Flying Safety

HEADQUARTERS UNITED STATES AIR FORCE · RESTRICTED

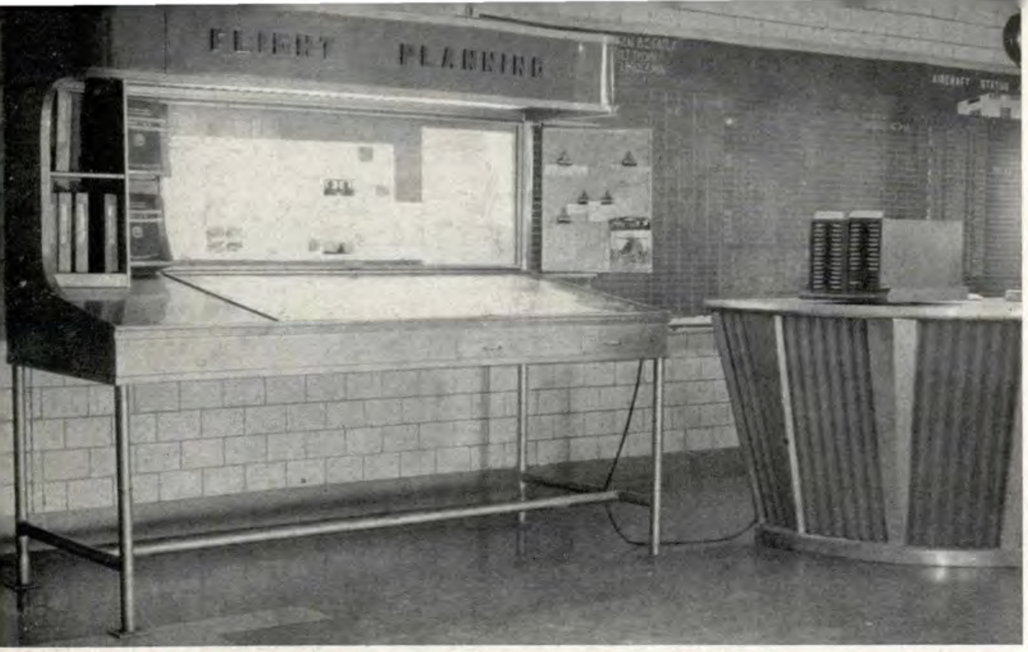
DECEMBER, 1950

FIGHTERS in KOREA

Page 7

RESTRICTED

In This Issue: Your Airplane and **ICING**



Flight planning is a pleasant task when all aids are at hand.

Chart at Chanute AFB allows pilots to draw in proposed routes.

FLIGHT PLANNING

Flight briefing before domestic flights is rapidly being considered a more important factor in flight planning. It has always been a valuable necessity on intercontinental flights just as a great deal of stress has been placed upon the importance of weather briefing by a weather officer. However, too little attention is given to the other information necessary to the successful planning and completion of a flight. Once a pilot is cleared either by himself or the proper clearing authority, he is eager to be on his way. En route, or nearing his destination, weather conditions and other facilities are not as he expected. He then begins to look around in the cockpit for other information that he should have been briefed on, or briefed himself on at the point of departure. He may not have the proper maps, instrument procedures, or radio facility information. Many crashes have occurred and many lives have been lost because of improper flight planning before departure.

Considerable thought has been given to the situation by a great many people in the Air Force. One of the best ideas to correct the situation has been developed by M/Sgt. Wm. S. Quinn, Chief Dispatcher, and M/Sgt. David J. Bunting, Dispatcher, at the Base operations office, Chanute AFB, Illinois. A flight planning table has been built by them and is being used experimentally at that station, with favorable comment and success. Detailed working drawings of this system of flight planning and briefing are available to operations officers and will be forwarded upon request from Base operations, Chanute AFB, Illinois.

It can be seen from the photographs that all briefing material can be made handily accessible, and much information that a pilot would ordinarily overlook can be brought to his attention. Ideas such as this offer unlimited possibilities to assist all pilots in the prevention of violations and aircraft accidents.

GUEST EDITORIAL

The MAN *and the* MACHINE

In dealing with the subject of flying safety, one is immediately confronted with two major factors; namely, the man and the machine. Investigation of almost any aircraft accident shows the complex inter-relationship of human and mechanical factors in accident causation.

Lieutenant General B. W. Chidlaw, Commanding General of the Air Materiel Command, very excellently discussed factors concerned with the machine in an editorial which appeared in the September, 1950, issue of the Magazine *Flying Safety*. Therefore, let us now consider some of the factors concerned with man.

First, airmen selected to fly modern-day aircraft must be both mentally and physically capable of performing highly demanding, specialized tasks. Here the flight surgeon endeavors to make his first contribution towards flying safety by careful physical examination of all applicants for flying training. Selecting only those airmen most physically fit may be analogous to procuring airplanes which incorporate only the best mechanical and aerodynamic characteristics and reliability. Our problem does not end here for as with the aircraft we immediately find ourselves confronted with the inevitable problem of maintenance.

Every activity of a flight surgeon to properly support and maintain aircrewmen is aimed, basically, toward improving flying safety. Airmen should be at peak mental and physical efficiency while engaged in flying activities. A moment's hesitancy, inattentiveness, or the slightest error in judgment may result in a serious aircraft accident. The underlying cause may simply be a mental or physical lapse produced by the culmination of a series of related events. Contributory factors may be such simple things as the too liberal use of alcoholic beverages the previous night, attempting to obtain needed rest in a noisy, ill-equipped and ill-managed RON facility, or such factors as worry, preoccupation, or concern over some personal, financial, or domestic matter. Physical incapacities when related to psychological aspects of flying give rise to problems more complicated than even the worst occurring in aircraft maintenance.

The flight surgeon's aircrew maintenance program, with its application of the principles of aviation and preventive medicine to problems associated with flight, seeks to eliminate human factors which are a threat to "flying safety." It begins with selection and classification of flying personnel. It requires continuing efforts to maintain their health and physical fitness; it involves studying the medical aspects of flying safety; it strives to prolong effective flying careers; it is aimed at prevention, diagnosis, and treatment of disease and injuries peculiar to flight; it requires consideration of human requirements and limitations in the design and development of aircraft and associated equipment; and it includes the aeromedical responsibilities associated with air rescue, survival, and the air evacuation of sick and wounded. The basic purpose of these activities is to discover improved methods, procedures and equipment which will increase efficiency in flight.

Statistics indicate that pilot error is involved in 70 to 75 per cent of all accidents. This fact indicates a requirement for even greater effort in this field to attain the optimum degree of "flying safety." Hundreds of people in countless organizations today are engaged in studies and activities designed to improve safety, and many aspects of these activities are directly related or contribute to flying safety. Some of these groups are engaged in studies of railway safety, some in automotive safety, others in industrial aspects of the problem. If the terrific toll exacted hourly by accidents of various types is to be stopped it will demand the combined strenuous efforts of all concerned. The coordinated efforts of flight surgeons, psychologists, physiologists, aircraft designers, engineers, and members of many other scientific disciplines will be required to attain the highest possible degree of "flying safety."

The combined efforts of all will be to naught without the whole-hearted cooperation and support of every officer and airman and their participation in all phases of the "flying safety" program.

Harry G. Armstrong

HARRY G. ARMSTRONG
Major General, USAF
The Surgeon General

LEARN and Live

It's accent on the north for these USAF men who learn about survival in Alaska (above) and in the rugged Rockies of the U.S. (right).

KNOW ALL YOU CAN ABOUT SURVIVAL, YOU NEVER CAN TELL . . . IT MAY BE A LONG JOURNEY HOME

Okay, so now you're down somewhere in the far north. You're a fighter pilot or a crewmember of a bomber and it has now happened to you. Somewhere along the line a little mistake, maybe, has set off a chain reaction that has culminated in a crash landing which leaves you face to face with a hairy problem of survival.

In the magnified silence that follows the roaring, scraping, scrunching sounds of a crash landing, you may sit a little dazed for a moment, subconsciously thanking your lucky stars you're still in one piece. Later, probably you'll congratulate yourself no end on such a masterful bit of flying. But before you get too far into this "and-there-I-was-pat-on-my-back" routine, let's get a little more realistic and hash over some main points of land survival as currently taught in USAF survival schools. After all, your crash landing may be just the first leg of a long, rugged journey.

So now that you've been forced down and/or lost don't get in an uproar and figure you've "had it" just because you didn't go to a survival school. You've used the old bean in making a good crash landing so use it a little more to remember that if you've made any kind of preparations at all, you are a lot better off than, say, the Eskimo. You've everything he has, plus the ingenuity and more equipment, such as your survival kit.

First, it's a good thing that you brought your plane in for a crash landing instead of bailing out. Because a cardinal rule of flying in the Far North is *don't bail out* unless the plane is afire and in danger of disintegrating. Even in a fighter, your chances for continued life are far greater in almost any kind of forced landing than in a bail out in very low temperature with only the amount of survival equipment in your 'chute pack.

STAY AROUND YOUR PLANE

There are a number of reasons for the Don't-Bail-Out rule. In the first place, bailing out is a dangerous procedure in most cold or polar regions. You may be dragged by the wind and your body frozen before you can get loose from the parachute. Also, your chances of survival and of being found are far greater if you stick around the wreck of your plane. This is particularly true if you have stayed on your flight course at all times.

Furthermore, through crash landing you have the added advantage of a radio, extra kits, and the plane itself, which will furnish material for both shelter and improvised equipment which you can put to a good use. If you are a "graduate" of a survival school such as the Strategic Air Command's 3904th Training Squadron at Camp Carson, Colorado, or the Alaskan Air Command Arctic Indoctrination School at Ladd AFB, Alaska, you will have even less worry about surviving. These land survival schools fill the need to give USAF pilots and crews a specific type of training to teach them the rudiments of living in cold, rough country (including many parts of the United States) until they are rescued. Both of these survival schools are staffed by men who are experts in their respective fields.

And you can take it from them that the Far North and the polar regions are definitely not desolate and ice-locked lands of nameless terrors—unless you're unprepared for an emergency. Since the Far North is little traveled as compared to other more populated sections of the earth, a rugged myth has been built up because of exaggerated rumors and stories of people trapped in the north when they were not properly prepared.

Remember that animals, Eskimos, and even white men have lived there for several generations. There is a large variety of life — both plant and animal — that lives throughout the Far North.

Survival procedures will vary with the size of the crew. In an emergency landing a large crew is at an advantage, for there can be division of labor according to the skills of the individual members of the crew and, as a result of this teamwork, greater safety and comfort can be achieved.

Small crews and fighter pilots must also have a fairly accurate conception of the jobs that must be done in order to survive after a crash landing or bail-out. Regardless of the amount of planning and briefing before the flight, each survival situation will have its own peculiarities, and procedures must be planned carefully in order to take advantage of all favorable factors. Securing shelter and rations are two of the most important steps in survival.

Let's go over briefly a typical cold weather survival kit and some of the primary survival technique emphasized by the experts in teaching air crews going through the tough courses conducted by SAC and Alaskan Air command.

USING THE BAILOUT KIT

If you have bailed out, then you have the "Bailout Kit" which has a sleeping bag with a waterproof tarpaulin. With the tarpaulin and your parachute, you can construct a makeshift tent. The tarpaulin itself is colored blue on one side and yellow on the other. The brilliant yellow fabric may be used as a means of signaling searching aircraft and is easily seen against natural forest hues of green and brown or snow-covered terrain.

For body protection, heavy mukluk insert assemblies (snow boots derived from the Eskimo) are included in the kit, together with gloves and Arctic mittens.

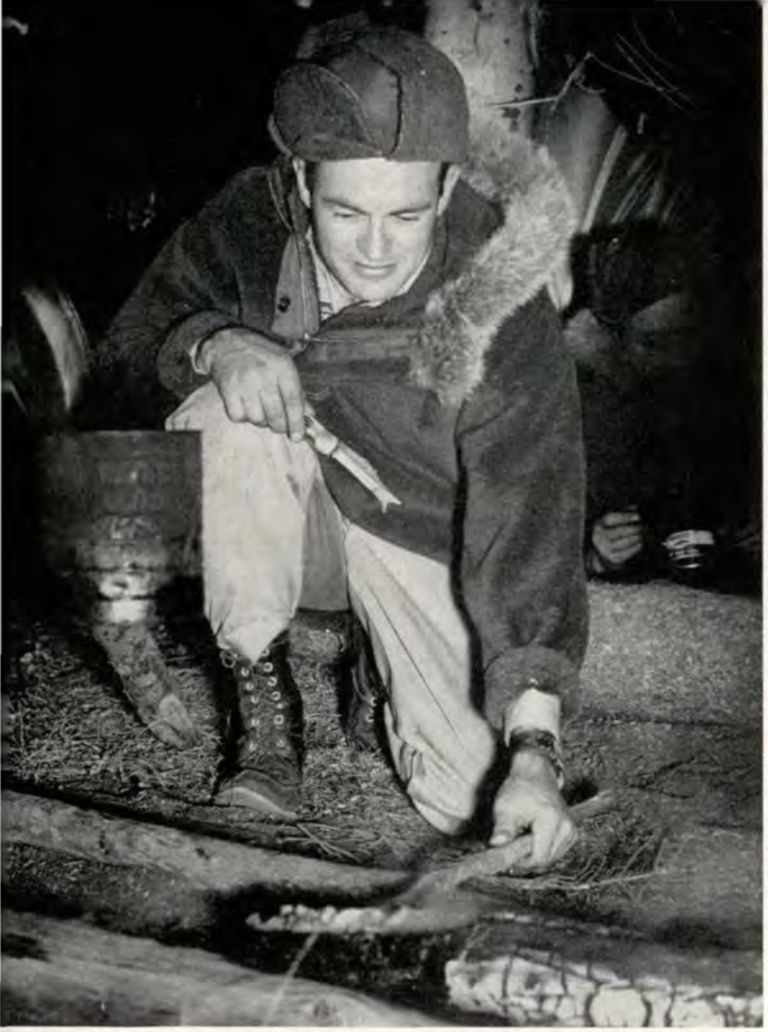
Two forms of head protection are provided. Although it is not popularly known, northern mosquitoes are large and vicious, making headnets and insect repellent necessary in summer. The other type of headgear, called a toque, is a woolen cap covering most of the face and neck and is worn under the flyer's parka hood. This particular item is a knitted version of the ancient head armor used by warriors in medieval times and proves very effective against the cold.

For emergency fire building, the kit carries a "Sterno" stove, a small can of solid fuel which burns slowly, and a waterproof match container holding paraffin-treated matches.

To aid in being found you have an emergency signal mirror and rocket-type distress flares capable of reaching 1500 feet of altitude while burning approximately two minutes. To spread on the snow as a marker, there is a powdered yellow dye, similar to that used in sea rescue. Under procurement at present is a hand-carried VHF 2-way radio.

The food problem is solved by SA-1 Rations. These provisions, sufficient for six days, can sustain a man for double that time if he is conservative. These rations

In rivers and lakes you can usually catch your dinner with a gill net from your survival kit.



Cook your catch—or hash, if you have no luck—over the glowing coals of your campfire.

are also destined for improvement. The meat bar, having a sweet taste, becomes unpalatable after repeated eating, the idea of injecting a meat flavor has been recommended.

Various possibilities of survival conditions have necessitated the inclusion of a medical first aid kit and a combination snow knife-machete with a detachable handle. This handle is practical for use either on the snow knife or on a square utility plate doubling for a shovel. A hack saw blade and small file are also included.

In case game should be in the vicinity of the marooned flyer, a .22 pistol or a .22 Hornet rifle, ammunition, wire for snares, and a small fishing kit are part of the survival collection. A small sewing and repair kit, a compass, snow goggles, and Arctic survival instructions complete the bailout kit.

All items making up kits of survival equipment have been tested in the field under winter conditions. Consequently, these experiments have been the basis for many of the improvements now underway. The same goes for the survival training angle. As broken down and outlined by the survival experts of the SAC and Alaskan schools, the basic principles of surviving in the Far North include proper clothing, fire, shelter and food.

Adequate cold weather clothing is the first requisite. Remember that clothing in itself is not warm, but it serves as an insulator to protect the heat developed by the body from the cold outside air. The desirable characteristics of satisfactory cold weather clothing should never be overlooked or forgotten, namely:

a. That they must be good insulators.

b. That they must be non-compressible.

c. That they must be kept as dry as possible.

Garments possessing these characteristics and worn on the layer principle will provide protection against even the most adverse weather.

In survival you are on your own as far as your clothing is concerned—there is no re-supply and what you have must last you until the emergency is over. Learn now how to wear properly and care for your clothing. Needless to say, mending and cleaning of clothing whenever possible, will pay dividends in health, comfort and safety. The old saying that "A stitch in time saves nine," is worth remembering.

MAKING YOUR FIRE

To build your fire you should "begin by going backwards." Thousands of fires have gone out because the builder didn't build backwards. Many men have frozen to death by making this mistake. The following steps should prove of some help to you:

First, choose the place for your fire. In heavy snow and thick timber, see that there are no snow-covered boughs above your fire that will avalanche snow when the fire warms them.

Arrange your largest pieces of wood. If parallel, place little cross pieces or fire-dogs of wood or stones, underneath to raise them.

Tinder is your fire starter and should be composed of bone dry and highly inflammable materials. In all far northern regions, grass is one of the commonest materials for starting fires. Sometimes you will find a variety of grass that grows so high and thick that it can actually be used for cooking. Among growing plants there will be many dead twigs, stalks and roots which if properly assembled and used, will make good fires.

Where evergreen trees grow, the tinder problem is instantly solved. The slender dead branches that curl inward close to the trunk, are protected from rain or snow by the larger, green growth above. These small branches can be broken off by hand in any quantity needed, and if bone dry, will start a fire without any other material.

The best evergreen tinder is the ends of branches that have died from natural causes, or have been broken by animals. Dead conifer branches turn a deep, reddish brown, and being filled with dried pitch, literally explode when a match is applied to the tips. These highly inflammable branches are known as "Indian Kerosene" by woodsmen.

If a dead porcupine tree or a smaller supply of Indian Kerosene is found near camp, it should be gathered and stored in the Parateepee or under the Lean-to for aid in starting fires easily and quickly.

BUILDING A SHELTER

It is not advisable to camp on the lee side of a hill in open country where deep snowdrifts form.

The lee of large thickets or free stands are safe locations and provide an ideal place for the construction of a wind break, as snow has usually settled before penetrating deeply into a thicket, grove, or stand of trees.

In almost all parts of the northwest, a "slab shelter" is frequently employed by hunters forced to spend a night in the open in stormy weather.

Fallen tree trunks that have been subjected to dampness, have rotted centers and become punky before the outside or casing has lost its hardness. Such logs can be kicked apart with a stout hob-nailed shoe, or, split into slabs with an axe or hatchet. These slabs are curved along their length and can be formed into waterproof walls and roof by laying them against a ridge pole supported by the lower limbs of two trees. The method of laying the slabs is similar to that used in laying curved tiles.

This shelter is valuable because:

a. It can be constructed without an axe.

b. It is wind and waterproof.

c. When wood log slabs in proper condition are found, it can be constructed very quickly.

Other shelters made of boughs which are so frequently illustrated in sporting magazines, are the poorest of all outdoor shelters. Boughs do not reflect the heat of a fire and are not windproof.

In a rainstorm, these shelters become very wet, and, if a fire is started after a snowfall by night the snow will drip straight through the roof. Sitting under a tree is better under such conditions.

POINTS TO REMEMBER

1. The most important thing to remember in constructing wilderness shelters is the advisability of making camp early enough to do a good job. The moment you realize that you must spend the night in the open, begin to look for a satisfactory campsite.

2. Men frequently keep on going until overtaken by darkness. Poor materials, workmanship and haste result in spending a miserable night.

3. It is far better to start shelter construction an hour earlier, when good building materials can be located and selected, than to push on in the hope that a good location with adequate building materials will be found farther on.

4. Don't exert yourself to the point of overheating your body. Working until you are hot and perspiring can be as dangerous in the cold as attempting to warm yourself by the excessive use of stimulants. Above all, after you have made camp, don't crawl into your sleeping bag when you are wet with perspiration.

HUNTING YOUR DINNER

An animal never compares events or considers situations, as man does. If an animal has been previously shot at or has seen other game killed, this animal will be exceedingly shy for a considerable period of time. Game animals in areas where killers abound are constantly on the alert against an attack by carnivorous animals than against an attack by man. Animals cannot estimate rifle ranges, but if they see a wolf sitting on a hill, they decide that it time to move.

If an animal out of shooting range spots you, it will eventually maneuver out of sight. While it has not identified you as a human being, its suspicions have been aroused. The best thing to do is to stand absolutely still for some time, allowing the animal time to settle, as it may still be observing your movements from the farther side of a hill or thicket.

After a long period of time has elapsed, start moving slowly downwind and at a right angle to the course taken by the animal.

While it is more difficult to stalk frightened animals, you must never give up hope. They may be the only animals in the area and if you give them an hour or two to settle down, you may be able to re-locate, stalk and get your meat. There are no infallible rules in hunting. In survival, however, there is one iron-fast rule, "Time is never wasted so long as you get meat in the end."

Brush up on your first aid training. Winter survival is more rugged than in the summer and your life may depend on how much you know about treating injuries before you're rescued.

Finding Your Way

Almost every survival procedure should be adapted to snow conditions. Methods for procuring food, types and use of shelters, clothing, fires and travel under cold weather conditions become highly specialized. Here again, experience is of the utmost importance, and the most valuable advice that can be given is to use extreme caution when traveling in sub-zero temperature.

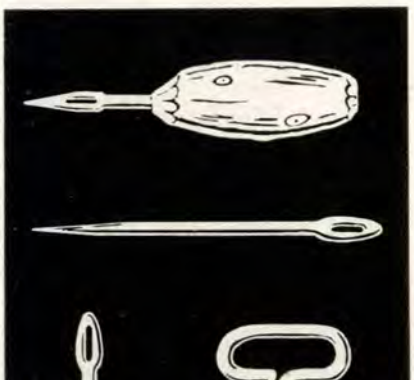
Don't travel when temperatures fall to 30 below zero, unless there are some very important reasons for doing so. It is not that *traveling* in 30° below zero may not be comfortable or pleasant, but if anything goes wrong in those temperatures, you will be in for a bad time. A strong wind, springing up even when the temperature is only a few degrees below zero, may place a man or party in a serious predicament if they are far from shelter. The most dangerous situation for a man is to be caught out at night when a blizzard or very cold wind is blowing. For if you struggle on aimlessly to the point of exhaustion, until your clothing is wet with perspiration, you are unwittingly committing suicide. When you fall down in a stupor, you will freeze.

Take It Easy

The first thing to do, if caught in a blizzard, is to locate a shelter. A hole hollowed out with a snowshoe will do. Take it easy and avoid sweating. Gather your clothing around you in order to hold in the heat, and sleep. "If you fall asleep you will freeze to death," is an old wives tale, because when you get too cold you will awaken, and by steady movement you must restore body heat and sleep again. Sleep will remove your worries, shorten the passage of time and strengthen you. The main thing is to remember not to get caught without shelter.

The novice is prone to follow a campass line, the experienced man follows the line of least resistance and recognizes at a glance, that a curved route may be shorter and easier; that an apparently smooth stretch of forest may be filled with deadfalls or that a smooth, green meadow is in reality an impenetrable line of beaver ponds.

The parateepee makes a good shelter. Sewing awls and fish hooks can be made from ordinary can opener key.



The slab lean-to, made of rotten logs and branches, can be one of the best shelters for surviving in the North.

Use Game Trails

Game trails can be used when they follow your projected course. Trails made by deer are frequently extensive and useful. On scree (shale fragments) or rock slides, mountain sheep trails are very helpful. Moose and bear trails are almost always unreliable and frequently lead into thickets or swamps. Equally promising routes may offer varying prospects, such as the chance of securing game or water holes. In other words, route finding in wild country requires the highest degree of mental concentration, knowledge of wilderness "road signs", common sense and judgment. Fortunately, trail walking practices develop progressively by instinct as time goes on, and a clear mind will register observations and form deductions almost subconsciously.

Rivers will always offer the easiest and fastest avenue of communication through the wilderness. In the summer the use of rafts or boats will ensure speedy travel; while in the winter, their level surfaces will afford easy walking. Large lakes or connecting systems of smaller waterways likewise provide good travel avenues. "Overflows" are caused by river water flowing over the ice and are very dangerous in low temperatures, as the danger of thin ice is always present on both lakes and streams. If travelers guard against these two dangers, the level surfaces will allow for rapid traveling.

It's Up to You

Brief as this basic survival advice is, you now have a pretty good concept of the elementary but vital principles essential for survival. The rest is up to you — how well you learn and remember survival tips or training. Learn survival as well as you can . . . you can't know too much about it.

The utmost in survival equipment and training is the collective mission of the USAF survival schools. Through better equipment and knowledge there is increased safety and protection for yourself and for others who may be forced to meet the challenge of surviving after a crash in a northern wilderness.

Fighters IN KOREA

In a Dogfight or On a Strafing Mission USAF Pilots Find the Jet Is Here to Stay

Capt. H. E. Smith checks rockets before takeoff.

KOREA is a land of mountains, bad weather, heat, cold and rice. It is also a land with two widely differing political ideologies, which at this particular time are finding it increasingly difficult to live side-by-side in the same world. Of paramount importance to the Air Force, Korea is a place where Air Force planes and Air Force men received their first test by fire since the end of World War II in 1945.

Actually, the air phase of the action in Korea, until early in November, was pretty one-sided. There was little enemy air opposition, and as a result most of our fighter activity was aimed at ground targets with only ground fire to contend with. In spite of this, our fighter pilots learned many things. Some of these things are primarily applicable to fighting in Korea. They might also apply to other places in the world which are similar in terrain features, weather, military resources, etc. Other things which have been learned may be of value to our airmen no matter where they may engage in combat.

One thing of considerable importance is that in spite of other opinions to the contrary, our fighter pilots found the jet, namely the F-80, to be an excellent weapon.

The jet had been criticized as being too fast to do a proper job of strafing ground targets. An F-80 pilot, recently returned from the Korean fighting, laughs at such criticism. He says the F-80 can fire at any speed between 200 and 600 mph and is just as effective at one as at the other.

The time the jet can spend over the target area is of course considerably less than that of the F-51. But it's long enough with the control arrangement which was set up in Korea. The T-6 was used as a target control plane and according to a captured North Korean was the most feared of all U. S. planes. The Reds knew that when a T-6 was overhead they could soon expect the air to be filled with bullets, rockets and bombs from fighters and even bombers. The use of the T-6 and liaison planes permitted the jets to be guided to targets almost as soon as they arrived in the area. It saved much time and allowed the fighters to be on their way home in a few minutes to get ready for another mission. The control system doubled the effectiveness of the jets.

For targets which were specifically assigned prior to takeoff there was no problem whatever in using jets. They flew straight to the target, which might have been an airfield, railroad yard, tunnel, bridge, etc., destroyed it without waste of time, and returned.

Fighter pilots in the Korean action habitually gave much closer support to ground troops than they did in combat previously. One pilot stated that he had knowingly strafed within 40 feet of our own troops. Of course, there was an embankment separating the two forces on the ground, but that's still mighty close. On that particular strafing job, the fighter pilots never saw what they were shooting at. They had been instructed by the controller just where to fire. But their effectiveness was proved by the fact that 260 dead enemy soldiers were found in the ground attack which followed the strafing.

In spite of the fact that the F-80 was proved perfectly well suited to the type of fighting done in Korea, the F-51 still fitted admirably into the picture. At the beginning, besides its tactical excellence, the F-51 was definitely a morale booster. It had been used in combat before, whereas the F-80 had not. It was a known quantity; there was no doubt as to what it could or could not do. It was known as a reliable, effective airplane which had once served the Air Force well and could do it again. In addition, its use in this "old fashioned" fighting permitted the Air Force to conserve its more modern types of planes for the possibility of a more modern war. And time may prove that this was a very important function of the F-51 in Korea. In any case, there was a job the F-51 could do. And it did that job admirably.

One very important question which was answered in Korea was "How much combat damage can the F-80 take?" A returned F-80 pilot answers, "The F-80 took everything the North Koreans could give to us—when they could hit us." He further states, "To my knowledge there was not one fire in the F-80 due to anti-aircraft fire. They couldn't set our planes on fire." Whether or not this statement should be qualified is beside the point. It shows the high regard of pilots toward the F-80.

Some F-80's came back from the combat area in pretty sad looking shape after being hit by ground fire. But they came back. One incident which could have occurred anywhere, but happened in Korea, attests to the ruggedness of the plane. A pilot lost all his fuel and was forced to make a wheels-up landing on a grass strip. He was able to scrounge some jet fuel and recruited some South Koreans who raised the plane sufficiently to lower the landing gear into place. He took off from the strip and flew back to his base without difficulty.

Flight Safety received a lot of emphasis in Korea. To begin with, pilots were of a generally high experience level—more so than were pilots nine or ten years ago. They realized the value of being safety-conscious. Air discipline was strictly enforced. And this extended to such things as use of the oxygen system. Everyone knows

Mechanics work around the clock to keep jet fighters ready for daily missions. Above, Sgts. W. P. Holloway and H. B. Huckabee remove oil filter. Below, Sgt. W. L. Alldridge changes machine gun.

that a pilot's judgment is not sufficient to determine when or at what altitude oxygen is needed. So a definite procedure for oxygen use was worked out and its use was mandatory. Oxygen checks during altitude flight were considered more important than fuel checks and were made periodically. An extra bail-out bottle was always present in each airplane. Oxygen systems were inspected regularly. And each pilot received adequate indoctrination in oxygen use and procedures.

Weather flying was frequent in Korea and special navigation and landing procedures had to be developed. The GCA units were considered to be tops.

A rectangular traffic pattern for visual landings was used widely. The reason was two-fold. One is that a definite downwind and base leg gives the pilot ample time to check his plane for battle damage, pump down the gear, etc. With low fuel supplies being the rule, it was better to find out such things early so that a go-around would not be necessary. Another reason for the rectangular pattern was that planes sometimes returned from a mission with bombs or tiptanks still in place. Peeling for a 360° overhead approach might result in losing a bomb or gas tank right over the field. That's unhealthy for people and installations on the ground, so pilots flew clear across the field, then made a rectangular pattern.

The pilot's personal safety was stressed heavily. Because the flight from Japan to Korea involved considerable over-water flying, rescue facilities had to be pretty super. They were, and all pilots were thoroughly briefed on ditching procedure and water survival. An elaborate survival kit was furnished all pilots for use in the event they went down behind enemy lines or in the water. If anything, pilots say, the kit was too elaborate, particularly when it had to be worn during flight at low altitude when the temperatures were extremely high in summer.

Good maintenance was considered most important. If an F-80 had one piece of installed equipment which was not operating properly, the entire airplane was considered out of commission and it did not go on the mission. Yet, in spite of this, one F-80 group hung up a record of 80 per cent in commission over a month's operations.

There will undoubtedly be many more lessons learned from the Korean action than have so far been recognized. Much information is still more or less in the minds of individuals and has not yet been brought out into the open for assessment. New tactics, new techniques, and even new equipment will undoubtedly be developed as a result of the Korean action. In that respect, the Korean affair may prove to be of value to us. Korea may some day prove to have been the testing ground which saved the free world.

TIPS ON TRAINING

Editor's Note—Captain H. R. Tanner left Nellis Air Force Base one day last summer and headed for an F-51 Group engaged in the Korean fighting. A short time

A plane has to measure up to careful preflight inspection before a combat mission. Here, 1st. Lt. William F. McCrystal checks elevators on his Shooting Star before taking off to attack enemy positions.

Lt. Frank C. Buzzee grins as he assures the flight surgeon that he is ready to fly again. Damaged by ground fire, the F-51 was brought in for a skilful landing and Buzzee went on to fly another mission.

later he was in the thick of the fight. Later, he found time to write down his impressions and pass on a few tips to the boys who stayed at Nellis. The letter which resulted is here quoted in part:

Dear Gang:

It has been nearly a month since I left Nellis and a tremendous amount of traveling, doing and learning has been going on.

Some pointers that are good to pass on about the flying here, are:

Stress instrument flying—a lot of good boys have been lost during instrument conditions. Formation instruments is a *must!* There is a lot of work with DF homers and GCA.

Lieutenant Leighton on the instrument board at Nellis gave me a tip that probably saved the Air Force an airplane and saved me possible injury on a bailout. The second day that I was in the squadron I was sent out on a close support mission north of Pohang to aid an ROK guerilla invasion. It was a three plus hour mission with instruments out to target and instruments back to base. We carried two Napalm bombs, four 5-inch rockets, and full ammunition. And that's rough on fuel consumption.

We flew out in the soup with no sweat—dropped our stuff and were on the way back when we ran through a line of thunderstorms. We made it through that line OK but when we went through the second line of thunderstorms the turbulence was so bad that it broke the formation and each man flew on his own at different altitudes. Fortunately, we hit a break as we made landfall and were able to let down VFR over the ocean. The flight leader found the number four man and took him home. The number three man found his way to another field and landed OK.

I was so low on fuel that I was scared stiff. Was able to contact my base DF homer, finally, and received a steer. I then let down to the deck and took up the heading. It was a good heading and it brought me right over the field. The ceiling was about 200 feet and visibility was less than a mile. I tried a 360° overhead but couldn't keep the runway in sight and when I came out near the end of the runway I was going too fast to get it onto the runway. I then made a 270° turn to the left until I hit the runway perpendicular then turned right 90° and started a low visibility approach that Lieutenant Leighton had taught me. It's the 90° low visibility approach and it worked right on the nose the first time. I feel strongly that Leighton's tip was the thing that pulled me through it OK.

The high angle strafing is the only thing for the type of work that is being done here . . . Besides there are too many cables and high tension wires for comfort. Several boys have been lost to ground fire and cables. A good high strafing job concentrates the fire on the target where it is needed. Another thing is rocket blast —got a little too eager on one run and hurt my aircraft.

Cruise control is another item that pilots should think about. We fly some mighty long missions out of Japan, with only internal fuel and sometimes (in weather especially), stretching fuel induces a little sweat.

COVER PHOTO—No time was wasted by Maj. William J. O'Donnell when he returned from leading a flight of U. S. Air Force Lockheed F-80 jets on a strike, for without even getting out of the cockpit of his plane, he briefs Maj. James H. Buckey on the target area. Minutes later, Major Buckey was leading a second flight o F-80's to that target.

Explosive Decompression

By Keeping a Clear Head—And a Clean Airplane You Can Minimize Dangers of a Canopy Blowout

MOST airplanes being designed and built today will operate most efficiently at high altitudes. The human body operates best at low altitude. Ordinarily, this would dictate one of the many compromises which are necessary in the development of any new airplane. But in this case, tactical requirements cannot be compromised by human frailties. If, in aerial combat it is necessary to go to extreme altitudes to get on top of the enemy, then the humans who man the airplanes must go to those altitudes.

The pressurized cabin or cockpit was developed to enable airplane crewmembers to overcome man's inability to survive at high altitude. It does its job admirably. Humans can now survive flight at altitudes undreamed of a few short years ago.

But along with this new ability to fight above 40,000 feet, a new problem has developed for pilots and crewmembers—the problem of "explosive decompression." Ignorance of the effects of sudden decompression has led to an unjustified fear on the part of many crewmembers. Perhaps the fear is partly a result of the natural reluctance of man to tangle with things he doesn't know much about. In fighters, it has been built up out of all proportion to the danger it really represents.

In at least one case of high altitude explosive decompression, the biggest danger was found to be not the decompression or the cold as might be expected, but dirt! Not dirt in the atmosphere, but dirt in the airplane, which swirled up in the cockpit and got into the pilot's eyes. And the biggest source of discomfort to the pilot was, of all things, noise—noise caused by the rush of air through the cockpit during the pilot's rapid descent after the canopy failure.

A test pilot took off from Edwards Air Force Base in an F-80C to test a new fuel control and engine configuration. He made a locked full-throttle climb to 45,000 feet, flew at that altitude for about one minute, then started a 200-mph indicated descent at idle RPM.

Just after passing through the 40,000-foot level, the pilot heard a loud explosion. In a fraction of a second, vapor formed in the entire cockpit, and simultaneously the pilot's eyes became filled with dirt which apparently came from the cockpit floor. A tugging of the oxygen mask away from the face was felt, but the pilot immediately grasped it with his left hand and encountered no further difficulty. He was wearing a "Toptex" helmet, without a chin strap, but noticed no tendency of the helmet to leave his head.

It took nearly a minute for the pilot to clear the dust from his eyes sufficiently to see that about two square feet of the right side of the canopy was missing. He immediately checked the oxygen and found it okay.

At this time, the pilot became aware of the extreme cold, so he immediately began a maximum rate descent to warmer levels.

During the descent, the rush of air through the cockpit created a high noise level which made it impossible to use the radio. The noise left the pilot with a slight headache and a loud ringing in his ears for several hours after the flight, but no other ill effects were suffered.

After descending to 15,000 feet altitude, the plane was leveled off and slowed to about 180 mph. The pilot was then able to use the radio, and made a normal landing at Edwards Air Force Base.

In this case the pressurization differential was only about 4,000 to 5,000 feet when the canopy failed, although it had been higher a few seconds before.

In another case, an F-80 pilot leading a two-plane formation at night experienced explosive decompression at 38,500 feet and encountered a little more difficulty. The pressure differential was greater, the cockpit pressure being set at about 23,500 feet, and the explosion was "terrific" according to the pilot. Here again, the oxygen mask tried to pull away and actually did pull loose from the helmet on the right side. The pilot grabbed it and held the mask to his face but was unable to hold it tightly because of the necessity for using his hands to control the airplane. The result was that he partially lost consciousness. The wingman perceived that something was wrong and gave the pilot instructions for descending, talking to him continually until a safe altiture of 6,000 feet was reached. Here, the use of oxygen was not necessary and the pilot was able to make a safe landing a few minutes later.

Although the letdown was fairly rapid, averaging in excess of 6,000 feet per minute, the pilot in his semiconsciousness state leveled off four separate times. The promptings of the wingman to continue the descent may have saved this pilot's life.

There have been several other explosive decompression instances which were brought to the attention of Flight Safety. In some of these the airplane, usually the tail section, was damaged when it was struck by pieces of the canopy. In no case did the pilot suffer any ill effects from either the decompression or the cold. But all the pilots realized that two things were of paramount importance—insuring an oxygen supply and descending immediately.

A physiological training officer, analyzing a case of explosive decompression, stated that surprise and shock immediately after the explosion is the first reaction. In such a case, the pilot may be confused for several seconds before he realizes what has happened. And at altitudes of 35,000 and 40,000 feet or above, those few seconds have magnified importance since the time of useful consciousness without oxygen is only a matter of seconds. With each 1,000 feet above 37,000, the possibility of pilot confusion becomes *critical!*

Hypoxia is, of course, the greatest danger to a pilot after explosive decompression. Judicious use of oxygen is ever important, but is especially important after decompression at altitude. Excitement accelerates the effects of hypoxia, and because of the surprise always involved in sudden decompression some degree of mental agitation is to be expected. Pilots who realize that the actual danger is slight are not so likely to get excited. Allied to hypoxia is the matter of bends. They're just another reason to get down in a hurry and really represent no problem unless the altitude is extreme.

Analysis of the tendency of the oxygen mask to leave the pilot's face brings up the subject of lung expansion. The sudden cockpit pressure change at the time of the explosion is magnified by air being forced out the pilot's mouth. This is caused by sudden expansion of the air in the lungs which forces some of it out through the mouth with a considerable propulsive force. The mask must be very firmly secured to prevent its loss under such conditions. Some organizations use a cloth inner liner which fits snugly about the head underneath the helmet. The mask is securely attached to the liner rather than the helmet. This prevents loss of the mask in the event the helmet should be pulled off the head.

As long as the pilot's oxygen system remains operative, the effects of explosive decompression on pilots flying airplanes under 40,000 feet are practically nil. This is so because the pressurizing system is designed to limit the pressure differential to a ratio which the pilot can easily withstand if decompression should occur. Actually, he can withstand considerably more decrease in cockpit pressure than he is likely to experience.

The effects of cold at high altitude have been shown by experience to be almost negligible, providing, of course, a descent is begun very soon and the pilot is not flying in beach attire.

The important things for a pilot to remember if he should experience explosive decompression are, first, keep calm; second, assure an oxygen supply by using 100 per cent oxygen and a tight mask fit; and, third, don't waste time in getting to a lower altitude.

Without Charts where are you?

When the Big Question Is Finding Your Way, Aeronautical Chart Service Has the Answer

Aeronautical charts, like parachutes, can be life savers. A pilot without charts—the right charts—sooner or later becomes lost. Adequate planning of a flight is the answer, and that requires a knowledge of what kinds of charts are necessary for any particular mission.

To give air crews safety insurance by providing them with the best charts it is possible to create, and to encourage pilots and navigators to use those charts most effectively, is the enthusiastic, daily job of officers at the headquarters of Aeronautical Chart Service in Washington, D. C.

"We must do everything we can to stimulate the interest of air crews in aeronautical charts," Colonel Paul C. Schauer, Commanding Officer of Aeronautical Chart Service, has told his staff. "When a crew taxis up to the gas pit they assume they will get the proper fuel. I suppose there's the same sort of faith when they go to an operations office for charts. Of course, they really ought to check to make sure they receive *all* the charts they need, and charts that are the latest revisions, not some obsolete numbers."

"Pilots and navigators can add to the safety factor of charts," said 1st Lt. Howard A. Courtney, during a roundtable discussion of the relationship of ACS to Flight Safety held recently in ACS headquarters. "I had an object lesson in 1948 when I flew one of the planes which combed Venezuela. British Guiana and northern Brazil for a C-47 which had disappeared. No trace of it ever was found, despite a very intensive search, and many of us believed it likely that the airplane, while in a cloud, struck an uncharted mountain peak. That terrain was very poorly mapped, as a lot of other remote areas are. If a pilot finds by experience that an altitude is wrongly marked on a chart, that a river is misplaced, or that any kind of inaccuracy exists he can easily note the facts on the franked, addressed mailing slip which is on the back of every ACS foreign area chart, and drop it in the mail. The Chart Service will take quick action. The pilot's simple act may save lives, his own or his fellows' in the Air Force."

"I'd like all Air Force personnel to know," said Colonel Schauer, "that their aeronautical charts are as nearly perfect as it is humanly possible to make them, but there is never any end to our efforts to improve them. We welcome every bit of information and every suggestion from the Air Force which may result in better charts. This organization is constantly on the alert to give greater service within the field of its mission."

That mission is to provide all the aeronautical charts and related material required by the Air Force in peace and in war. Operating under the control of the Air Materiel Command, the Aeronautical Chart Service covers the globe in its assigned mission and charts a special pathway to global thinking and action.

Some 13,000 charts are produced. They are made for a multitude of specific purposes. There are charts for air navigation, for air pilotage, for planning, for finding targets, for air support of ground troops and, in fact, for every USAF use. Azimuthal equidistant and polar stereographic charts are examples of the latest global thinking. The Pilot's Handbook, issued in various editions which cover all the routes flown, is familiar to every pilot. Intensive study, undertaken in coordination with all the major jet commands, is proceeding vigorously to produce charts which will meet the exacting requirements of great speed and high altitude flying. The employment of color on charts is a matter of continuing experiment.

To accomplish its mission, the Aeronautical Chart Service maintains, in addition to its Headquarters, the Washington Plant; and the Aeronautical Chart Plant and the Aeronautical Chart Service Store, both in St. Louis, Missouri. It also contracts some of its work out to other governmental agencies and private concerns.

The Headquarters is relatively small, being primarily a policy and planning group. It also exercises headquarters direction of operational activities and headquarters coordination with the government's mapping and charting agencies concentrated in Washington. Further duties include representing the Air Force at various appropriate international and domestic conferences, and service on committees which coordinate mapping and charting activities within the Federal Government and the Department of Defense. At Headquarters, the decision is made with approval of Headquarters, United States Air Force, as to what new types of charts shall be made.

One activity at the Washington Plant is the accomplishment of emergency projects. A year or even longer may be required for the making of a chart because of the extreme adequacy and accuracy demanded, but emergencies sometimes require a job to be done yesterday, as the saying is. It is done. The major function of the Washington Plant is the research necessary to produce and revise charts.

Basically, there are two methods of chart making. The older makes use of every source of information except aerial photography. Those sources include existing maps and charts, captured enemy material, books, magazines, reports from military chart users, data from domestic and foreign airlines, documents—old and new, information from foreign governments, data garnered by other American mapping agencies, and a variety of other aids. When the photo-grammetric method is used, aerial photography becomes the basis for the job but the other sources are used as well. The U. S. Air Force has photographed more than 16,000,000 square miles of the earth's surface, and approximately 70 per cent of that photography has been utilized in aeronautical charts.

The greater part of the photogrammetric work is accomplished at the plant in St. Louis. That plant is the major ACS production facility, accomplishing the compilation, drafting and reproduction of the charts. At that plant, too, is prepared and printed the air overprint which, superimposed on the base chart, makes it an aeronautical chart. The overprint contains the aids to navigation, the information relating to airfield facilities, radio beacons and ranges, etc., according to the intended use of the chart series. A mass of data for this overprint flows in from contacts which have been made in all parts of the world. Constant changes in some of this data make the approach and landing charts in the Pilot's Handbooks the most frequently revised of all aeronautical charts. Holders of the Handbooks are promptly informed of corrections, additions and deletions.

The finished charts go to the Store from which they are distributed to all quarters of the globe. Routine military requisitions are handled with dispatch, the charts being shipped within 48 hours. Emergency requests are filled immediately, and in a matter of hours, or even half-hours, are on their way. Methods of shipping vary with the need and the available facilities.

Some operations offices and overseas depots may not realize the extent of the service ACS can give them, according to 1st Lt. Russel J. Brahmer, who participated in the safety discussion at Hq. ACS. "Naturally, they have our Catalog of Aeronautical Charts and the twice-a-month bulletins listing the latest editions," Brahmer said, "but I've found that some don't understand that they have only to tell us their problems and they'll get the right charts pronto, and if they need a special job, we'll do it."

"They don't lack information on that score in FEAF," Colonel Schauer said. "More than a million charts went to the Far East during June, July and August. Of that total, more than 700,000 were shipped in July alone. The Korean fighting developed a tremendous demand for WAC, pilotage and approach and landing charts over and above the substantial stock they had on hand in the theater depot."

"And I understand, Colonel," said Capt. Charles C. Griffin, "that those June-through-August figures represented less than 12 per cent of our chart distribution during that period."

"Nearly 120,000 of the million were approach and landing charts," said Capt. Gene A. Luccesi, Chief of the Aids to Navigation Section. "That brings up another safety angle. Pilots should not remove those charts from the Pilot's Handbooks, because sometimes they don't get replaced. And without a letdown chart, where are you?"

* * *

In 1923 the first true American military aviation charts were authorized; the authorization was for strip charts which contemplated coverage of 52 routes flown by military aircraft, and five years later a majority of them had been published. The first experimental aviation chart using aerial photography was completed in July 1930; it covered a route from Wheeling, West Virginia, to Richmond, Indiana. The Division grew rapidly during World War II, and so great was the demand for charts that it was necessary to let out a great deal of the work on contract to other government agencies and to commercial companies. Production grew incredibly. The top was reached during the fiscal year of 1945 when more than 42,000,000 copies of charts were reproduced; nearly 11,000,000 of them went to overseas theaters, the remainder being utilized within the United States.

The present magnitude of the ACS task is indicated by the fact that 17,550,000 charts were distributed during the fiscal year which ended 30 June 1950. Distribution during last July, spurred by Far East requirements, amounted to more than 3,335,000 copies.

That is a far cry from the early nineteen-twenties when Post Office Department route maps, road maps, commercial state maps, nautical charts and the like were used for air navigation.

Flying safety meeting of pilots in Hq. Aeronautical Chart Service. L-R: Col. Paul C. Schauer, Commanding Officer; Col. Charles R. Greening, Capt. Claude H. Bridges, Jr., Lt. Russell G. Fitzgerald, Capt. William E. McLendon, Capt. Charles C. Griffin, Lt. Howard A. Courtney, and Capt. Gene A. Lucchesi.

YOUR AIRPLANE

SNOW AND ICE ARE WINTER HAZARDS
BE SURE YOU UNDERSTAND THE LIMITATIONS OF YOUR PLANE

Intensive research has made vast progress in combating ice in winter flying operations, but in spite of these strides Old Man Winter is still sitting up there in those clouds just waiting to take a vicious swing at some unsuspecting pilot.

Keep your guard up by knowing the score on this danger . . . Give the subject some thought and do a bit of Tech Order reading concerning your own particular aircraft. Each type of aircraft reacts somewhat differently under icing conditions, therefore it would take a shelf of fat books to cover the field specifically. Meanwhile, here is the latest thinking on the subject, condensed for easy reference and for the purpose of stimulating interest in icing problems.

ICING—WHEN and HOW

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.

This flying hazard is predominant in cumulus clouds and especially heavy in cumulonimbus clouds. Icing will also build up quite rapidly in stratus and strato-cumulus 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 super-cooled 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 super-cooled 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 airfoil and therefore decreases lift.

Rime ice forms when droplets freeze without completely breaking into a film of water, thus giving 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 deicing boots. 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.

ditions 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

and ICING

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.

FLYING REFRIGERATOR

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, usually found on the impact tubes, the carburetor screen, the mouth of the boost venturi, or other carburetor protusions.

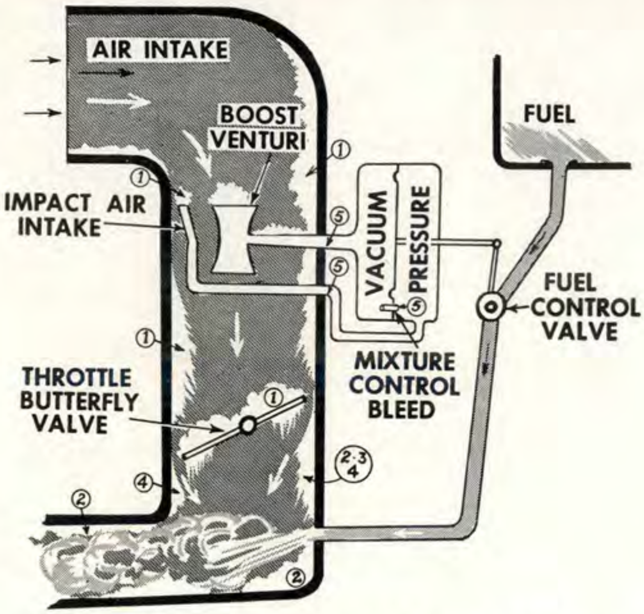
The effect of ice on the carburetor screen is a blocking off of the airflow which is the usual characteristic by which carburetor icing is recognized. Icing of the impact tube or boost venturi leans the carburetor mixture.

FUEL AND WATER VAPOR ICING

Don't let a sunny spring day fool you! Your air induction system has a very efficient ice manufacturing system which, rain or shine, needs only the proper con-

C-54 engine and B-29 nose show ice formed in flight.

YOUR AIRPLANE and ICING



Numerals indicate location of the five types of icing. KEY: 1—Impact Icing, 2—Fuel Vaporization 3—Water Vapor Icing, 4—Throttle Icing, and 5—Bleed Passage Icing.

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 in accordance with two of the basic laws of physics which state that the pressure in a venturi varies inversely as the velocity, and the temperature varies as 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 engine), 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. Provided the fuel is cold enough, this ice will form even though carburetor air temperatures are maintained at maximum permissible values. *The symptoms are an extremely rich mixture.*

Under ordinary conditions the fuel would be cold enough to cause trouble of this mixture only if the airplane was refueled at a base where the outside air temperature was very low, or if the airplane remained in very low temperature air for a prolonged period. Ice crystals form in fuel that has been stored under extremely cold conditions. These crystals then form the troublesome bleed ice.

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

Since bleed passage icing requires special treatment, it is recommended that the following operating procedures be used when an engine power loss is encountered under icing conditions, when it is known that the temperature of the fuel is well below freezing:

1. Use maximum permissible preheat.

2. When fuel flowmeters are being used and the power loss is accompanied by an appreciable increase in fuel flow, manually lean the mixtures to restore fuel flow and BMEP to their original value.

When fuel flowmeters are not being used, cautiously determine whether the engine is lean or rich by slowly moving the mixture control lever from the rich toward the lean position. If leaning causes a power increase, lean the mixture until the power is restored to its original value (where BMEP gages are not being used it will be necessary to estimate when the power is back to normal from such things as cylinder head temperature, indicated airspeed).

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.

ANTICIPATE ICING

Some types of aircraft engines and engine installations are more susceptible to icing conditions than others. A comparison of major aircraft accidents in which carburetor icing was involved shows liaison planes accounting for nearly half of the total number. Cargo planes, including the C-46, C-47 and C-45, were second in the number of carburetor icing emergencies, with trainers, bombers and fighters following in that order. Regardless of the type of aircraft involved, however, failure of pilots to anticipate or recognize icing conditions until too late for effective use of carburetor heat was given as the principle cause of the majority of the accidents.

There are two recognized methods of deicing carburetors: (a) heat rise, (b) alcohol. Heat rise is always provided first and in some airplanes, alcohol is provided as a secondary measure. (Note: Because of the fire hazard of alcohol under combat conditions, Air Force aircraft do not usually use alcohol.) Heat rise is a continuous type of deicing and alcohol is a momentary type of deicing, its function being the same as alcohol in the radiator of your car. It should be remembered that if the engine fails completely from carburetor icing, the source of energy for carburetor heat rise is gone. This is why some aircraft carry alcohol—to restore power after the preheat has failed to revive the engine. 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 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.

Your Airplane and ICING

Other signs of icing besides manifold pressure are variations in fuel flow meters, which means either richening or leaning. Excessive richness can be seen by a drop in engine power and exhaust torching. Leanness can be discovered by loss in engine power and usually backfiring. You should try to determine whether the effect on the carburetor is from loss of airflow, as noted by manifold pressure, or improper metering of the carburetor as noted by indications on the engine of a richness or leanness, and adjusting the mixture accordingly.

Effect of Automatic Controls on Icing

It should be remembered that aircraft incorporating automatic manifold pressure regulators or exhaust turbo regulators, or combinatons 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.

• • •

This is a generalization of carburetor operations and it is the pilot's responsibility to acquaint himself with the particular carburetor icing procedure for his aircraft's power plant. Tech orders and the manufacturer's directives on the problem of icing and their engines are available at your base engineering office.

TURBO HEAT

The B-36, the B-50 and the C-97 airplanes use exhaust turbo supercharging which normally supplies very warm air to the carburetor. On these aircraft there is usually more concern about too much heat in the operation, with the problem of keeping the carburetor air temperature below maximum limits rather than worry about too low a carburetor temperature. However, there are conditions of operation such as on extremely long range missions where the engine horsepower requirement is so low that the turbos will not produce sufficient heat.

To complicate this problem further, such operation usually is at low altitude (under 6000 feet) where the engine can develop enough manifold pressure on its own to meet the requirement for low power cruise. At these low settings, the automatic controls tell the turbo that it is not required to perform any supercharging. Under such conditions, this airplane is as vulnerable to carburetor icing as any other aircraft where the pilot neglected to use his preheat until it was too late. To combat this condition, the B-50 and the C-97 have an exhaust turbo by-pass.

When operating conditions will not give a high enough carburetor air temperature to insure an ice-free carburetor, it is possible to utilize the heat of compression of the turbo supercharger even though the supercharging is not required by the engine. This is accomplished by opening a by-pass valve around the supercharger where the excess air flows around in a circle and the engine draws off only what is required to maintain power. Every time this air goes through the supercharger it obtains a certain amount of temperature rise. Under this type of operation, too much temperature rise can result and, consequently, the inter-cooler is brought into action to reduce the carburetor air temperature.

There are instances, such as at very low power and altitude, where even in the preheat position (turbo by-pass) it is not possible to obtain enough heat rise because of the limited heat available from the turbo-superchargers. By increasing power or altitude additional heat can be made available. Adequate preheat will be provided above 10,000 feet altitude.

Whenever visible moisture conditions exist, the following procedures will eliminate the possibilities of carburetor icing:

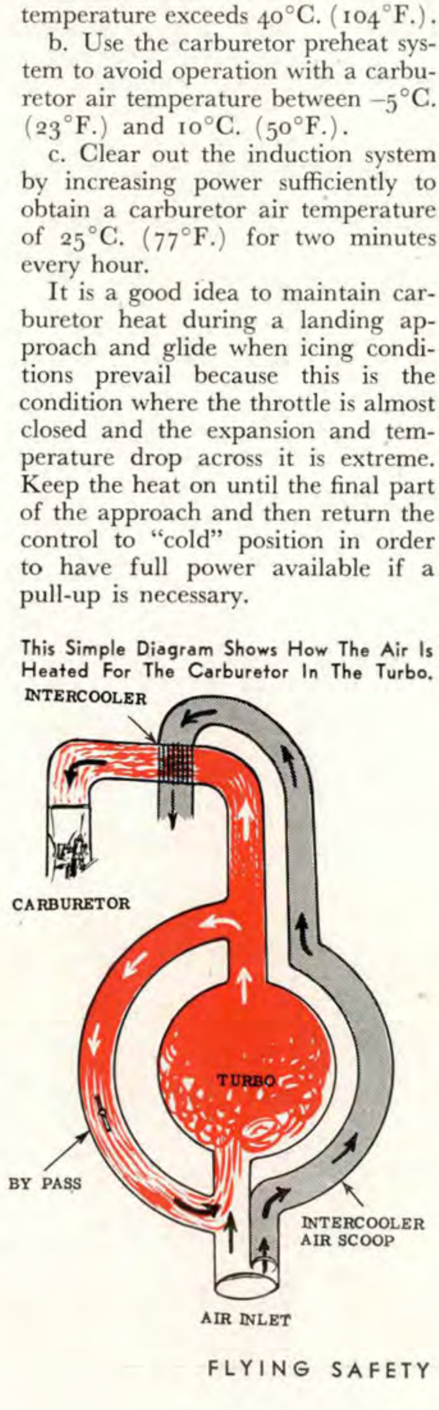
a. Keep inter-cooler flaps closed at all times unless the carburetor air temperature exceeds 40°C. (104°F.).

b. Use the carburetor preheat system to avoid operation with a carburetor air temperature between –5°C. (23°F.) and 10°C. (50°F.).

c. Clear out the induction system by increasing power sufficiently to obtain a carburetor air temperature of 25°C. (77°F.) for two minutes every hour.

It is a good idea to maintain carburetor heat during a landing approach and glide when icing conditions prevail because this is the condition where the throttle is almost closed and the expansion and temperature drop across it is extreme. Keep the heat on until the final part of the approach and then return the control to "cold" position in order to have full power available if a pull-up is necessary.

This Simple Diagram Shows How The Air Is Heated For The Carburetor In The Turbo.



PRECAUTIONS FOR PILOTS

Winter hazards annually cost the Air Force millions in airplanes and equipment. There is a satisfactory solution to each of the varied winter hazards. The solutions have been worked out many times, but occasionally disaster strikes. And usually when it does it is the result of either poor flight planning, unfamiliarity with proper procedures, or poor pilot technique.

Neglecting to take adequate precautions has and may again cause disastrous accidents. It is up to you to do all you possibly can to make certain that you are aware of all winter weather dangers, that you know the results, and that you are familiar with the best preventive procedures.

Miscellaneous factors which should be considered in winter operations are:

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.

Light snow can sift into the smallest openings—wing and fuselage sections near any openings should be inspected for snow accumulation.

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.

One type of accident which occurs with monotonous regularity is the collision of aircraft with snowbanks at the edge of runways and taxi strips.

The stream of reports of accidents resulting from winter conditions can be cut to a trickle if you take heed.

LAST RESORT DE-ICING

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 cutoff 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.

WINTER CHECKLIST

Here is a winter checklist that will help take the hazard out of cold weather flying:

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

Remove frost and snow before takeoff.

Check controls for restrictions of movement.

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

Don't take off in slush or wet snow if it can possibly be avoided.

Use pitot 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. (Use carburetor preheat for prevention. Don't wait to cure.) Watch your carburetor air temperature, especially between -5° and 10° C (23° and 50° F.).

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. Before starting landing approach, move throttle back and forth slowly to make sure carburetor butterfly valve is free of ice.

Carry carburetor heat during final approach and change to cold just before flareout.

Before take off check anti-icing and de-icing equipment. Be sure it is in good operating condition. You might need all of your equipment.

YOUR AIRPLANE and ICING

This propeller tip shows how ice builds up on leading edge.

Propeller Icing

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.

Jet Icing

High speed jets operating at stratospheric altitudes, rarely have the same type icing problem that confronts conventional aircraft, except of course in pattern work (climb to altitude and letdown).

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. Mr. P. M. Bartlett, Air Materiel Command, and Mr. T. A. Dickey, Navy Bureau of Aeronautics, presented a rule of thumb to the effect 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 bring about a 15 per cent decrease in thrust, they said. Thrust losses would normally call for higher engine rpms, but higher rpm further increases turbine temperatures until the pilot is left "in an untenable position."

For unprotected engines the test group found that temperatures near freezing are the most critical for ice accumulation.

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 S.O.P. 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 from it when you pull out.

Vision in newer jets is 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 low go-around. By easing the heat onto this very cold glass there is far less chance of breaking it.

WHAT TO DO IN ICING

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 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.

Warm front icing area.

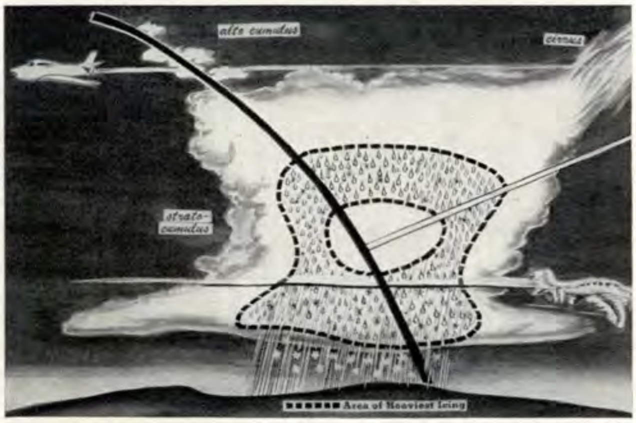
You will find the most severe icing above the crest and to the windward side. Avoid turbulent areas. When you run into wet, sticky snow, climb above it to colder temperatures where the snow will not adhere so readily. Fly through an icing area fast.

Try to remedy the situation by escaping from icing conditions—leave the region of icing before 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.

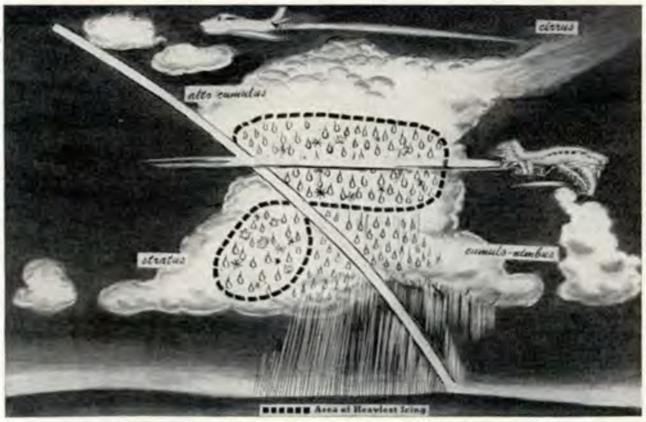
Handling an iced airplane is essentially a matter of maintaining speed and a low angle of attack. The airflow will continue to adhere to upper surfaces as long as the angle of attack remains small, but there is generally a very abrupt and complete stall when you increase the angle of attack. In rough 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 layer of warmer air.

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

Icing in occluded front. Iced plane flies in heaviest area.



Cold front icing. Jet plane flying high encounters least ice.



Your Airplane and ICING

Progress of Icing Research

Icing has commanded a top priority in the research field and Wright-Patterson Laboratories have equipped a veritable "flying icebox"—a pipe-bedecked C-54 which can coat itself with snow and ice or create a blanket of artificial fog—to help the USAF take the bite out of Jack Frost.

Ice is stock-in-trade for the crew of this AMC flying laboratory and two others, a B-24 and a B-29, all stationed at Ypsilanti, Michigan's Willow Run Airport. Their job is gathering data on icing and testing new equipment so that engineers can best arm today's aircraft against high altitudes and bad weather.

Attached to the outside of the unorthodox C-54 is a complex maze of pipes with nozzles arranged so they can shower the plane with a steady stream of water or produce a mist so fine it becomes a fog.

When the plane, aptly dubbed "Squirtin' Gertie," reaches high altitudes this fog—which is the same as natural clouds—becomes supercooled and freezes the instant it strikes the fuselage. Inside during these experiments, engineers record information from a maze of dials while the test is photographed by cameras and stroboscopic lights. Later, all this information is studied and translated into practical methods for combating aircraft icing.

One of the main problems engineers are facing with the thermal anti-icing method is to reduce the weight and bulk of needed equipment. To accomplish thermal anti-icing tests, the trio of flying laboratories carry enough heating equipment for nine six-room houses.

"Project Summit," a cooperative effort between the Air Materiel Command, Navy Bureau of Aeronautics and five turbine engine manufacturers (Wright Aero, General Electric, Pratt & Whitney, Allison and Westinghouse) is now in its third year of intensive research with its testing facilities located on the summit of Mt. Washington, in the White Mountains of New Hampshire, where winter winds exceed 100 mph 17 per cent of the time; exceed 50 mph 98 per cent of the time, and where icing conditions exist 25 per cent of the six-month test period each year. Weather conditions at 5000 feet altitude duplicate most icing problems that a pilot might encounter, thus making it an ideal test laboratory.

In 120 hours icing test time accumulated on the centrifugal type Allison J-33 engine there was "insufficient evidence to justify anti-icing of these engines." Icing problems in the axial flow, they reported, are being met by direct heating of the critical components of the engine inlet. General practice is:

Inlet Screens—Use of retractable screens with retraction before icing is encountered.

Inlet Guide Vanes—Use of hollow heated vanes utilizing heated compressor discharge air or combustion chamber hot gas as the heat transfer medium.

Struts and Bearing Supports—Use of hollow heated construction similar to guide vanes or use of electrical surface heating.

Accessory Fairing—Use of double wall construction with hot air, hot gas, hot oil, or use of electrical surface heating.

Although heating of the engine air inlet does work, it causes too large a loss of thrust and presents monoxide problems when engines are used as a source of pressurized air.

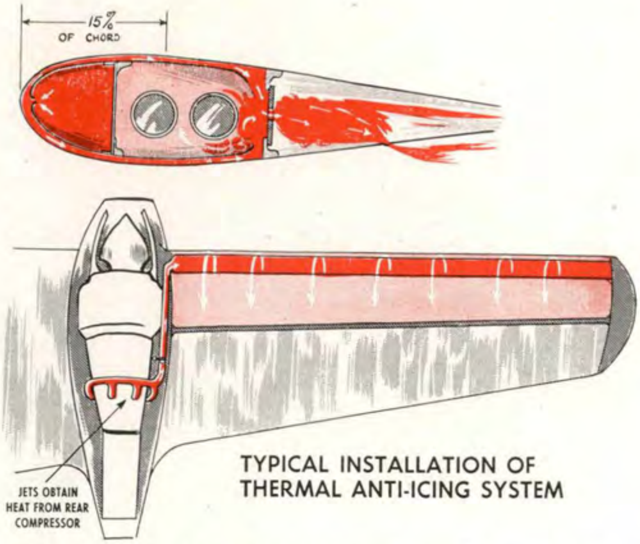
Now, to the airframe itself. All-Weather interceptors have emphasized the necessity for a system that will enable safe operation of jets during icing conditions in which the conventional type aircraft has trouble. To accomplish this, engineers are working on an internal aircraft electrical heating system—also an internal heating component using hot gases.

The most efficient and successful method thus far is the thermal system of hot air heating the wing with a chordwise flow of heat.

The basic theory of this system is to prevent ice by completely evaporating water droplets by the heating of the leading edges up to about 15 per cent of the chord.

The heat is obtained by use of compressor bleed, air taken off the last stage which has the necessary operating heat 121° to 260°C., or 250° to 500°F., and pressure of from 20 to 100 psi. This air is channeled through ducts to the internal leading edge (see sketch), and flows back inside the wing to dissipate out the trailing edge.

Loss of Power Thrust during operations is approximately eight per cent with a corresponding percentage of *increase of specific fuel consumption*. Also there is an *increase* in *tail pipe temperature*, due to the extra fuel and loss of charge air which is going out into the wings.



Heating of Jet Wings Would Prevent Ice By Evaporating Water Droplets. However, with a Loss of Power.

Ice Research Facilities on the Summit of Mt. Washington After a Storm.

The task of overcoming turbine engine icing is now being licked and continued research will be conducted toward design refinement and improvement of equipment.

Not to be outdone, egg-beater designers have come up with an answer to old man winter.

A prototype anti-icing system for the Sikorsky H-5 helicopter has been developed by the Propeller Laboratory of the Air Materiel Command and Sikorsky Aircraft Corporation. The Unit consists of a heater which is mounted outside the helicopter cabin and supplies hot air to the hollow portion of the rotor blades.

The heater, used both for rotor anti-icing and cabin heat, produces 200,000 BTU of heat per hour and uses 16 pounds of aviation fuel in doing so. A blower is used to force the hot air from the heater through flexible ducting on the outside of the fuselage to a rotating collector ring on the blade rotor. From there air is ducted into the blade and forced out along its entire length. Helicopters using solid blade construction will use electrical anti-icing systems, Air Materiel Command says.

KEEPING CURRENT

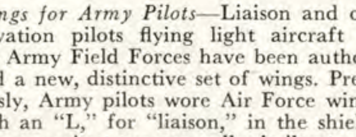
More Flying Classrooms—An additional undisclosed number of T-29 "Flying Classrooms" for training navigators and bombardiers has been ordered by the U.S. Air Force from Consolidated Vultee Aircraft Corporation. Convair has already completed a number of the twin-engine navigation trainers ordered previously.

Based on the 40-passenger Convair-Liner commercial transport design, T-29's are distinguished on the exterior by four astrodomes atop the fuselage, a large radome beneath the fuselage, and 18 antennas.

New RATO—Designed to use smokeless powder, a new aircraft booster rocket has been developed for use on various military aircraft. Although the new unit weighs considerably less than JATO's now in use, it provides an equal amount of thrust. The weight saved adds to the pay loads of airplanes which require an assist in takeoff's from aircraft carriers or runways.

Door Added—Boeing Airplane Company has added an extra cargo or personnel door to one of its Air Force C-97A Strato-freighters in the Pacific Air Lift. Located on the right side of the fuselage, the new entry gives the C-97 a total of four doors, allowing the plane to be loaded or unloaded in two-thirds of the time formerly required.

Light Dope—A large number of small airplanes are lost by fire every year when an inexperienced mechanic lets an extension light rest on the fabric of a seat or on the "doped" surface of a plane. These lights have even been placed close to freshly doped surfaces (in one case with the hope that the heat would help



dry the dope). Carelessly used extension lights (especially with no wire guards on them) are probably the most prevalent cause of fires in hangared aircraft. Airlines are requiring vapor proof lights in dope rooms to reduce the fire hazard.

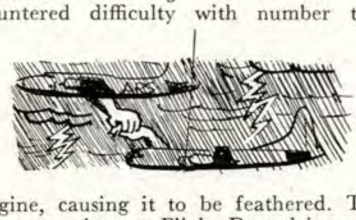
Wings for Army Pilots—Liaison and observation pilots flying light aircraft in the Army Field Forces have been authorized a new, distinctive set of wings. Previously, Army pilots wore Air Force wings with an "L," for "liaison," in the shield. The new wings are generally similar to Air Force wings, but with a new shield. The Army aviator badge, as it is known, may be worn by Army aviators now on flying status in the commissioned ranks. There is also a senior Army aviator badge, with a star over the shield, for officers who have logged 1,500 hours flight time and who have seven years Army flying service.

Lifting Bags—Use of pneumatic bags originally developed as Air Force Type F-1, to lift a large air transport successfully was recently demonstrated after an

airliner landed with one main landing gear in the retracted position. B-29's have been lifted in this manner where ground conditions are such that use of jacks would be hazardous.

Greeks Had a Sentence For It—According to reports, Greek pilots who pull flying safety boners and damage aircraft and equipment through pilot error are subject to a "jail" sentence. Some typical sentences reported were 20 days confinement for a nose-over; five days for groundlooping, and 20 days for a major landing accident.

Bomber Saved—A Boeing B-50 bomber with a crew of 13, en route from the Azores, was recently intercepted and escorted to safety by an aircraft of Flight D, 1st Air Rescue Sqdn, Kindly AFB, Bermuda. The B-50 bomber had encountered difficulty with number two

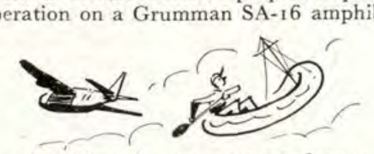


engine, causing it to be feathered. The alert was given to Flight D, and immediately Bermuda Rescue sent an SB-17 into action. After 30 minutes out over the Atlantic Ocean solid instrument weather was encountered, lasting during the entire mission.

The bomber flying at 12,000 feet was soon intercepted by the use of radar equipment 315 nautical miles from Bermuda, and was asked to keep in contact with the rescue plane by radio. Both aircraft, flying on instruments, returned to Bermuda, with the Air Rescue aircraft flying 1000 feet above, guiding the bomber the rest of the way in. It was only after the SB-17 had safely landed that the crewmembers actually sighted the missing B-50, which had landed nine minutes earlier.

Check Doors—Instructions have recently been issued to all Air Rescue Service activities reminding pilots to check the life raft door locking mechanism at each preflight. This measure was taken to insure proper locking and functioning of the life raft door.

In a recent reverse propeller pitch operation on a Grumman SA-16 amphib-



ian, the life raft compartment door was lost, because of failure to check this equipment at preflight.

Civil Licensing—A new Civil Air Regulation Amendment 20-9 has liberalized requirements for issuing private and commercial pilot licenses to former military pilots. It provides for licensing pilots who have been more than 12 months out of the service and allows graduates of military flight schools to qualify for licenses without the previously required six months service as rated pilots.

And There He Was—Flight B, 10th Air Rescue Sqdn, Elmendorf, Alaska, recently dispatched a Sikorsky H-5 helicopter to investigate a J-3 cub aircraft that had landed on a First Task Force firing range.

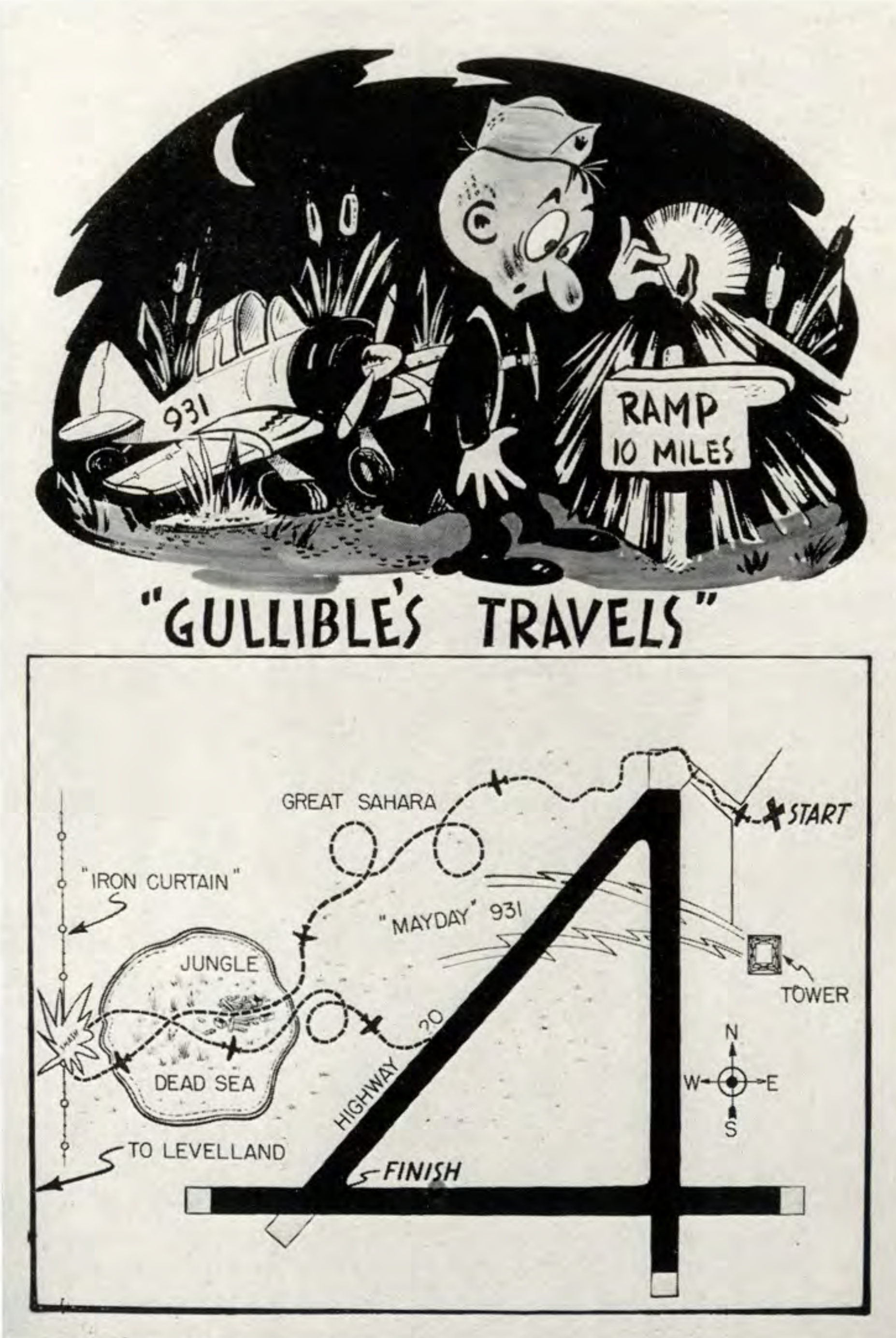
Upon arriving, the helicopter pilot found a note inside the Piper Cub which stated, "Have gone to Fairbanks for gas."

The cub pilot returned to find another message scribbled in pencil on the bottom of his note, which read, "If you don't hurry and get this plane off the firing range, you won't have anything left to pour your gas into."

F-94A Tested—Air Force's Flight Test Section at Edwards AFB at Muroc is running accelerated service test on Lockheed's F-94A, flying a 24-hour schedule seven days a week, putting six months of operation on each of three planes within 3 days. The test requires 150 hours per plane.

Briefly Noted—USAF expedites the big ones with a new diesel tractor with double-end controls, capable of running sideways and towing 400,000-pound aircraft . . . Ten "Ford Trimotors," forerunners of the modern multi-engined air-transport planes, are still registered as "active." They were built in 1928 and 1929 . . . The jet engine overhaul line at Tinker AFB is the largest one in existence. It has been in operation just three years. From the time it enters the overhaul line, until it is sent out again for use, each jet engine receives from 300 to 400 man hours of attention from specialists . . . Luke Field, Arizona, is being reopened as a jet training base.

WHO HID THE RUNWAY?



Scheduled to fly solo transition in a T-6 from 2020 to 2120 hours, promptly at 2020 the cadet was cleared and started to taxi north on the parking ramp to taxi strip number one. At taxi strip number one, he turned left and proceeded to taxi to intercept runway 20. Assuming he had crossed runway 17, he turned right at a slight angle to pick up runway 20.

The tower operator at this time called and asked the number of the plane on the runway. (He was under the impression the T-6 was on the runway—when actually it was to the right, taxiing at an angle to it.)

"I am not on the runway, but should be up in a moment," the cadet replied, thinking he was taxiing to intercept it. Upon reaching a fence he stopped and knew he had been taxiing in the wrong direction too long. Judging the distance between the aircraft and the fence with his landing lights, he decided to make a 180° turn to the right, unlocked the tailwheel and completed the turn unaware at the time that in the turn he struck the fence.

On reaching runway 20, he called the tower and stated he had overshot the taxi runway but was now on it. Continuing to taxi down 20 until reaching the number one position for takeoff, he completed a run-up. Then he noticed one of his tires was going flat and started to return to the parking ramp. Unable to do this, as the tire had gone flat, he asked permission of the tower to clear the runway and cut the switches. Then he climbed out of the plane and proceeded to see how bad the tire was, while waiting for a tow tug.

It was not until this time that he noticed the left wing was damaged. Climbing back in the T-6, he immediately told the tower the wing was also damaged. This was acknowledged and the plane was later towed into the parking ramp.

The plane retrieved, it was found that all three tires were punctured by odds and ends picked up in his travels.

The student did a remarkable piece of work traveling through the dry lake as there is quite a dip and the soil is very sandy. Accident investigators had trouble following his tracks in a jeep.

—Cartoon by 1st Lt. Jack Tippet

Flying an Airplane Under Ideal Conditions Is Not Really a Difficult Task. But the Ability to Handle an Emergency Requires Additional Training

TRAINING *for* EMERGENCIES

By Lt. Col. Vincent J. Donahue

Capt. Francis D. Peters in Dehmel Trainer instructed by 1st Lt. Edward McDonnell at USAF Instrument School.

Galling as it may be to the ego of Air Force pilots, it is a fact that during World War II, women pilots with little heavy aircraft time ferried four-engine bombers as ably as their male counterparts. Admittedly, they were not cleared for night or instrument flights, so we have no way of knowing how they would have performed under night or instrument flying conditions.

The foregoing piece of intelligence is served up only to point out that flying an airplane under ideal conditions is not really a tremendously difficult task. However, under emergency conditions or in heavy weather the story is, as the late Damon Runyon would have put it, somewhat more than slightly different. In the final analysis, it is in the emergency situation that the chips are down, and it is then that the pilot must make the right move at the right time, or else.

The importance of adequate training in emergency procedures cannot be over-emphasized. In times of great mental stress when everything seems to go wrong with an airplane at once, it is not uncommon for pilots to "forget" everything they knew or thought they knew, concerning emergency procedures, usually with disastrous results.

Training in emergency procedures must be so thorough that "over-learning" results, rather than merely acquiring a certain familiarity with the procedures concerned.

We all know that the average pilot is prone to "hit the ceiling" if maintenance personnel do not perform their jobs in an exemplary manner, yet this same average pilot has been known to hit the wild blue yonder "cold"—that is, without knowing the emergency procedures designed and virtually guaranteed to work in his favor every time. Each flyer must be informed in the most convincing manner through the use of unmistakable terminology that his life may some day be forfeited if he does not thoroughly know those emergency procedures so vital to his personal safety and to the success of his mission. Further, that it will be more than carelessness, it will be criminal negligence, if he takes only sufficient time to learn in a vague, general way that with which he should be intimately conversant in every detail.

If pilots realize that knowledge of emergency procedures separates the men from the boys when things get rough, their close attention is normally assured throughout the training course. Training in emergency procedures in the past has been limited to the procedures which could be demonstrated to the subject. Inadequate training aids have been relied upon to convey to the pilot some idea of the procedures involved in coping with an in-the-air or on-the-ground emergency situation. In too many instances these Rube Goldberg devices, which in certain training situations have some value, have served little purpose in teaching the pilot what steps to take and when to take them, if confronted by trouble. The robot movement of arms, levers and pistons, together with the splashing and coursing of hydraulic fluids through varied color lines have had too little relationship to the steps to be followed in the cockpit when an emergency situation actually cropped up.

In psychological circles it is known that learning increases in proportion to the number of sense modalities, or sensations, involved in the learning task, and that the energy and effort expended in learning a task definitely affect the degree of retention of the task learned. The way is plainly indicated, then, where training in emergency procedures in the interest of flight safety is concerned.

For satisfactory retention of knowledge of emegrency procedures, no better guarantee exists than the repetitive accomplishing of the particular procedure employing as many sense modalities as possible. And how is this to be accomplished? There are a number of answers to this question, but the best answer is the synthetic flight trainer, the flight simulator, or anything you wish to call it.

There are now available trainers which duplicate the flight characteristics and the cockpits of jet fighters and four-engine airplanes with remarkable realism, almost to the smell peculiar to the airplane duplicated. In-flight and on-the-ground emergency procedures, which represent too great a difficulty or danger to be duplicated in the actual aircraft, can be reproduced in these trainers. In the future, psychological research may determine the optimum number of trials needed to insure greatest retention of the knowledge of any emergency procedure. At the present time, however, we have no recourse but to train until over-learning definitely results. It goes without saying that this over-learning process must feature only the best in training methods and training devices. With the appeal to the number of sense modalities possible through the use of the flight trainer, its superiority to other existing training devices is readily understandable.

As synthetic flight trainers become available to the Air Force, and a number of different types are already on procurement, intensive training in emergency procedures on an Air Force-wide basis should be initiated without delay. Once such training is under way, we may rest assured that there will be fewer pilots who will be "separated" by an emergency with which they could not cope.

FIXED PITCH

Hints On Emergency Operation Of New Electrically Controlled Propellers

Since the majority of the pilots in the Air Force have been trained in aircraft utilizing constant speed propellers, many are unfamiliar with the characteristics of fixed pitch propellers with regard to effect of power, airspeed and altitude. The electrically controlled propellers which are being used in increasing numbers can be placed in a fixed pitch position when complete electrical failure is experienced. Two recent accidents, in which both aircraft were destroyed, were at least partially due to a lack of knowledge of the propeller characteristics.

Let's create an example of fixed pitch operation: An airplane is climbing at 25,000 feet when electrical trouble is experienced and the propeller control switches are placed to fixed pitch. Because of altitude, the propeller blade angle is fairly high. Since the airplane was in a climb at the time of the emergency, the power was relatively high which also tended to increase the blade angle and airspeed probably was low or moderate, comparable to landing pattern speed.

Now, with the propellers in fixed pitch, a descent is made. Power is reduced but airspeed is increased so the rpm will show little change. As the airplane descends, air density increases so the propeller rpm gradually decreases. Upon reaching 5000 feet, the pilot levels off to prepare for landing and slows the airplane down to lower the landing gear. Lowering the airspeed will again cause the fixed pitch propeller to lose rpm and it is quite easy to conceive a situation where there would not be sufficient power available to sustain level flight. In this example, full throttle would be the only source of increased manifold pressure because the turbo-supercharger system would be inoperative without electrical power.

This provides a closed circle of events: an airspeed decrease causing a loss of engine rpm resulting in a loss of power which causes further loss of airspeed. Definitely a "revoltin' development." Therefore, for a landing to be successful under these conditions, it will have to be well planned. It should be noted also that the higher the altitude when the propellers are placed in fixed pitch, the higher the loss of rpm after descent will be. There are two main forces creating twisting moments on propeller blades, air load and centrifugal force, the net result of which tends to force the blades to a low pitch, high rpm position. Consequently, any creep from the original fixed pitch position would tend to increase rpm, *not* decrease, so all rpm decrease noticed is the result of increasing air density and/or decreasing airspeed.

Fixed pitch position should be used immediately when electrical system or propeller trouble is experienced. In the fixed pitch position the propeller brake, if properly set, will hold the blades at the angle at which they are operating when the switch is placed in the fixed pitch position.

In the case of electrical system malfunctioning, after the trouble has been located, consideration may be given to short-period operation of the electrical system to change propeller settings prior to landing to provide the necessary power.

In the case of propeller malfunctioning, however, if the decision has not been made to place the propeller in the feather position, it must be remembered that using either the manual or automatic pitch change releases the propeller brake and provides the possibility of a runaway propeller caused by the forces on the blade tending to move the blade to "flat" or low pitch. Such trouble would normally be confined to an individual propeller malfunction and on multi-engine aircraft leaving one propeller in fixed pitch at a reduced rpm would not present a serious problem.

—A. S. Witchell, Jr., Convair

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CONTENTS

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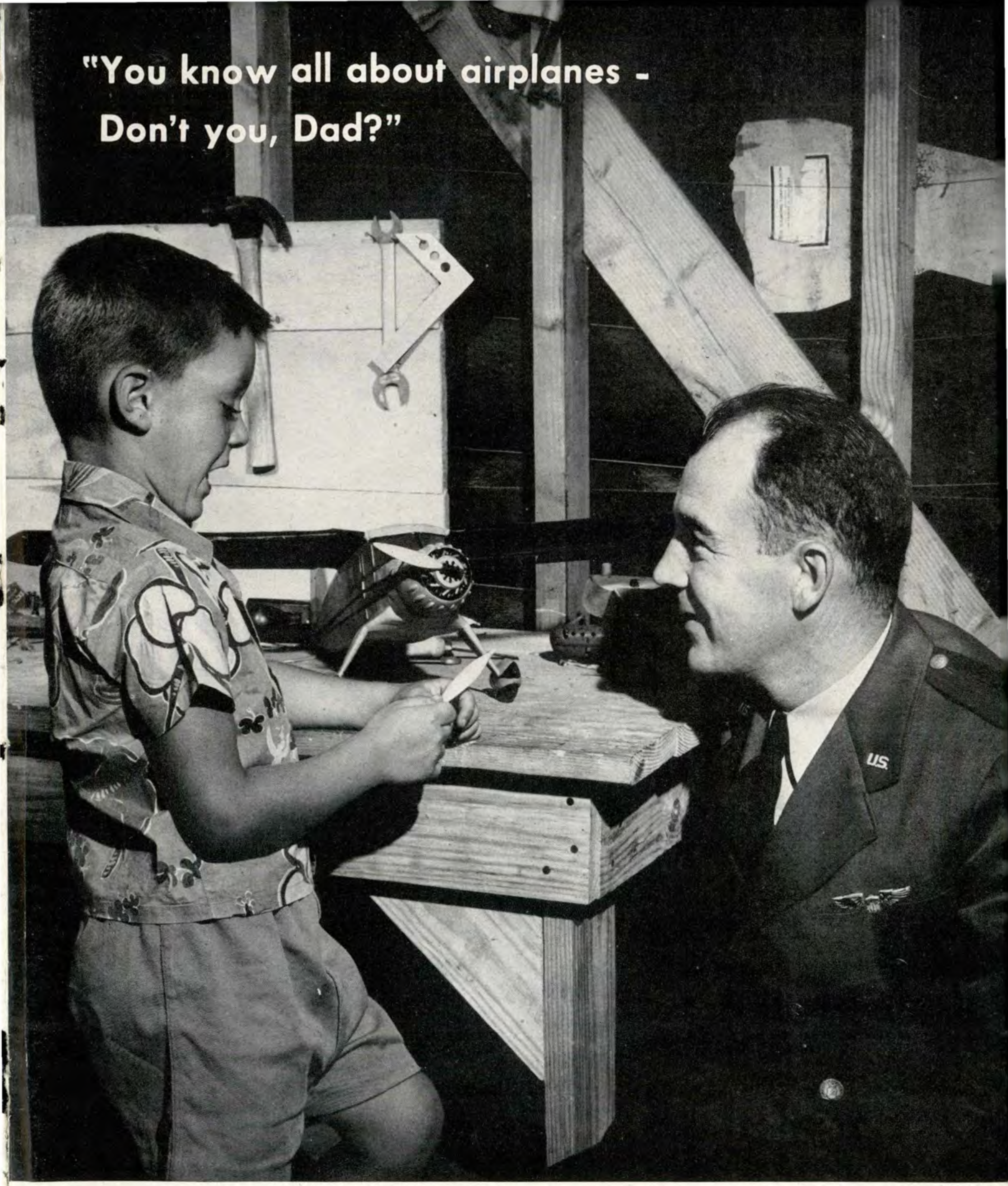

Kosloff

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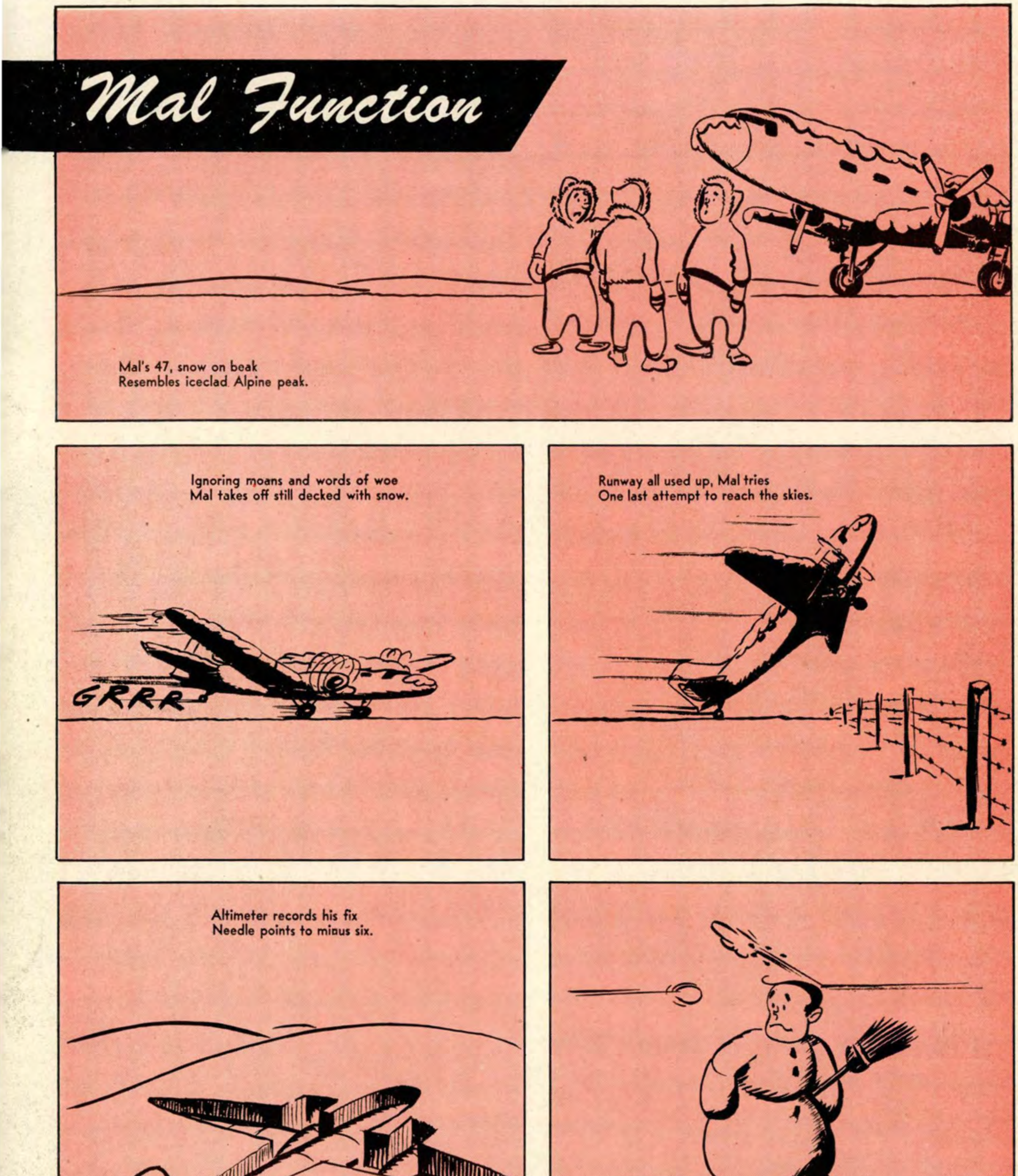

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