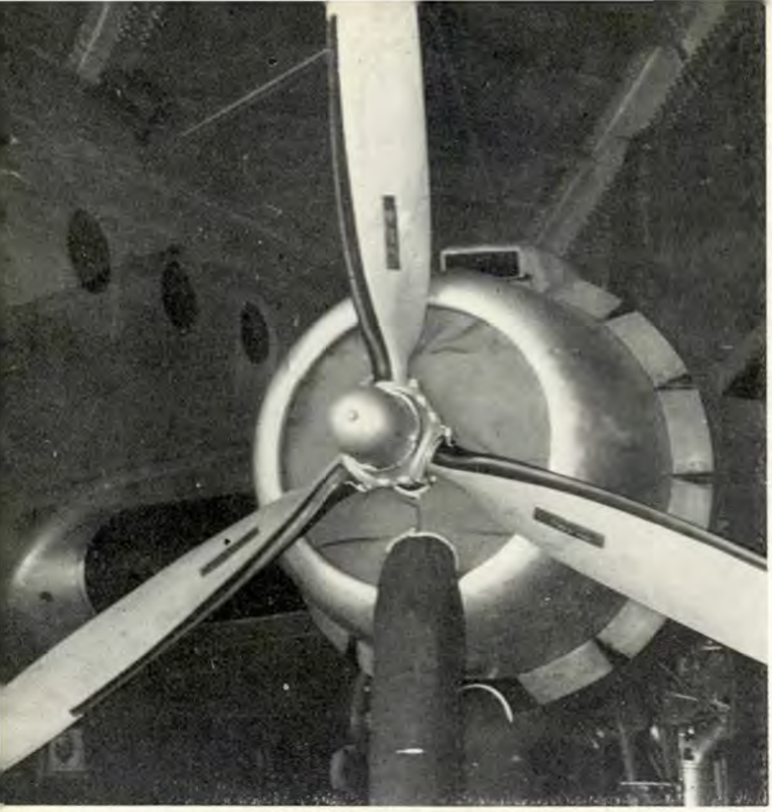
You personally can see to it that something is done about snowbanks piled too close to operating areas, by informing your Flight Safety Officer and Operations Officer of the hazards. They will take it from there. Snow removal means not only clearing off hard surfaces but also getting it far enough off the sides so that a plane can be operated on the ground freely.

Slush on the runways after a thaw can cause a great deal of concern to air crews on takeoffs and landings. After gear retraction, slush thrown into wheel wells can freeze the gear into an up-and-locked position, which, in extreme cases can result in a wheels-up landing. On both takeoff and landing, slush thrown by the wheels and props can badly damage flaps, wheel well doors and other skin surfaces. If at all possible, avoid takeoffs and landings under such conditions.

Brakes, if used during landing roll, should be applied gently and cautiously. On airplanes equipped with reverse-pitch propellers, reversing of propellers is the safest and most efficient means of rapid deceleration on slippery runways. It must be remembered, however, that in loose snow reversing the propellers will result in temporarily limiting forward visibility.

Depth perception in snow-blanketed areas can be deceiving. Although the runway might be clearly visible from above, it may disappear on the final approach and roundout because of lack of contrast between the strip and surrounding ground. It is advisable, therefore, to request the tower to turn the runway and approach lights to full intensity whenever ice, fog or snow flurries are present. Besides aiding in orientation in the traffic pattern they help materially in judging height above the runway. GCA assistance should be requested in conditions of low visibility as well as low ceilings. Glare can reduce a pilot's depth perception to such an extent that he can either stall out high above the runway or drive his plane into the ground. Both are notoriously hard on airplanes. Under such conditions, a pair of sun glasses becomes a safety item.

Remove every trace of frost, ice or snow from wings, fuselage, tail surfaces and propellers before takeoff. Even though the accumulation of snow on the plane is not of sufficient weight to do any harm, drag induced by rough surfaces can drastically alter a plane's flying



Heating engines before starting is a must in Arctic operations. Above, cowling excluders are used in heating a C-54 engine.

Engine heater hose can look like a bunch of overgrown snakes when multi-engine planes are being heated. Cockpit also gets heat.

characteristics to such an extent that it might never get off the ground.

Another important pre-takeoff item is to check all controls for freedom of movement. Light snow can sift into the smallest openings and also slush thrown up by the wheels the day before might have frozen during the night. Make certain both by visual inspection of all openings and by moving controls and flaps through their full travel that they are not restricted by ice or snow.

Airfield conditions can change rapidly during the winter months. Consequently, all flights must be carefully planned and particular care should be taken in checking Notams. Even though you might have been into a field the day before, check the Notams again before clearing for the same field. A few inches of snow or a change in temperature in the meantime could have made a tremendous difference.

Thorough preflight briefing is extremely important. Briefing should include all information on the planned mission so that no question will exist in any crewmember's mind as to exactly what he is expected to do under normal conditions and for any emergency that might arise.

There are many other matters concerning winter flying hazards with which you must become familiar. Peculiarities in local weather behavior and airfield conditions, peculiarities of the particular type of aircraft you are flying, the local SOP for winter operations—all of these should be studied carefully.

It will take some concerted effort by you and your brother airmen to cut out winter accidents caused by snow conditions. But you can do it.

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A letter to Major General L. P. Whitten, Commanding General of Northeast Air Command, asking for some general observations on cold weather operations in NEAC brought the following reply:

"Arctic operation and maintenance instructions contained in the various aircraft handbooks are, in most cases, considered adequate for the maintenance of aircraft operating in the North Eastern Arctic. The following are some suggestions for operation of aircraft in sub-zero regions of the NEAC:

"It is considered a 'must' to dilute engines when temperatures are 32 degrees F and below. At temperatures below 5 degrees F external heat is applied to engine power section, oil cooler, oil supply tank and accessory section.

"To preclude the possibility of low oil pressures and subsequent shutting down of engine during flight, it has been found necessary to drain 'Y' drains and sumps at all times when aircraft engines require preheating. C-47 aircraft require draining of the 'Y' drain and oil cooler, the latter being necessary because of its location in the system. A recent flight of a C-47 aircraft resulted in a ruptured oil cooler. Upon examination it was found that the bottom cores had burst. It is felt that this condition was brought about by the freezing of moisture and congealing of oil in the bottom of the cooler.

"The combustion heaters installed in C-54 type aircraft are very satisfactory provided a high grade of maintenance is performed. Difficulty is experienced with these heaters after the aircraft has cold soaked for even short periods of time. It his been determined that much of this trouble is due to water in the gasoline which freezes into ice particles and causes the heater to malfunction. This condition is covered in paragraph 4-4,

Heating engines and cockpits are not the only uses for heaters. Frozen brakes must be thawed out before the plane can be moved.

When the time comes, our bombers cannot be prevented from accomplishing their mission because of cold weather. Get ready now.

T. O. 00-60B-1. To alleviate this condition external heat is applied to the heater pump located in the nose wheel well. This is accomplished during ground preheating operations. Heat thus applied precludes the possibility of ice formation within the pump and subsequent non-operation of the cockpit heater in flight.

"Heat is also applied to the heater regulator in the crew compartment. Sufficient heat to the referenced heater pump and heater regulator will in most cases insure adequate operation of cockpit and cabin heaters during flight. This command requires that heater regulators be removed and cleaned at each intermediate inspection. The application of heat in the nose wheel well also provides adequate warm temperatures for cockpit and crew compartment.

"Engine covers installed as 263 property on C-47, C-54 and C-82 aircraft are considered too bulky and stiff for installation at low temperatures. Cowling excluders are considered more efficient for use in preheating engines and are being locally manufactured. Provisions have been incorporated in the excluder for attachment of a heater duct from ground heaters. This type excluder also prevents blowing snow from accumulating inside the engine nacelle.

"Little difficulty has been experienced with the freezing of brakes in our Northern operations. However, when this condition existed it was found that in most cases dust seals were not installed on the wheels. These seals help prevent blowing snow from accumulating on the brake assembly and freezing. NEAC SOP requires that all C-54 aircraft operating in the northern regions of this command be equipped with dust seals.

"Ice accumulation and the subsequent blocking of engine vent lines has resulted in ruptured engine oil supply tanks on C-54 aircraft with a resultant engine failure on flights when the free air temperature is –30 degrees F and below. In all cases it has been noted that the affected aircraft engine vent lines protruded approximately three to six inches beyond the engine cowling. To date, no like incident has occurred on aircraft with vent lines protruding not more than one inch from the engine cowling. It is recommended that all engine vent lines be kept as short as possible."

PREVENT WINTER ACCIDENTS

- Slow up your taxi speed.
- Call for a tug if you believe conditions are not safe for taxiing.
- Don't use excessive power to taxi.
- Use brakes with caution.
- Watch for snowbanks during landings, take-offs and taxiing.
- Wear sun glasses if glare is present.
- Remove all frost, ice and snow from your plane before taking off.
- Check freedom of controls before takeoff.
- Avoid landing and taking off on slush covered runways.
- Request bright runway lights for landings in ice, fog or snow flurries.
- Report instances of inadequate snow removal.
- Check NOTAMS and brief yourself and your crew thoroughly for each flight.
- Be careful.

DOWN —

Courage helps when you're downed in ice and snow country, but it isn't enough. There are things you've got to know if you want to stay alive.

IN SOME RESPECTS, Arctic survival is a good deal like boxing. You've got to be able to roll with the punches. The man who stands up straight and takes his blows on the chin, relying on brute strength to withstand the punches and finally overcome his opponent is to be admired for his courage. But, in boxing, courage sometimes is not enough. In cold weather survival, it seldom is enough.

Actually, the term "Arctic Survival" is a bit misleading. True, the procedures known by that tag were developed primarily for Arctic areas. However, most of them will also apply to many other places on the globe, including a number in the United States. Every winter, bitter cold spells invade some of our northern states and below zero weather hangs on for days or weeks. It is no less essential for pilots who fly over such areas to be well versed in "Arctic" survival procedures than it is for pilots who fly in Alaska. Possibly, the chances are better in the ZI for a speedy rescue, but the chances are also good that there will be plenty of time to freeze to death before rescue is effected.

The Air Force operates a number of survival schools for its airmen. These schools take anywhere from two days to two weeks to present their instruction. It is not possible to give you the full treatment here. For example, a book could be written on just the one subject of obtaining food—another on preparing a shelter.

Generally speaking, there are three major points to winter survival; they are shelter, warmth and food. There is another which is all important, but which has little to do with physical survival and usually becomes a factor only after the survivor has been downed for a comparatively long period of time—that is mental health. After several days this may become a real problem.

The following tips on cold weather survival apply just as much to cold weather areas of a dozen different parts of the globe where USAF pilots fly as they do to Alaska. Maybe one of them may save your life.

Your first important action will be your decision to crash land your plane or bail out. If possible, you should crash land because there are several ways in which you can use the airplane to advantage, even though it may not be in shape to fly again. Of course, there are some things which may force you to use your chute. If the terrain is too rugged, if it is night, or if your plane is on fire, for example, you would undoubtedly bail out, even knowing that you are throwing away a good aid to survival in your airplane.

While we're on the subject of your plane, let's just have a look at the ways in which it can help you stay alive. First of all there is the old reason probably known to everyone in the Air Force . . . the airplane will be much easier for searchers to see from the air than you yourself would be. And that's a very good reason. It's also a tip to you to stay with your plane unless you know pretty positively that you're bettering your situation by leaving it.

But there are other reasons for crash landing if it is possible to do so with some assurance of safety. Your plane will have oil, and possibly gasoline, that you can drain out and use for fuel to keep warm. (This is a good place to mention that it's a good idea to carry several packets of matches with you on every flight you make.) In most areas, there will be wood nearby which you can use for fire. But there won't always be, and in any case, the oil or gasoline will make it easier to start a wood fire. Also, burning oil makes a dense black smoke which would attract the attention of searchers quite readily.

The plane itself doesn't make a very cozy shelter and

BUT NOT OUT

you should not plan on trying to live in it if it is at all possible to construct any of several other types of temporary "housing." But parts of the plane can be used to advantage in building a shelter, in making tools, in signaling, and in a number of other ways which are usually covered in survival manuals available to all flying crewmembers. Your radio, for example, may still be working after a crash landing. And a radio can make rescue a simple matter.

So the word is—if you have a choice—choose a crash landing over a bailout. Then stay with your plane unless there is a good reason for leaving it. It takes a mighty good reason, too!

Your parachute is another life saver when you're down in snow and ice country. It has many uses. The parachute can be used for:

- Clothing; mukluk boots, puttees, neck and face cloths, eye shields, hats, handkerchiefs, scarfs.
- Shelter; blankets, bed rolls, tents, lean-tos.
- Hunting and fishing equipment; slingshots, snares, fish hooks and lines, fish seines and nets.
- First aid; litters, splints, bandages, dressings and slings may easily be made.
- Travel packs; if you've decided for some good reason to start walking, you can make a very serviceable back pack of your chute.
- Miscellaneous; there are other miscellaneous items such as sails, awnings, snowshoes—even blackjacks—for which your parachute can be used.

The parachute may come in very handy for many things besides getting you safely to the ground in bailouts.

Regarding how to build a shelter and how to obtain food, if you have any frontiersman instincts at all or even if you were once a good Boy Scout, your problems may be eased considerably. The subjects of shelters and food are treated in any good survival manual and also in numerous books and other publications. They should be studied.

Tarpaulins or parachutes may be used to make a tent or parateepee which will serve as good windbreak. Here is one type of tent.

As mentioned before, parts of your plane may be used to build a shelter. A good shelter may be constructed under the wing of the plane, using the wing as a roof. Even your enemy, the snow, can be used to advantage in building a "house." Any trees or wood available and your parachute make the task much simpler.

Obtaining food is made much easier if you are equipped with a gun and fishing tackle. If not, you may have to depend upon snares, improvised fishing tackle (which can be made from your parachute lines and ripcord pins) and whatever you may be able to find in the way of edible roots, herbs, etc. There are numerous written sources of finding out, in advance of the emergency of course, just what is and is not edible. One warning is that you should not eat snow if it is possible to melt it first. Snow just makes you thirstier and also is rough on your mouth. If you have your choice of snow or icicles, melt the icicles because you get more for your fire.

Fire is all important in cold weather survival. Before anything else is said, let's repeat the warning: *always carry plenty of matches.* Carry them in your survival kit and also in your pockets. A lighter, with extra flints, is also a handy gadget to carry because it will help you to save your matches. If you've crash landed your plane, you can use gasoline from the tanks as lighter fluid. You can waterproof your matches by covering them with paraffin which also makes them burn longer.

Men of Arctic Survival School in Alaska try their hand at making an igloo; it's good shelter but the beginner may be wasting time.

The Eskimo's "house of snow" is inexpensive but hard to build.

What not to do. Your airplane is a survival aid; you should not leave it unless you know positively that you will help yourself.

Scratch the paraffin off the match head before striking. If a waterproof container is available, that's the place for matches.

There is a real art to preparing your fuel for burning. First a dry, straight branch should be split into thin pieces with the grain, then with a sharp knife shave long thin shavings to a point an inch or two from the end so that the shavings are not separated from the piece. When properly done, a large cluster of curled shavings attached together at the base will result, and two of these held in one hand and lighted will easily start a fire. This "torch" is used to ignite small dry pieces of kindling which in turn lights larger pieces of wood until you have a strong blaze. Gasoline from your airplane makes firebuilding simple.

If you do not have matches or a lighter to start a fire, don't give up. There are other ways of firebuilding which have been used for thousands of years. Stone, steel or magnifying glasses can be used. Any good Boy Scout can show you how.

Not the least of your problems may be one which lies in your own mind. You have to fight against losing the will to live.

There have been many cases of crews forced down in the Arctic and getting past all the initial hardships but gradually cracking up mentally as their hopes for rescue wane from day to day.

Stones make the best fireplace, but if none are around you have to use what is available. Even your enemy, the snow, can help.

Loneliness, a feeling of helplessness, boredom, worry and the inability to satisfy completely such physical needs as hunger and thirst are all unseen enemies which you must fight against. The weapons you have to use in this fight are activity, ingenuity, humor, a fighting spirit and sometimes faith.

Probably the best of these weapons is well directed action because it not only aids in your mental fight, but also helps to improve your physical situation. After a few days of Arctic loneliness, success in snaring a rabbit, fixing up a more comfortable shelter, rigging up a signaling device—almost anything you accomplish will give a great mental lift. Set yourself small tasks which will keep you busy and help to pass the time until you are rescued.

Don't lose track of the days. Keep a record of time even if you have to do it by scratching on a small stick or by putting a pebble in a special pocket each day. It may not seem important now, but you can draw comfort just from knowing whether it is Monday, Friday or Sunday. If you have a watch, take good care of it.

Your mental problems won't be so bad if you are down with a crew and have someone with whom to talk and share the chores. Work up song sessions, assign everyone specific duties—you might even hold religious services.

Watch yourself and your crew for signs of mental crackups. If you can figure out what is your greatest mental hazard, perhaps a solution may suggest itself to you.

When you are down in snow and ice country, you can bet that things aren't going to be soft. You'll have a rugged life just staying alive. But you *can* stay alive. It's been done before . . . many times. And one thing you can be mighty sure of is that your Air Force will lose no time in getting out the search parties. Your chances are good.

Have you noticed recently that the days are getting shorter and that there is a snap to the air that wasn't there a couple of weeks ago? A sure sign that winter is getting closer every day.

Sounds reasonable, doesn't it, that now is the time to start thinking about winter and its effect on you, your outfit and on everything that it takes to keep your outfit a going concern. Whether you're in Alaska, Greenland, Rapid City, S. Dak., or Memphis, Tenn., it will have some effect on your operations and the degree of the effect is entirely dependent upon you and your knowledge of what to expect and what to do about it.

The Air Force has come a long way in improving the low temperature operability of our airplanes and the equipment you need to keep them flying, but in the process it has become more and more apparent that the key to success or failure rests entirely on you and your ability to grasp the significant factors which remove low temperature operation from the usual routine. You don't have to be a blood relative of the early Arctic explorers or qualify as a sourdough to appreciate the rigors of temperature. You don't have to suffer personally from frostbite or low temperature exposure to know that you want no part of it. These things you know because you've read or heard of them at some time or another, but do you know just how reduced temperatures will otherwise affect your particular job in the overall team effort?

If you don't, it might be wise to get across to you the fact that one of the most important products of the low temperature testing program is the development and accumulation of procedures information, which, like all other information, is of no practical value unless it is used and used to advantage. Peculiar operational and maintenance techniques are developed and expanded continually as a phase of the low temperature test program. Survival information expands with the completion of each test season. This is the type of information you should use to advantage during the coming winter season.

A continuous program is in effect to provide you with this type of information through the medium of Technical Order publications which are constantly revised to reflect the latest available information.

The Pilot's Handbook, the "Dash One" (—1) Technical Order in any particular aircraft series, usually contains a complete section on extreme weather operation. This section, which is not limited to just the low temperature problem, gives pertinent and specific information on procedures peculiar to operation of a particular type of aircraft in low temperatures. The critical temperature where preheat is required, time dilution charts, time preheat charts, peculiar starting procedures and many other items which can be used and used effectively in the operation of the aircraft at low temperatures are contained in this section.

The Erection and Maintenance Handbook, the —2 Technical Order, has low temperature maintenance procedures scattered throughout. While this information is not as conveniently compiled as it is in Section 5 of the "Pilot's Handbook," it nevertheless is there, and it is equally as pertinent as an aid in reducing maintenance troubles by the application of effective preventive maintenance procedures. Familiarization and compliance with the servicing and lubrication requirements for low temperatures will go a long way in keeping your aircraft off the list of those requiring major maintenance.

The Inspection Requirements Handbook, the —2 Technical Order, outlines those little extras, over and above those things you're normally required to do, which must be done to insure safe operation at a reduced overall maintenance penalty when operations are being conducted under low temperature conditions. It might seem peculiar to you that more inspection items are added (which takes more time) and still a reduction in the overall maintenance penalty is claimed. You will find, however, that it takes a lot less time to wipe a shock strut piston to remove an ice accumulation than it does to replace a leaking hydraulic packing which resulted because you didn't take the time to do what was originally a simple minor task.

"Winterization Instructions and Check List" Technical Orders are a little different than most Technical Orders in that compliance is required only when certain basic conditions are satisfied. These conditions are outlined in another Technical Order, 00-60A-1, and for the majority of readers they are such that compliance with the "Winterization Instructions and Check List" will not be required. However, even if your operations are such that compliance with the Winterization Instructions and Check List Technical Orders is not required, these publications can be used to advantage. If considered as a reference manual, the —7 Technical Orders can be used to determine those systems of the aircraft which should be subjected to a thorough functional check prior to the start of winter.

The "Handbook of Instructions for Arctic Operations," Technical Order 00-60B-1, is an almanac of hints on low temperature operation, effect of temperature on humans, Arctic crash survival, and many other items ranging from how to catch a rabbit to how to preheat a B-36.

A ready index to these and many other publications bordering on the subject of winter operations is contained in Technical Order 00-60-01, titled "List of Applicable Publications, Operation and Maintenance of Aircraft and Equipment under Cold Weather Conditions."

In the few days left before the first icy snap, take a close look at some of these publications. See if you can't use some of the information to help you get your job done better and quicker. If this data is put to use during the coming winter, you and the Air Force will benefit.

WHEN YOU GO FLYING in the wintertime, do you expect ice? You should, because pilots who don't expect it and therefore aren't prepared for it are the ones most likely to get into trouble when ice is encountered. So expect ice in your winter flying, look for it . . . and be ready for it.

To be ready for ice, there are many things you must know. But when you are ready for it, you are ready for the pilot's greatest in-flight winter enemy.

Each type of airplane presents different problems in icing and for many of them the corrective procedures are different. You should read up on the Tech Orders concerning the particular types of airplanes you fly. Meanwhile, here are some general observations on the subject of icing.

Icing may be anticipated whenever there is visible moisture in the air near or below freezing temperature—except in the case of carburetor icing which may occur, as you are aware, at summer temperatures with no visible moisture present.

SURFACE ICE

This flying hazard is predominant in cumulus clouds and especially heavy in cumulonimbus clouds. Icing will also build up quite rapidly in stratus and stratocumulus cloud formations along fronts. The stratus formation will usually cause rime ice as the water droplets are small. This condition, however, is changed when rain is falling from above through a stratus layer or when turbulence is present. Clear ice is found in the cumulo-type cloud as its turbulence has a tendency to build a larger supercooled droplet. Heavy icing is found in this area due to the large concentration of moisture present in cumulo build-ups.

Glaze or clear ice is formed by the freezing of a film of water which has spread over the aircraft, from the breaking of large supercooled rain drops. It is identified as clear, smooth and transparent. Clear ice is the most dangerous form. It builds out from the leading edge in a mushroom shape which spoils the airfoil and therefore decreases lift.

Rime ice forms when droplets freeze without completely breaking into a film of water. This gives it a rough, opaque, granular and porous appearance. Generally, rime ice does not destroy the shape of the airfoil and can be removed easily from leading edges with pneumatic de-icing books. Rime, however, does have a tendency to stick just to the rear of the boot. Being rough, rime increases the drag and increases the stalling speed.

Various combinations of the two might occur when flying through cloud formations of both the stratus and cumulus types of an occluded front. Besides its effect on lift, drag and stalling speed, surface ice, by its weight, increases the wing loading and displaces the center of gravity. By preventing the movement of control surfaces, icing can cause a loss of control.

Frost is a known hazard during winter operations, and it can be dangerous on takeoff, so be sure to brush it off wings and all surfaces, before starting. Early sun will often melt it if the plane is in a position for the sun's rays to hit the coated surfaces. But make sure that the airplane is clean because frost changes the lift and drag characteristics of the airfoil.

ICE

Icing is likely to occur below temperature inversions, along fronts, and over mountains. Temperature inversions, typical along a polar front, are caused by a relatively warm air mass rising above sub-freezing polar air. Moisture falling from the upper warm air through the lower cold air cools to sleet, freezing rain, or snow, and usually forms clear ice.

You can often avoid inversion icing by climbing into the warmer air. Continue to climb as long as temperature increases. Level off when temperature stops rising, as there may be another icing layer above. In warm fronts, the over-running warm air may be above freezing in the lower levels, preventing icing in that region, but the upper portion of the cloud system may be cold enough to cause severe icing.

In cold fronts, the presence of cumuliform clouds and the upward air movements that cause them are likely to cause clear ice formation. Although the cold front formation is narrower than the warm front, icing is more severe because of the higher rate of accumulation. Icing is most frequent and most dangerous over mountains.

Mountain ranges cause upward motion of air capable of supporting large droplets of moisture. With low temperatures, this results in clear ice.

You will find the most severe ice above the crest and to the windward side. Avoid turbulent areas. When you run into wet, sticky snow, climb above it to colder temperatures where the snow will not adhere so readily. Fly through an icing area fast.

Try to remedy the situation by escaping from icing conditions—if possible, leave the region of icing before

HOW TO LIVE LONGER

Check weather carefully. Ask the pilot who just came through.

Check controls for restrictions of movement.

After runup in fog or rain, check wing and empennage for ice in propeller blast area.

Use pilot heater when flying in rain, snow or clouds, as well as known icing zones.

Remember when ice forms you will use more fuel to get to destination.

Ice on the airplane causes increased drag, and all types of ice prevention measures take work away from the airplane that would normally go into the cruise range of the airplane, whether it be heat or boots. Therefore, if icing conditions are anticipated, a more conservative cruise control also must be anticipated.

If flying in wet snow or freezing rain, change altitude if possible.

Glaze ice is common in cumulus clouds. Choose an altitude of least icing.

Use propeller de-icers just before getting into ice.

Use full carburetor heat to clear ice and for ice prevention if icing can be anticipated.

Watch your airspeed — stalling speed increases with ice. Don't climb at a low airspeed.

Check wing de-icers. Use them properly. Do not land with de-icers on. They act as spoilers.

If you have a load of ice, don't make steep turns.

Don't try three-point landings, if iced-up. Fly in with power.

Surface icing is not limited to wings; the nose and underside of your plane can ice up just as easily and you may never know it.

Much has been learned about airplane icing, both formation and elimination, through an Air Force sponsored ice research program.

using the de-icer boot, as there is a tendency for the ice to build up in ridges at the point where the boot ends if it is used for too long a period.

Handling an iced airplane is essentially a matter of maintaining speed and a low angle of attack. The airflow will continue to adhere to upper surfaces as long as the angle of attack remains small, but there is generally a very abrupt and complete stall when you increase the angle of attack. In rough air, descend only if you have safe terrain clearance for IFR. In freezing rain, add power and climb as rapidly as possible, without increasing angle of attack any more than necessary, into a layer of warmer air.

Don't Forget That Lifesaver—"The 180!"

PROP ICE

Propeller icing may occur under the same conditions as surface icing. Propeller ice is especially dangerous because it decreases propeller efficiency by altering the blade profile and increasing the blade thickness. When ice is thrown from one or more of the blades, it causes excessive vibration and an unbalanced condition. The ice from the propellers is thrown off with such force that the B-29's on the polar flights must have armor plate on the fuselage opposite the propeller track to prevent the piercing of the fuselage.

Whenever you must fly during icing conditions, prevent ice formation on propellers, blades and spinners by using anti-icing solution or heat. To treat the blades, an electric pump, controlled by a rheostat in the pilot's compartment, pumps anti-icer fluid from a supply tank to a slinger ring from which it is distributed to the propeller blades. When you expect icing conditions on a flight, fill this tank before takeoff. About two quarts of fluid an hour will be sufficient to keep blades free. Surprisingly enough, the little ports through which this fluid flows sometimes become blocked by ice, making the system inoperative. Check these ports before flight.

Other aids to propeller anti-icing are: alcohol anti-icing by means of rubber feed shoes; anti-icing spinners, usually rubber covered; and anti-icing solutions, applied to the dome, spinner and blade. A heating unit for the leading edge of the propeller blade (a rubber sheathing with an internal electric heating element) is being used now. The B-36 uses heated air ducted through the propeller blade.

Propeller de-icing should also be used as an anti-icer, that is it should be turned on just before entering the icing zone so that the fluid will have an opportunity to cover the propeller thoroughly—thus ice will not stick.

Often, it will take rpm vibration in addition to the fluid to shake the propellers clear.

IT'S NO SECRET:

- Wing and fuselage ice has formed at temperatures as high as 40°F., but is usually heaviest between 15 and 32 degrees.
- Water condensation in fuel tanks can freeze over the air vent and stop the flow of fuel.
- Ice can form on spark plugs of a cold engine, making starting difficult.
- Engine temperatures must be watched closely during letdowns, particularly if an inversion exists which may cause abnormal cooling.
- If a hatch or other opening is left open when a plane is parked, air is allowed to circulate and this may prevent formation of frost on the inner side of windshields.
- Brakes should be left off when airplanes are parked to prevent them from freezing in locked position.
- As far as the health of pilots is concerned, exercise is even more important in winter than in summer. Watch the condition of your ears, nose and throat. Get an adequate diet of heat-producing foods.
- The stream of reports of accidents resulting from winter conditions can be cut to a trickle if you take heed.

carburetor ICE

Sometimes the things you can't see are the most dangerous; and you can't see carburetor ice.

Out of his bottomless bag of tricks, old man weather pulls none more insidious than his year-'round-favorite, carburetor ice.

There are five basic types of carburetor icing: impact icing, fuel vaporization icing, water vapor icing, throttle icing and bleed passage icing.

Impact icing is similar to the icing on the outer surfaces of the airplane, and is usually found on the impact tubes, the carburetor screen, the mouth of the boost venturi, or other carburetor protrusions.

The effect of ice on the carburetor screen is a blocking off of the airflow which is the usual characteristic by which carburetor icing is recognized. Icing of the impact tube or boost venturi leans the carburetor mixture.

It doesn't have to be cold for carburetor ice to form. Your air induction system has a very efficient ice manufacturing system which, rain or shine, needs only the proper conditions of air humidity and pressure-temperature changes to choke itself with ice. Outside weather is not always the determining factor as we think of icing in terms of freezing rain.

Functioning much like the expansion valve of a refrigerator with its own built-in ice plant, the carburetor can make the ice when the outside air temperatures are as high as 32°C. (90°F.) and with a temperature and dewpoint spread as much as 12°. Here's how it may be explained:

Vaporization of the liquid fuel causes a lot of heat to transfer from the incoming air in order to vaporize the fuel, thereby resulting in a drop in the temperature of the air in the mixing chamber. Then, as the velocity of the air entering the system is increased in the carburetor venturi, its pressure is decreased and a slightly lower temperature yet is obtained. This is in accordance with two of the basic laws of physics which state that the pressure in a venturi varies inversely with the velocity, and the temperature works with the pressure.

Fuel evaporation icing is extremely critical on aircraft whose carburetors incorporate fuel injection at a point within the venturi body on the carburetor. Such carburetors are used on the C-45 airplane (P&W R-985 engine) and the T-6 (P&W R-1340 engine) and on most liaison airplane engines. On the other hand aircraft having engines where the fuel is injected directly into the cylinder (R-3350 engine) or injected into the supercharger impeller (R-4360), icing due strictly to fuel evaporation is no longer a source of icing trouble.

The evaporation of moisture which may be present in the incoming air also induces a cooling effect. Naturally, the cooling effect from this source is not as great as that produced by the vaporization of the fuel, except under certain conditions—severe sleet or heavy rain.

Throttle icing—During part throttle operation an expansion of the air takes place when it passes through the throttle butterfly. This expansion is accompanied by a temperature drop. In the case of moisture in the incoming air, this temperature drop can change the moisture to ice, with the resultant icing either at the throttle butterfly valve or at some point past the valve.

Bleed Passage icing—In the inner workings of the carburetor, there are many small passages, drains, vents and bleeds; some carry air and some fuel. Under some conditions it is possible to have an extremely cold fuel temperature where the cold fuel passing through the carburetor adjacent to an air passage will decrease the temperature of the air sufficient to precipitate and freeze the moisture contained in the air. Based on experience, it is known that mixture control bleed ice can form on any engine using pressure type carburetors incorporating the mixture control bleed in the regulator section.

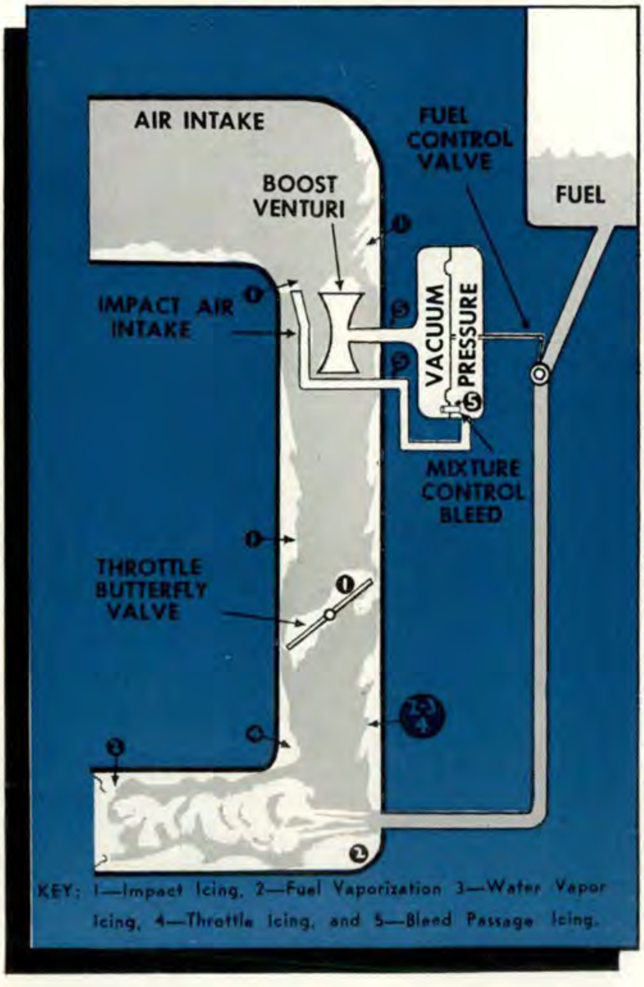
Under marginal conditions mixture control bleed ice might be removed by using very high carburetor

Carburetor ICE

air temperatures. However, under most conditions, such ice cannot be removed even though the carburetor air temperature is increased to the maximum permissible value. Under these conditions it is necessary to lean manually to obtain normal mixtures. Manual leaning should be used only in the cruise power range (except possibly in a serious emergency). It may be necessary to lean back almost to the idle cut-off position to restore full power conditions in some cases.

In the Air Force, the primary means of combating carburetor ice is through the use of carburetor heat. It is a continuous type of de-icing. It should be remembered that if the engine fails completely from carburetor icing, the source of energy for carburetor heat rise is gone. This stresses the fact that preheat is essentially a preventive medicine and not a cure. When you are approaching known icing conditions, select your preheat ahead of time and remain alert to your

The carburetor of your airplane engine can manufacture ice even when weather is mild and sunny with no visible moisture in the air.



responsibilities to the preheat system.

Carburetor icing may be suspected if a gradual loss of power is noticed when all other conditions, such as altitude, airplane attitude, and engine control settings remain constant. Under most conditions the formation of carburetor ice is a relatively slow process, and it is possible for a pilot to increase throttle openings gradually in order to maintain constant rpm and manifold pressure values without realizing that ice is forming.

On reciprocating engines not employing manifold pressure regulators or exhaust turbos, a good test for carburetor ice is the application of full carburetor heat for a few seconds while maintaining a constant throttle setting. Upon returning the heat control to its original setting, note whether or not the manifold pressure has increased above that which was indicated prior to the application of full heat. An increase in manifold pressure indicates carburetor ice was present which had restricted the passage of air into the engine.

It should be remembered that aircraft incorporating automatic manifold pressure regulators or exhaust turbo regulators, or combinations of both, such as the B-50, C-119, C-97, F-51, will not give the usual carburetor icing indication as noted by manifold pressure decrease or stuck throttle.

In the case of icing where automatic controls are involved, the pressure sensing devices of the automatic controls will automatically increase the throttle and/or the turbo boost to compensate for any loss in manifold pressure, due to the ice, with the net result that the pilot does not know what is happening until it's too late. Therefore, on these airplanes, it is essential that flight crews anticipate icing conditions and use anti-icing procedures.

The best way to avoid carburetor ice is to maintain a little carburetor heat whenever conditions conducive to icing are present. It should be remembered that heat application causes some loss of power and increased fuel consumption which will affect your cruise control.

If you get carburetor ice and application of full heat fails to remove it, emergency steps must be taken. If you have an alcohol anti-icing system, use it immediately. If this also fails, there is one last measure to take: Return the heat control to "cold" and lean out the mixture until the engine begins to backfire. The backfiring may loosen the ice and blow it clear of the intake passages. High power settings are advisable, as some engines (R-2800 in the T-29, for example) will slip into idle cut-off without a murmur at cruise power settings.

It must be remembered that this is a dangerous procedure and should be used only as a last resort. The carburetor air heater doors will be badly damaged if the heat control is in any position except full cold. Be prepared to enrich the mixture immediately and reduce the throttle as engine power is regained. Then apply sufficient constant heat to prevent further icing.

JETS and ICE

High-speed jets operating at stratospheric altitudes rarely have the same type icing problem that confronts conventional aircraft.

The most severe effect of jet engine icing, tests have shown, is the choking off of air flow through the engine and the resultant rise in turbine temperatures accompanied by a loss in thrust.

A rough rule of thumb is that there is a two per cent reduction in thrust for each one per cent loss in inlet (ram) pressure. A one-pound pressure drop would cause approximately a 15 per cent decrease in thrust. Thrust losses would normally call for higher engine rpm, but higher rpm further increases turbine temperatures until the pilot is left "in an untenable position."

You may recall that several months ago a number of jet fighters on a mass flight crashed or made emergency landings because the intake screens iced up, resulting in air starvation of the engines. This multi-accident occurred in an early summer month, and the possibility of recurrence in winter is much greater. To prevent its happening again, instructions were issued to remove intake screens from most jet fighters stationed in the ZI. For overseas operations, removal of the screens was left to the discretion of the commander concerned because other hazards might overbalance the danger of icing.

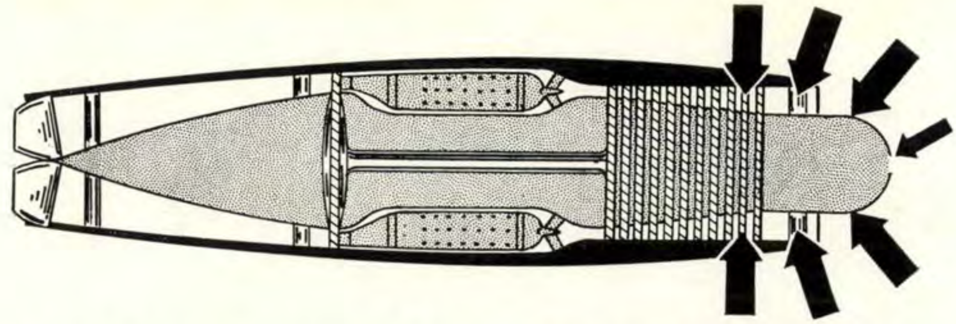
The conditions under which this induction icing could most easily occur would be a combination of temperature below freezing and heavy moisture in the air. This could exist in any cumulus cloud associated with frontal activity. But the condition is not necessary, because such icing could also occur when no clouds exist and there is no visible moisture in the air. For its operation, the jet depends upon a ram air effect which could cause icing whenever the temperature and dewpoint are in proximity at or near freezing temperatures.

Indications of induction icing are a loss of thrust and increased tailpipe temperature. Corrective action is retarding the throttle and leaving the icing area as quickly as possible.

In future jet aircraft, anti-icing provisions and retractable intake screens will probably be standard, but for the present, removal of the screens where possible is the accepted treatment.

Jets are not immune to icing of external surfaces. Severe ice, reported as up to five inches thick by the pilot, has been picked up in what was normally considered a "light" meteorological condition. This is explained by the tendency of the thinner wing and tail sections to collect a larger than normal percentage of the super-cooled water encountered. It had formerly been thought that heat resulting from air impact and friction heating at higher jet speeds might reduce or prevent ice accumulation. But apparently, the heat loss due to evaporative cooling in clouds is more than sufficient to compensate for dynamic heating and the ice can form readily under certain conditions.

No severe control problem has been encountered as



Above, arrows indicate points at which turbojet engines are most susceptible to icing. Designers are at present developing methods of preventing ice formation in these areas and the problem should soon be eliminated.

a result of external icing of jets although the pilots have reported mild sluggishness in the airplane's handling characteristics. Reduction in airspeed and large increases in stalling speeds due to the drag effect of the ice have been noted.

Normally, jet operation is such that the plane would not have to remain in an icing area for any appreciable length of time. The above information on external icing was gained during tests in which pilots sought out icing areas and purposely stayed in them to permit ice to build up so that its effects could be studied. In most cases it is possible to leave the icing level before ice accumulation becomes of dangerous proportions. Meanwhile, anti-icers are being develpoed which should solve the icing problem.

Because of the density of cold air, the thrust of the jets at very low outside air temperatures is greater than usual, and jet airplanes can take off at 98 per cent of normal takeoff power and still get off a thousand feet sooner than in moderate climates.

Due to thaw conditions, caused either by the ambient temperatures or by preceding jet takeoffs, the end of the runway occasionally becomes so icy that it is impossible to run up to full power before starting a takeoff roll. This is particularly objectionable in formation takeoffs. Releasing the brakes when the leader reaches 80 per cent rpm (or sooner if necessary) and completing the final power and instrument check during the first two or three seconds of the takeoff roll has proved to be a fairly satisfactory solution of this problem.

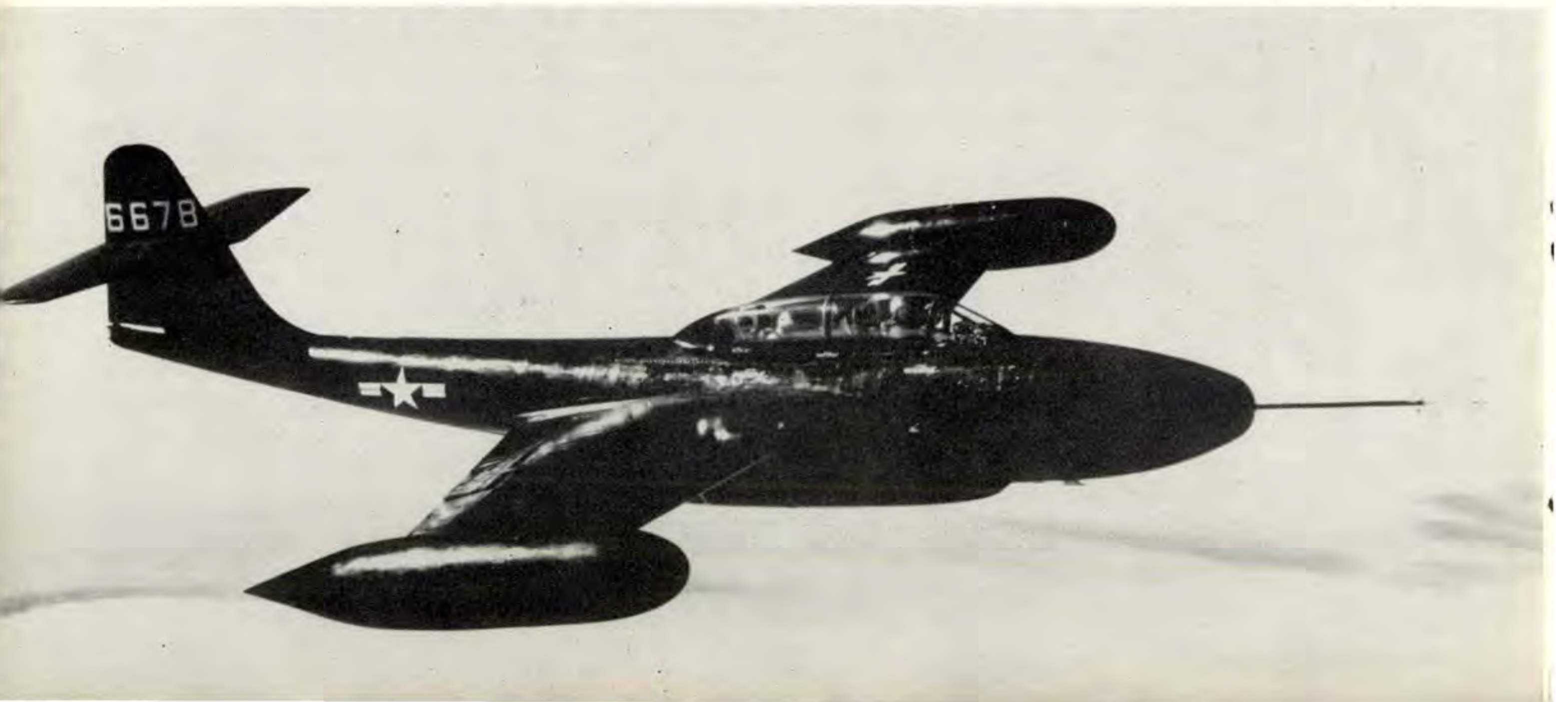
Despite all the precautions taken by ground and air crews during maintenance and preflight periods, there can still be windshield icing or frost formation if ground haze is present during the takeoff. Be ready to go on instruments at any time during the takeoff run and during the time it takes for the windshield to clear up.

If conditions permit, taxi with sufficient rpm to cut in the generator, as low temperatures decrease battery output.

Park at a 45° angle to the line of jet airplanes so that when you pull out, you won't blow slush and snow on the other airplanes. Also, move well forward from the line before starting a turn.

Vision in jets is being taken care of by double glass with an air space. Hot air is ducted into this air space thereby melting the forming ice. There has been considerable trouble with cracked windshields due to switching on full heat at sub-zero temperatures. It is a suggested procedure that the heat be brought into the windshield air space by intermittently switching the system on . . . quite similar to the technique of "milking-up" flaps on a go-around. By easing the heat onto this very cold glass there is far less chance of breaking it.

Induction icing in jet airplanes is similar to carburetor icing in that visible moisture is not necessary. Best procedure is to get a good weather briefing and avoid areas of low temperatures and high humidity; once ice has formed try to leave icing area.



OIL DILUTION

Why dilute engines? The answer is simple. It's to insure that fluid oil will be available for the next engine start. In below freezing weather, undiluted oil may congeal with the result that fluid oil will not be available to provide lubrication when the engine is next started.

Actually, dilution is merely the process of adding gasoline from the fuel system to the engine oil. In some respects, it is similar to adding alcohol to the water in the radiator of your car. The purpose, of course, is different.

There are several precautions which you must keep in mind when diluting your engines. In the first place, engines should not be diluted when the oil temperature is above 50°C. At such times, the gasoline which is added to the oil merely evaporates so that you may as well have saved yourself the trouble of going through the diluting procedure.

If the oil temperature gage reads too high, shut down your engines and wait for the temperature to drop below 40°C. Then restart and proceed with the dilution. If the oil temperature again reaches 50°C before you've completed the dilution, stop again, wait for the oil to cool, then restart and continue with the dilution. If two or more dilution periods are required, the total time should be that required for your type airplane under the temperature conditions expected.

Remember that after an oil system has been diluted, you cannot determine by the usual visual inspection methods how much oil is available in your airplane for the next flight. Gasoline has been added to the oil supply, and it will evaporate rapidly after the engines are next started and the oil temperature has risen. Prior to the next flight, after extreme cold weather has required extensive dilution periods, it is a good idea, if the mission permits, to run the engines at normal temperatures for as much as a half hour to permit the excess fuel to evaporate. Then check the oil supply and add oil if necessary before taking off. This procedure not only assures you of a sufficient supply of oil, but also eliminates a cause of oil discharge through the breathers and loss of oil pressure during high power takeoff or operation.

If your airplane is equipped with full feathering Hamilton Standard propellers, which use engine oil to operate, the propeller feathering switch should be activated during the last two minutes of oil dilution periods. When a drop of 400 rpm is observed, pull out the feathering button and allow the rpm to return to normal. Repeat this procedure three times. If full feathering is not available, the prop pitch control should be operated until a change of 400 rpm is noted. This, also, is to be done three times.

Normally, oil dilution is accomplished at a tachometer reading between 1,000 and 1,200 rpm.

Technical Order No. 00-60B-1, Instructions for Arctic Operation, authorizes the use of other dilution procedures which are found by experience to be more satisfactory than the instructions given in this and other "dash one" tech orders. Such procedures should be sent to Headquarters, Air Materiel Command for evaluation and possible incorporation in operating instructions. Tech Order 00-60B-1 gives the recommended dilution periods for all Air Force reciprocating engine aircraft under varying temperature conditions.

Dilution periods vary with the temperatures which are expected during the time the engine will be shut down. Generally speaking, a three-minute period will suffice for temperatures between 4 and —12°C; 6 minutes for —12 and —29°C; and 9 minutes for temperatures between —29 and —46°C. One minute of dilution should be added for each additional 5°C below —46. These periods, of course, are averages. The appropriate technical order should be considered for the exact dilution requirements of the type airplane you fly. The point is that whenever low temperatures are likely, you should give the tower a call before you shut off the engines, and ask for the lowest temperatures expected during the night or the time before the engines will next be started. Then you will know how much to dilute.

MEDICAL SAFETY

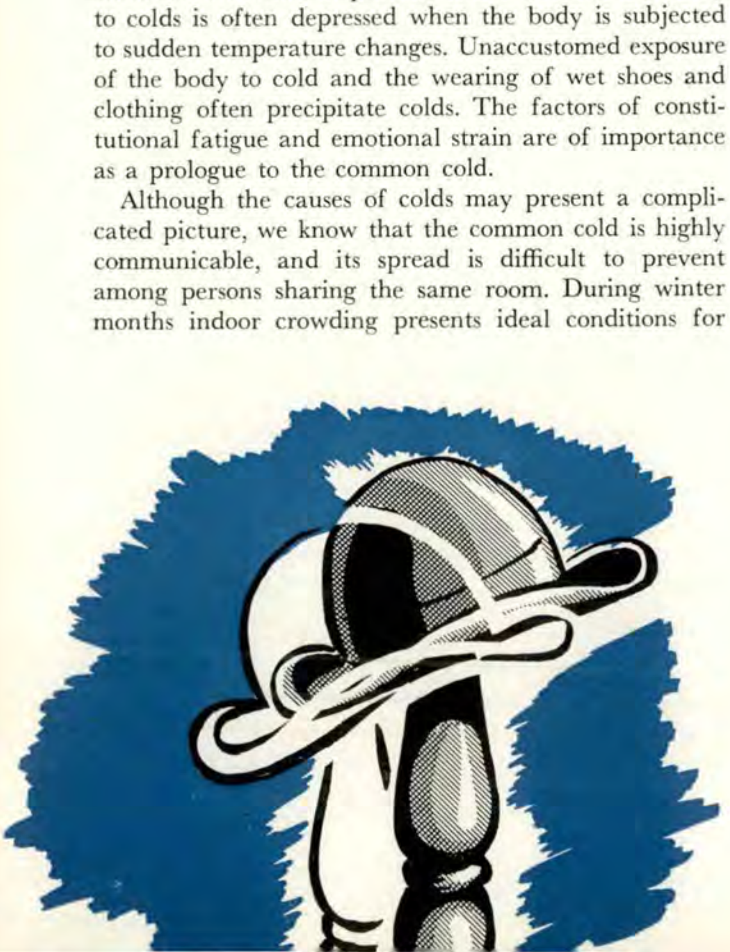
AH-CHOO!

We are coming to another season for the common cold. Although colds may plague some individuals at any time of year, they are much more common during the colder months, starting in full force in the Autumn, late September and during October. Your chances of getting one or more colds this Fall are pretty good. You may have one now. It is said that only one person in four goes through the winter without a cold; however, if you happen to be between the ages of twenty and thirty your chances for avoiding colds are better than average since during this prime period you are less subject to colds than at any other period of your life.

What causes this pestilence known as the common cold? We may evasively state that there are many different causes responsible for initiating the common cold—or we may smugly say (since we admire a logical sequence of events) that lowered resistance allows a virus to invade the lining of the nose altering its normal defenses so that bacteria (always present in the nose and throat) can make a secondary invasion. The virus of the common cold is comparable to parachute troops. As in war, the attack of the virus is of minor importance if unsupported. It does, however, prepare the ground for the main advance of bacteria by destroying the first line of defense. The virus unsupported by these secondary invaders is short lived.

Since bacteria and viruses are usually hanging around all the time, we must look to this "lowered resistance" factor in an effort to prevent colds. General immunity to colds is often depressed when the body is subjected to sudden temperature changes. Unaccustomed exposure of the body to cold and the wearing of wet shoes and clothing often precipitate colds. The factors of constitutional fatigue and emotional strain are of importance as a prologue to the common cold.

Although the causes of colds may present a complicated picture, we know that the common cold is highly communicable, and its spread is difficult to prevent among persons sharing the same room. During winter months indoor crowding presents ideal conditions for infective agents to be transferred rapidly from one person to another by sneezing, coughing and nose blowing.



How can we prevent colds?

If you could isolate yourself completely, you probably wouldn't get a cold. A famous explorer of the far North says that in the Arctic when small parties are isolated from all other human beings, their members will eventually recover from whatever colds they may have had. However, when two previously isolated groups meet, members of both will come down with colds and very likely everybody will catch them.

If you remained constantly under the protection of ultra-violet disinfecting lamps you might avoid a cold. Babies in hospital nurseries have been successfully protected by these lamps.

Since it is unlikely that you can do either of these two things, the most effective measures left are:

- Reduce to a minimum contact with crowds.
- Avoid people with colds.
- Avoid rapid temperature changes.
- Wear ample clothing and warm dry shoes.
- Get a moderate amount of exercise.

Spraying the nose and throat and gargling with antiseptics are usually ineffective in preventing a cold. The highly advertised supplemental vitamins and cold vaccines both oral and hypodermic have questionable value in reducing the number of colds.

It appears now, as you knew from experience all along, that you're almost bound to have a cold this winter; so the next question is, "What is the proper treatment?"

An old English medical book humorously advocated the following therapy, to be instituted at the first inkling of a head cold, "To hang one's hat on the bed post, drink from a bottle of good whisky until two hats appear, and then get into bed and stay there."

The only part of the above prescription known to be effective is the advice, "get into bed and stay there." Rest in bed is the most sane and effective measure during the early stages of a common cold. This will diminish the severity of the cold, limit its spread, and reduce the chances for the development of more serious infections.

If you are, however, one of the millions of people who pride themselves on their ability to drag around "wid a dold," uncomfortable and a menace to all friends and enemies, don't fly! The barometric pressure changes with flight may cause severe sinus or ear infections which will keep you grounded for a long time. Remember that ear and sinus difficulty are the most frequent complaints of all pilots and crewmen with colds. Your best bet is to avoid a cold. A high constitutional resistance means a low cold incidence.

WINTER NAVIGATION

NAVIGATION NEGLIGENCE this winter will be a big contributing factor in an unknown number of USAF aircraft accidents. Some crashes and emergency landings will come about as a result of dry fuel tanks and many pilots who become lost will blame covering blankets of winter snow for their failure to find navigational check points.

The safe and successful completion of a winter mission naturally depends on the number and the reliability of navigation instruments aboard the plane; the time available for navigating by the pilot, and the amount of preflight planning that goes into the mission.

Effective preflight planning is the key to reduction of winter navigation accidents. And this preflight planning does not merely involve plotting a course, marking off distance intervals and finding out the frequency and status of radio at destination. Besides these things the pilot planning a winter mission should determine the predicted wind, double check the weather and make a detailed study of the route to be flown, particularly if the flight is to be a long cross-country.

Wind is one of the more important factors that escapes the attention of many pilots. This ignorance of wind direction and velocity is usually the reason for going miles beyond or running short of an ETA. Careless use of IAS in place of true air speed for computing the time en route can result in some strange predictions of arrival.

It only takes a few moments to pre-compute the true air speed before takeoff and this will provide more accurate ETA's at check points. Snow obscures many landmarks to make the navigation task more exacting. But often the difficulty does not lie in snow hazard but in the pilot's own lack of emphasis on preflight navigation planning.

Good instrument navigation, whether with jet or conventional aircraft, can be much more than just a rough estimate of an ETA over a specific fix. By careful planning and the elimination of any errors noted in flight, precise navigation can usually be accomplished in any type of weather.

For the pilot-navigator, weather elements may be classified into four groups according to their effects upon normal flight. These factors are (1) variation of ground speed and drift, (2) the reduction of airplane efficiency, (3) danger to the aircraft structure, and (4) difficulty in navigation.

Broadly speaking, there are several things that may be encountered which can affect the speed and direction of an aircraft. Specifically, the wind direction and velocity at flight level; time allowance for traffic clearance and an instrument approach, and the weather conditions at destination which would require use of the alternate plan.

Any of these weather conditions may be determined fairly accurately before a flight. The wind direction and velocity are given in the forecast. Waiting time for traffic or an instrument approach is already known, and an alternate plan is ready.

After flight planning, the next important navigation consideration is the beginning of the mission just after the course is set. If possible, the first check point should not be more than 20 minutes' flying time from departure. In some cases the climb will have been completed and this point can be used as a starting basis for figuring ground speed to future ETA's. This first check point can be invaluable in getting an indication of the airplane's track. If the first check point is 40 minutes out of departure the pilot may have considerable difficulty in locating himself after that interval of time, especially if check points are scarce and the ground speed and/or the track is much different than expected. Hence, the need for this first check point to be close in.

To take advantage of this simple and effective method of navigating, the pilot must pre-compute reasonably accurate magnetic headings and true air speed. Approximate drift correction can be determined by checking wind direction relative to the true course and applying a few degrees correction into the wind. In flight, follow through in adjusting the heading by reference to the check points in a manner similar to following course on a radio range leg.

In determining ground speeds and ETA's the SOP is to work with knots and nautical miles. In preflight planning before the ground speed can be determined, true air speed must be computed. For this purpose an approximation can be made. Estimate a ground speed by approximating the headwind or tailwind component of the predicted wind. If the wind is practically a headwind, subtract its velocity from the true air speed to get ground speed. Conversely, if the wind is approximately a tailwind, add its velocity to the true air speed and find ground speed. In a near calm or with crosswinds, the ground speeds will not be appreciably different from the true air speed. With quartering winds, the head or tailwind component can be estimated and applied to the true air speed.

After computing the ground speed and figuring ETA's to the selected check points, the pilotage mission is ready to begin. The next objective is to determine how well the predicted ground speed and heading is holding up by comparing the ETA's and ATA's at the primary check points and adjusting the subsequent ETA's from errors noted at those first few check points.

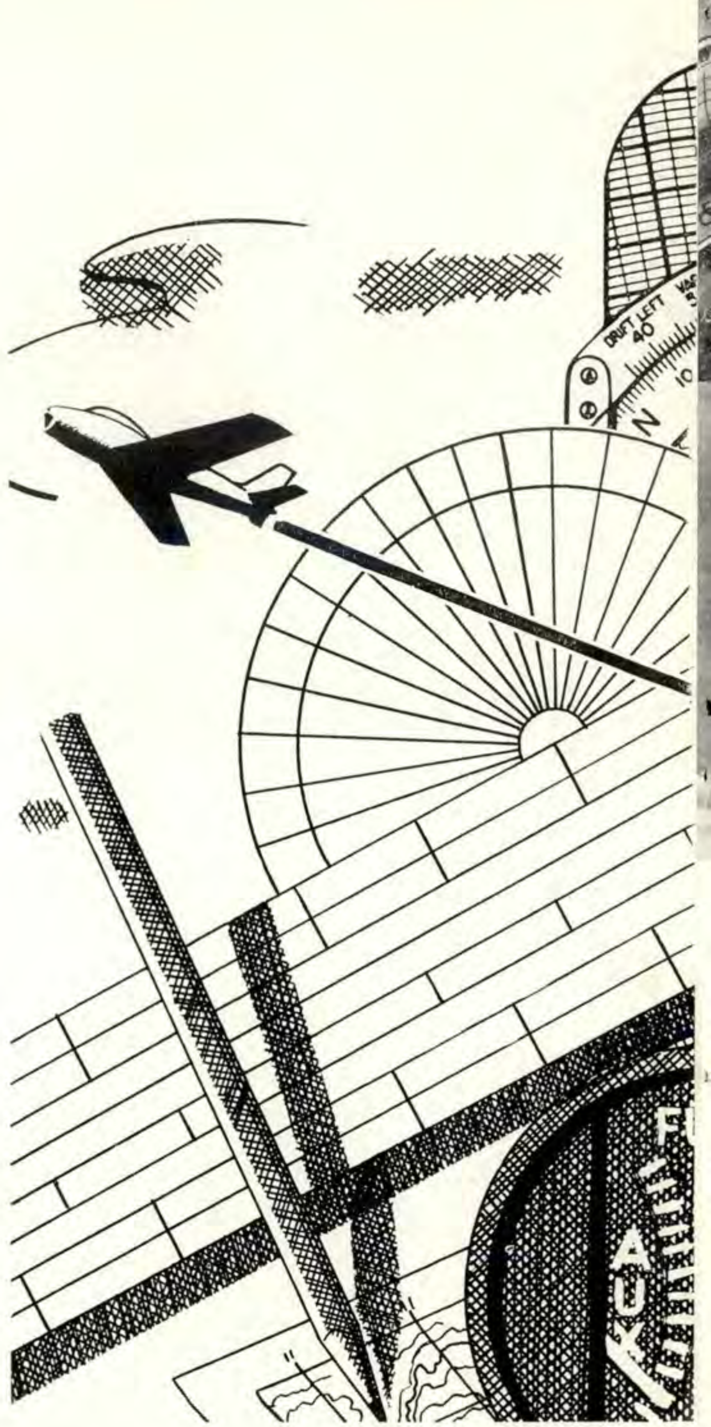
The selection of appropriate check points is important, but selections will vary, depending upon winter weather, visibility, terrain features, and the abundance of visible cultural features. For example, over snow-covered terrain the selection would not include streams or feeder roads, but rather main arterials, towns, prominent peaks, and cities, with beacons, light lines, etc., used at night. Even these check points may be obscured or barely visible. Hence, there is a need in winter flying for detailed preflight planning and accurate computations.

It is desirable that these check points be the type that extend perpendicular to the track or at least be visible from several miles off either side of the course. If the plane has drifted very far off course the pilot-navigator may miss less prominent check points altogether.

Good pilotage procedure requires full use of radio aids. Radio range bearings and single and multiple station fixes are as much a part of navigation as the pencil itself. The danger lies in total dependence on radio aids. If your radio contact is lost, you are lost.

JET AIRCRAFT

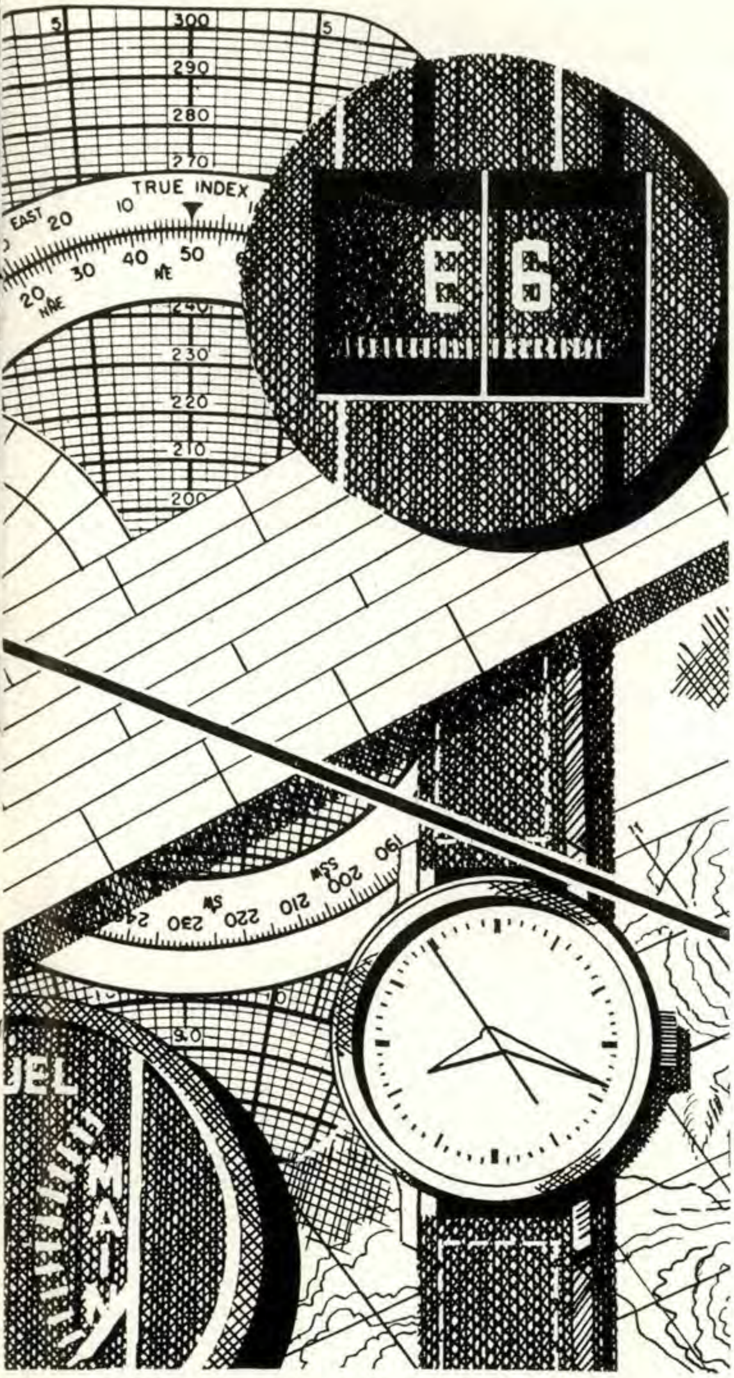
Navigation in jet planes differs in that it's more exacting, faster and higher work. The main thing is



to know position at all times. Keeping oriented and having the position pin-pointed constantly will do more than anything else in keeping the pilot out of a winter predicament.

According to one jet fighter pilot, successful navigation for a jet mission begins before the wheels leave the runway. Preflight planning is again of paramount importance and one of the first steps is adequate briefing by the operations officer or flight leader outlining what the pilot is to accomplish.

Since jets fly higher, at cruising altitudes the jet pilot has stronger winds to contend with and has a dimmer view of a checkpoint that is prominent at 10,000 feet.



This calls for a thorough familiarization of the route to be flown. For pilotage, unusual terrain features should be noted. The radio aids to navigation along the way should be studied in detail—and the NOTAMS checked.

Some pilots advise writing down the frequencies and call signs of range and large commercial radio stations that are on, or nearby, the proposed line of flight, and then slipping these notes into the right glove for ready reference. For quick reference, put a paper clip on the page or pages to be consulted in the Radio Facility chart, the U. S. Radio Data and Flight Information Manual, and the Instrument Letdown and Low Approach Manual. Don't, however, clutter and confuse the mind with too many things. A clear, concise digest is better.

The jet plane should be preflighted with great attention—and more important—after the engine is started, all of the communications equipment should be checked thoroughly. It's far better to find out on the ground that the radio compass or a receiver isn't working than to tune it in in flight at over 600 mph and expect it to show the quick way home.

With great speed being one of the jet pilot's specific problems in regard to navigation, it is apparent that flying through the sky at 8 to 10 miles a minute leaves no time for the pilot to figure things slowly. Calculations must be rapid and accurate and they must be mental due to the inconvenience of drawing new course lines on charts, using the E-6B and flying the plane.

For instance, one jet jockey's mental method of computing groundspeed on the climb is to add or subtract the prevailing windspeed at two-thirds the cruising altitude. That is, when computing the groundspeed on a climb to, say, 30,000 feet, the existing wind at 20,000 feet is added to or subtracted from the climbing TAS.

Or for a course interception, use the following rule of thumb. Flying a jet, a pilot leaves an eastern base for a destination 600 miles to the north. After flying 300 miles he finds that he has goofed off and is something like 50 miles west of the desired track. So, how many degrees to the right should he correct to intercept his original course at the destination?

One way would be for him to turn 60 or 90 degrees to the right and intercept his original course—but that would use up too much fuel. Instead the pilot might use the often-used formula of taking the miles off course, multiply them by six, and divide that by one-tenth of the distance flown. This formula is then further applied for the distance left to fly and the answers are added for the total number of degrees to correct in order to arrive at the destination.

Another approximation rule used in allowing for time lost during the climb to cruising altitude, is to add one mile per 1,000 feet of climb to the distance from the point of departure to the first check point, and using this distance as the basis for computing the ETA.

Salient points in adequate pilot navigation are:

• Careful, complete, preflight computation, including ETA's to appropriate check points.

• Follow the flight plan in the air, adjust the heading and ETA's in flight to remain close to course and develop accurate ETA's to subsequent check points. If the flight plan and flying regulations are rigidly adhered to and coupled with good reasoning, the pilot-navigator can never be accused of navigation negligence. Failure to prepare and use a flight plan in winter flying is not an indication of superior skill, ability and experience, but only an indication of negligence, carelessness and laziness.

FLYING THE SKI-PLANE

Just like learning to utilize the footgear type of "bed-slats," handling planes equipped with ski type landing gear demands much study and practice on the part of USAF throttle-jockies to master thoroughly the technique and performance of single and multi-engine ski-plane operations.

Primarily, for the pilot, this ski-plane technique must be based on three factors; that is, he must be familiar with the effect of wind and of different types of snow and he must be able, while still in flight, to "read the snow condition" on the ground.

In the air there is little difference between ski type and conventional aircraft, but on the ground the ski planes have advantages over the conventional type. They can be landed on snow or ice and, in an emergency, on slush. They can take off or land along a curved course. However, they must be handled with extreme caution on the ground because of the lack of brakes and their forward and lateral lack of control at low speeds.

Evidence of this lack of control during ground operations is illustrated by this taxi accident of a ski-equipped DeHavilland Beaver. At a Far Northern base the pilot landed the Beaver and taxied to the end of the runway to let off two passengers. While clearing the area after the passengers had de-planed, the airplane suddenly swerved to the left and started across the runway.

Realizing he could not control the movement of the single-engined plane, the pilot cut the power. After the engine was stopped the plane slid off the runway with the prop striking a runway light which caused minor damage to the plane.

Although the Beaver landed in calm wind and was equipped with runner-type ski, there were no anti-skid type skegs, (runner projections). This type of ski is suitable for soft snow operations, but is almost uncontrollable on hard-packed snow and icy runways.

Making turns during ground operations with a multi-engine plane, like the SC-47 (ski-equipped) type of aircraft, is a matter of technique in the coordination of power and rudder controls and requires a lot of practice. The amount and use of power, of course, depends on the wind and extent of turn desired.

As worked out by experienced ski-pilots flying the SC-47 under various types of snow and winter conditions, here are some SOP's and take-off techniques for flying the "gooney-bird on bed slats."

THE PRE-FLIGHT CHECK

- Check all hydraulic lines for leaks.
- Check underside of skis for worn through or weak spots.
- Check buffer blocks on the rear underside of skis for wear.
- Check ski controls for up and down travel. If skis do not fully extend or retract, do not take off.
- When working off concrete or asphalt runway, tie the rear of the skis up.

For operations on smooth, hard-packed snow or even loose, shallow snow on top of ice, line up into the wind, if possible, and apply forty inches of manifold pressure with the prop control in maximum RPM.

With power on, controlling the ski plane on the take-off run is SOP. As the plane gains speed, rudder control is gained along with increased maneuverability, which gives the pilot the opportunity of making curved take-offs. Only the condition of the snow affects the length of the takeoff run. Sticky snow will increase the run, while dry snow or iced surfaces permit a short run.

Hold the plane in a tail-low attitude until airborne and then level off to gain critical single-engine airspeed. Only then should the ski control be placed in the *UP* position. As soon as sufficient airspeed is built up to cause the ski to fly or make the airfoil on the rear of the ski effective, the landing gear should be retracted.

If the skis are not "flying" it is possible to damage the oil cooler or engine nacelle by retracting the gear too soon.

For takeoffs on rough, hard-packed snow or rough ice, line up into the wind. If the wind is not too strong and the snow is wind-packed in drifts, make the line up parallel to the drifts which usually follow a definite pattern made by prevailing winds. This decision, though, is left up to the pilot. With power applied, the aircraft will be held in a tail-low attitude with the tail held high enough to cut the drag caused by the tail wheel. As fifty mph indicated airspeed is reached, one-half flaps should be lowered. This will cause the aircraft to become airborne quite abruptly and caution must be used in lowering the nose of the aircraft as soon as possible.

If this precaution is not taken, it is quite possible to lose control of the aircraft in this semi-stalled condition and lowering more than half-flaps will not aid the SC-47 in becoming airborne any sooner. As soon as the aircraft is definitely airborne, put the ski control in the up position and milk up the flaps.

As soon as the flaps are up retract the landing gear and reduce power to the desired climb settings. It should become quite apparent after attempting a takeoff on rough snow or ice that a takeoff under these conditions is quite hard on the aircraft. Consequently, the best method to use is the one which gets the aircraft off as soon as is safely possible.

In making a high-altitude takeoff from rough or smooth snow, the technique will be the same as for a rough snow or ice takeoff.

SKI LANDING TECHNIQUE

Before making a normal landing, fly over the intended area of set-down and locate the smoothest section which can be used practically. Try to locate the wind direction and estimate the approximate velocity. If necessary, drop a smoke grenade and determine the wind direction. As soon as these factors have been determined, a landing can be made. A common SOP here is to select a point on the snow or ice to use in making the approach, the same as in a normal runway landing. If there is no point of visual reference on the snow or ice and the horizon is hard to define, it may be necessary to drop something from the plane to use as a visual reference for a landing point.

The landing approach should be made with power, with the propellers in the high RPM position during the last two hundred feet of the final approach. All ski landings should be made three point to avoid snubbing the skis and cut down on the landing slide. Unless the snow or ice condition is known to be hard and smooth, more than one-quarter flaps should not be used due to the possibility of damaging the flaps.

In making landings under low visibility and without a visual reference in the landing area, start an instrument approach from 500 feet into the forecast surface wind. Then maintain a three-hundred-foot a minute rate of descent until reaching an altitude of 300 feet. At this time the rate of descent should be slowed to 150 feet per minute. This rate of descent can be held until reaching an altitude of 100 feet. At this time the rate of descent on final should be about 50 feet per minute.

The attitude of the aircraft at this point should be nose high. A cross check can be made throughout the approach with the radio altimeter. At about 50 feet altitude, visual contact should be made and the aircraft should be flown onto the snow or ice surface in a three-point attitude. Upon touchdown the power can be cut back and the control column pulled into the full-back position to complete the ski-landing.

TAXIING

All taxiing may be done with the skis in the down position, however, on some surfaces it is more practical to retract the skis. Cross winds will offer no major problem with the skis in the down position and with the use of differential power.

UNSTICKING SKIS

In the event the skis freeze to the surface the method of unsticking them will be determined by the surface on which the aircraft is resting. If the surface is ice and has a thin layer of snow on it, i.e., not more than one foot, the skis may be unstuck by retracting them. If the snow is deep and soft, it will be necessary to dig out from under the wheel and place a piece of steel pierced plank matting under the wheel. After this is done, the snow may be dug out and the skis freed.

With this ski installation, pilot can choose either wheels or skis.

When skis become frozen to surface, they may be loosened by retracting them; alternative is to dig snow out from under them.

did you KNOW?

There is often a thin coat of ice under the fluffy blanket of snow which has accumulated on the wings of your plane. Don't depend on the snow blowing off during takeoff, even the light kind, and check for ice. Falling snow sticks at temperatures above 10°F. It also forms a coat of ice between 32 and —10°F.

* * *

De-icers, when on during the takeoff or landing, act as spoilers. They should not be turned on during this period.

* * *

Temperature inversions, in which ground air may be 15 to 30 degrees cooler than at altitude, are common during winter months. When letting down in cold weather, be careful to keep engines warm during the descent. This change of temperature near the ground also accounts for wing icing on the approach or after takeoff during the climb out.

* * *

"Whiteout" is a common polar phenomenon. To a lesser degree it may occur in any snow covered terrain. This deceptive "milkiness" has caused experienced pilots to think that they had plenty of altitude and to inadvertently make contact with the ground, with the usual results. Be on the lookout for this condition where the sky and land blend together. When it is even suspected, go on instruments.

* * *

Snow-grip tires should be on all aircraft flying into icy runway country. Even the best brakes will not stop an aircraft that is skidding down an icy runway. Every winter there are a few accidents of this nature which could have been prevented. The heavier transports seem to be especially addicted to the long skid when not properly equipped.

* * *

Snow or ice covered runways require that short field landing techniques be employed at all times since braking action is at a minimum. Instead of landing short, the common tendency, due to optical illusion, is to land long.

Climbs or letdowns through icing conditions should be made as fast as possible to minimize the formation of ice on the aircraft. It has been found that a heavy load of ice can be accumulated on the underside of the wings with only minor ice formation appearing on the leading edge.

* * *

Dust covers can be used to cover aircraft wheels while on the ground to keep out blowing snow which freezes the brakes after they cool.

* * *

Fire extinguishers should be kept at normal room temperature before using. Valves may not open at low temperatures.

* * *

Condensation is more apt to occur if an aircraft is hangared in cold weather. This necessitates careful checking for water at low points in all systems.

* * *

Propeller pitch should be changed from time to time during cruise, to prevent the oil from congealing.

* * *

Control system check during winter operation should include a careful examination to determine if any water traps exist which might result in the freezing of a pulley, cable or actuator.

* * *

During any type of precipitation in winter weather, hangar doors can be opened and aircraft chilled to approximately outside temperature before being towed out on the ramp. This prevents snow from melting upon striking the aircraft, and then freezing.

* * *

After takeoff from snow or slush, operating the landing gear and flaps through several complete cycles will prevent freezing.

* * *

When on the ground, canopies should be left slightly open to allow circulation within the cockpit to prevent canopy cracking from contraction and to reduce windshield and canopy frosting.

Cold, and the necessity of wearing heavy flying equipment tends to lower pilot efficiency. The physiologists say that many of the same symptoms which are associated with hypoxia have been noticed in pilots who are subjected to extreme cold. However, this is not dangerous, just a matter of expecting it and being a little more alert than usual.

* * *

For landing when it's really milky, with no way of telling if the ground is near or far, snow-wise pilots fly over the landing area and drop some object of known size. The old timers used to carry along a spare pine tree. The object serves as a guide to give the pilot enough depth perception to land safely. This method is especially handy if it is necessary to make an emergency landing on the ice cap. The main thing is not to kid yourself that you can "see the ground" under such conditions. Many others have tried it and landed on the nose.

* * *

There is no way accurately to estimate the number of inches of snow on a runway. If an airport is not being used, stay away from it, unless you have an emergency. One pilot "estimated" that there were two inches and landed on his back. There was an airport with cleared runways not far away.

* * *

Night takeoff accidents involving loss of directional control and collision with snow-banks point up the necessity for being really on your toes under these conditions. A slight veering to the left would ordinarily not be noticed but when there is a snow-bank in that direction the veer winds up as an accident statistic.

* * *

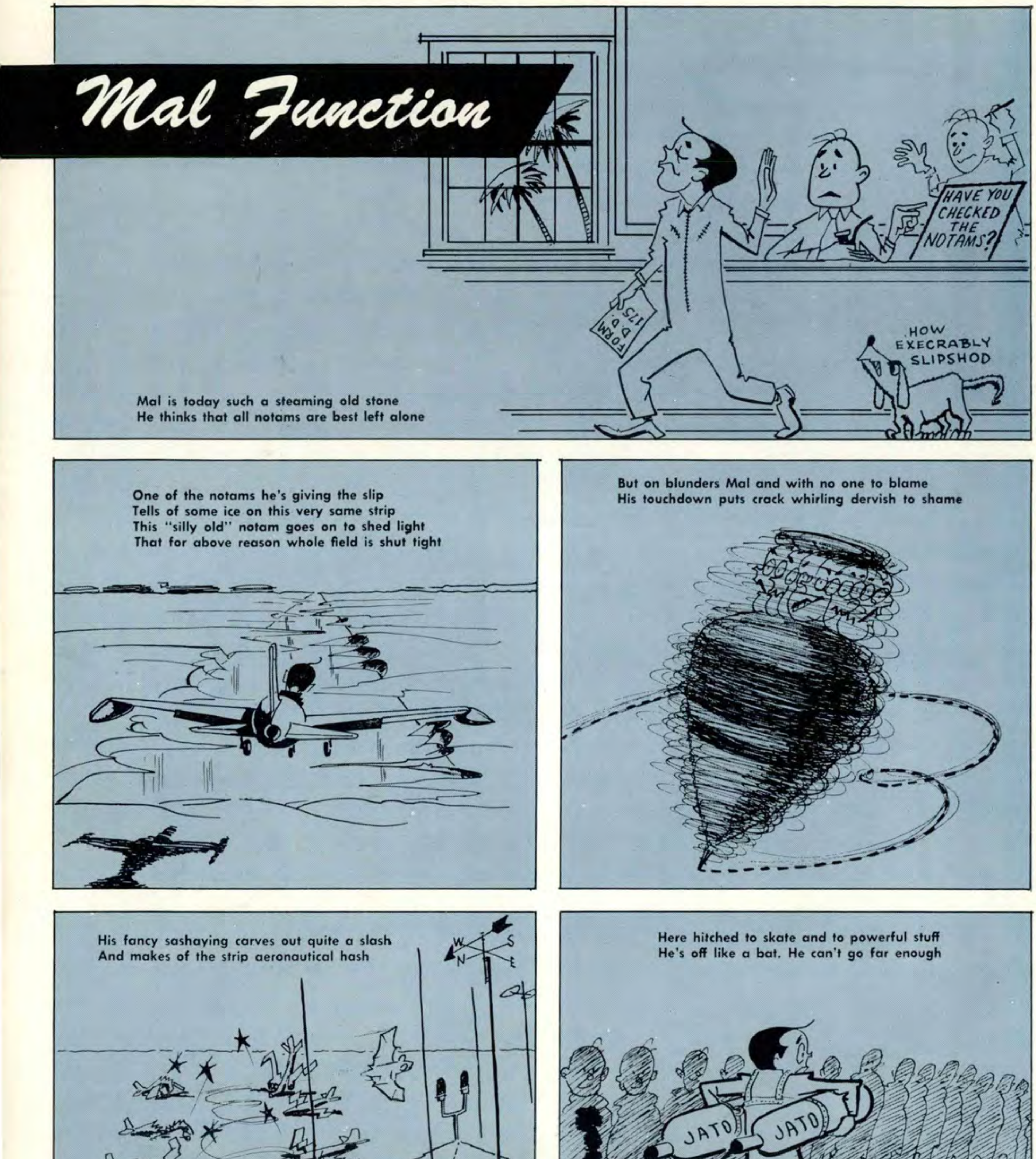
Moisture due to slush and wet runways freezes on micro-switches. In some cases the gear may actually be down when the warning light shows, necessitating a go-around for a visual check. This results in an excessive consumption of fuel and a tendency to ignore the warning light.

Brrrrr....

If Old Man Winter would treat this pretty lady so inconsiderately, it shouldn't be hard to imagine how he would treat you.

The Air Force furnishes you with warm clothing to protect you from winter's wrath. But the clothing does no good if you don't wear it. Wear the proper clothing properly—keep warm.

—Marilyn Monroe, 20th Century Fox—



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