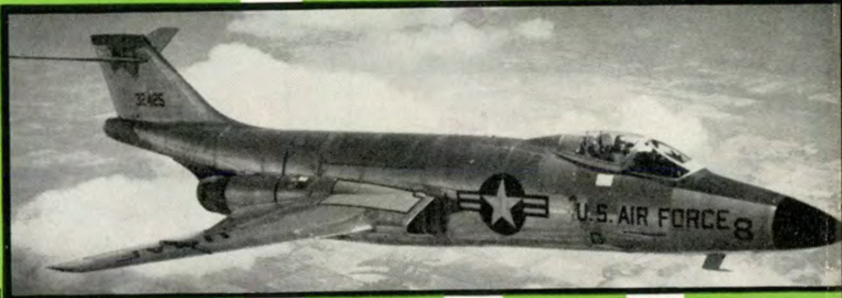
# FLYING SAFETY

UNITED STATES AIR FORCE

JANUARY

1956

## WHAT THIS YEAR HOLDS FOR YOU




# FLYING SAFETY

VOL. TWELVE NO. ONE

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## ADIZ SPECIAL

● One of the new ADIZ procedures needs some clarification. FLYING SAFETY (Dec. 1955), along with a few others, misinterpreted a paragraph in the new AFR 60-22. We believed that flights originating in the Western or Eastern ADIZs and flying towards an open area, were exempt from the IFR-DVFR requirement, provided they would not penetrate the Albuquerque ADIZ or the Northern ADIZ. THIS IS NOT CORRECT!

● *Regardless of the direction of flight, if you originate in the Eastern or Western ADIZs, you must file either IFR or DVFR.*

● FLYING SAFETY suggests that you get the map printed in the December issue, and a copy of AFR 60-22, dated 24 Oct 55, and familiarize yourself with the new areas and procedures.


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USAF PERIODICAL 62-1


# LETTERS TO THE EDITOR

### Getting the Facts

In the October "Well Done" there seems to be an error. With a complete electrical failure we wouldn't have the needle-ball nor would we have use of the alternate flight control system.

I believe that the failure must have been a failure of both generators rather than a *complete* electrical system failure.

I would like to point this out so that other F-86D pilots will not be confused. I think the "Well Done" was well earned.

We have used numerous FLYING SAFETY articles in the All-Weather Interceptor courses here at Perrin and think you do an excellent job.

**Albert B. Haley**
**F-86D Eng. Instr.**
**Perrin AFB, Texas**

*You are so right. It was failure of both generators. Thanks for straightening out our terminology.*

★

### Sleep at Last

Referring to the August issue of FLYING SAFETY generally and the "Keep Current" section specifically, meaning "Approach Chute," may I quote but not agree with you in the following statement: "The landing speed of the B-47 jet bomber has been considerably reduced through the use of the approach chute." It just ain't so! However, the approach chute does increase drag requiring a pilot to maintain higher engine RPM in order to fly correct approach speeds throughout the entire landing pattern.

By permitting higher engine RPM without a build up of airspeed, the approach chute enables a pilot to adjust rate of descent more readily and to accelerate the engines more rapidly if a go-around is necessary. That is the what and why-for, but the landing speed, approach speed, cruise speed, touchdown speed and all the little speeds remain the same, including the stall speed.

Now that this is settled I can sleep nights. Good night!

**Capt. Robert A. Gromm**
**442d Bomb Sq, 320th Bomb Wg**
**March AFB, Calif.**

*Good night. Thanks a lot. We dig you the most.*

★

### Rocky Reminder

I would like to toss this thought into the pot and see if it has any merit or could be utilized for any field which has the same landing problems as we do here at good old Wright-Patterson AFB.

Recent gear-up accidents at this base indicate that pilots are still not complying with instructions to read the checklist prior to landing or are relying on control tower operators to tell them they have neglected to lower their gear.

Since there is generally a reasonably flat area leading up to and along each side of the approach end of the runway, why not use a "rock garden" effect and spell out the slightly provocative phrase, "Gear Down?" in words five to ten feet high? Boulders of suitable size, either whitewashed or painted with fluorescent paint, would do the job.

To keep the rocks from being lofted out of their assigned resting spots by the first aircraft which may point its tail that way, I would suggest using a concrete bed. Regular painting may be a necessity, but since paint is less expensive than airplanes, one accident averted will be more than worth the cost.

**Capt. Walter E. Johnson**
**Flight Facilities Officer**
**Wright-Patterson AFB, Ohio**

*Sounds like a real going idea. A snow removal gang might have a little trouble sweeping around the rocks though. We are interested to know if any outfit has tried this idea? How about hearing from you, if you have?*

★

### A Piece of String

I read with a great deal of interest and appreciation your article in the October issue on "Live in Cool Comfort." I would like to add to it the reminder that there is no worse thief than snow.

Once you drop something, unless it is large, it is an almost impossible task to find it again. A piece of string with which you can tie small articles such as your knife, flashlight, mirror and safety matches to your belt is a really important item to carry in the emergency kit.

**Col. Charles H. Morhouse**
**USAF (MC), Hq 3rd AF**
**APO 125 New York City**

*You're so right. Something akin to looking for the needle in the haystack routine. We concur that a piece of string is a "must" for the little handy-dandy kit.*

# SAFETY
## a Product of Supervision

Colonel George L. Holcomb,
Director of Flying Safety, TAC

FLYING SAFETY is a product of many things, but primarily it is a product of supervision. Without supervision there can be no order. Without order there is chaos.

Admittedly, the above makes a mighty big case for supervision, something which is very difficult to define or explain, but which I believe to be the most important single factor in the prevention of aircraft accidents. Although figures show that most accidents are charged to the actual operator of the aircraft, a thorough study of all accidents would reveal that in many cases the operator was merely the last one to make a mistake and that somewhere along the line, persons in supervisory positions had erred.

Let us examine a hypothetical situation. A flight of two aircraft has just crashed while on a night instrument formation flight. Working backward from this tragic and costly climax to what should have been a routine operation, we find this.

The briefing given by the flight commander was inadequate. The operations officer had ordered the flight out under conditions which were beyond the capability of the flight leader. The squadron commander had no policy, in writing or otherwise, which outlined the qualifications necessary to lead flights under various conditions and circumstances. The group commander had not laid down a definite, clearcut policy on the selection of flight leaders. He neglected this because differences of opinion existed within the group as to the qualifications necessary and the method to be used to designate those pilots who might lead flights under various conditions. Finally, higher headquarters had committed the unit beyond its capability without knowing it.

This accident did not just happen. It was caused. It was caused by failures of people who could have prevented it. Although it is the immediate supervisor who is directly responsible for what his people do, staff agencies and commanders must assume some responsibility—for planning and directing, for discovering and correcting weaknesses which may lead to trouble. Supervision extends throughout the command and staff structure of the Air Force, and like that old familiar link in the chain, when one supervisor fails, there is a potential accident in the making.

What is supervision and why is it so important in the prevention of accidents? Supervision is sometimes referred to as leadership, but more often perhaps it is simply management. In the Air Force it might be called military management. In industry the job of management is to produce for profit. In the Air Force the results of management may be so important as to be measurable not only in dollars but in terms of cities, large troop or fleet concentrations or even in terms of entire nations or present-day civilizations.

Management in industry has long since learned that the most efficient method of production is also the safe method. No quarrel can be found with that conclusion and the Air Force can no more afford the losses resulting from the use of inefficient or unsafe methods than can industry.

Supervision means planning—planning based on a thorough analysis of the job to be done and an accurate appraisal of the tools to be used. Without planning there can be no direction or control. The path to the goal must be charted clearly, proper procedures must be established to guide the way and everyone must know where he is going, how he is to go and why. In all of this planning the principles of safety must not be overlooked. Safety does not just come naturally. It must be planned.

One of our biggest problems in this day of complex machines, high speeds and altitudes, is the ability of the human to keep ahead of the machine. Haste easily can make waste, and unnecessary speed in training easily can be too expensive in materiel and manpower lost through aircraft accidents.

I once read an article entitled "How to Eat a Steer." The point of the article was that a man can eat a

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*Col. Holcomb is well qualified to discuss the subject of supervision. A graduate of the U. S. Military Academy, he has served as a base commander both overseas and in the States during WW II and in Korea. In addition, Col. Holcomb was Chief of the Military Management Division of the Air Tactical School, headed the committee which prepared the curriculum for the first Squadron Officers' Course at the Air University and was a faculty member of the United States Military Academy.*

Many different aircraft fly under the TAC banner, among them being the C-123, F-84 and B-57. Proper supervision entails constant monitoring.

steer, one steak at a time, but if he is required to devour the entire animal at once, he will get indigestion. This may be likened to the danger of getting mental indigestion if required to absorb too much information at one time. One of the jobs of supervision is to see that the training program is broken down into "steak size chunks" so that the trainee can digest each chunk without ill effects.

Supervision means directing. Rules and regulations set standards and establish procedures, but they do not prevent aircraft accidents any more than traffic laws and speed limits prevent automobile accidents. Only the closest supervision can insure the continued use of proper procedures on the part of personnel involved in the maintenance and operation of our increasingly valuable aircraft.

How each supervisor should go about getting this necessary cooperation of his people is a problem which only he can solve. Normally, he cannot do it by order or threat. He can best do it by obtaining the confidence of his people and by setting a proper example himself. People follow people in whom they have faith, sometimes to their own detriment. They become blind to the faults of the man in whom they have confidence and they are easily led, or misled, by him.

Young pilots are impressionable. They will usually do what they think their supervisor wants, particularly if they have confidence in him. This places a great responsibility upon the supervisor, because if he wants a "daring" or "tiger" attitude in his charges, he will usually get it. Unfortunately, some of his followers may not be ready or capable and the results may be disastrous.

The supervisor who has the confidence of his people is likely to be the first, even before the chaplain or the flight surgeon, to know of current or impending personal problems. A wrench in the hands of a worried mechanic can be an instrument of destruction. A pilot with heavy domestic or financial problems is a hazard to himself and to others who fly with him. The supervisor has the best chance to discover and to eliminate this accident potential.

Supervision means controlling. It is not enough to plan an operation, establish procedures and place someone in charge of implementing those procedures. Checks must be made to determine whether the operation is proceeding as desired and corrections or modifications must be made in time to bring operations into line with the plan as revised.

Persons in supervisory positions must be able to recognize unsafe practices, flaws in procedures and hazardous conditions. In the interest of safe operation it is often necessary to do many things which were not a part of the original plan, such as altering training programs to emphasize certain phases, grounding or otherwise restricting the operation of aircraft or restricting pilots and crews to certain types of operations.

Up to this point I have been talking primarily about supervision from above. Now let me discuss briefly one other kind of supervision from which none of us can hide, self supervision. This is simply self discipline—knowing one's self and one's own capabilities and limitations, taking advantage of every opportunity to increase one's capabilities and practicing correct procedures until they can be performed as mechanically and as smoothly as Sam Snead's golf swing.

It means complete personal honesty and integrity and a loyalty to others which will transcend self and which will make a man admit a mistake or report a hazardous condition or unsafe act, even though such a report may reflect unfavorably upon himself or upon a friend. The pilot who fails to write up an engine which overspeeds to 111 per cent just doesn't have it. Neither does the squadron commander who reports that his pilots are ready and qualified for a particularly difficult mission when he knows full well that they have not been adequately trained for that mission.

Someone has said that "aviation in itself is not inherently dangerous, but, like the sea, it is terribly unforgiving of any carelessness, incapacity or neglect." Proper supervision can and will greatly reduce the incidence of carelessness, incapacity and neglect in the maintenance and operation of aircraft, thereby contributing materially to a safer and more efficient operation. ●

Note the contrast between the shelf ice and Arctic Ocean pack ice. You could land here.

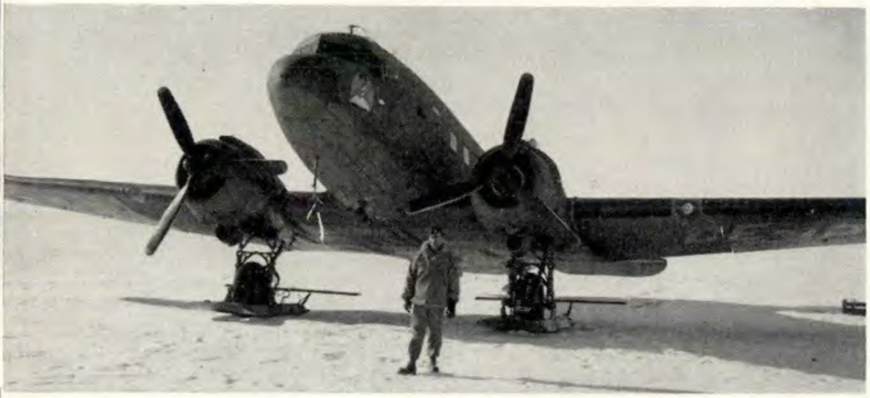
# Real Cool Landings

Lt. Col. Donald A. Shaw
ADTIC, Maxwell AFB, Ala.

THE CHANCES ARE that someday you will fly in the Arctic. Your flights will take you over vast expanses of snow and ice. The many airfields with their paved runways, towers and maintenance facilities to which you have been accustomed in Stateside and foreign flying will be missing. In their place will be vast areas of ice and snow, the surfaces of which may be your only available landing strips.

Probably you have read of emergency landings on ice in true and fictitious adventure stories and have been influenced by hair-raising accounts of arctic adventures. You may believe

A C-54 rests safely at Cambridge Bay, N.W.T. Strip later was used by C-74s which grossed at about 130,000 pounds.



For ski or skid aircraft, practically the entire Ice Cap above 5000 feet elevation can be used for an emergency landing area.

The rule for landing on the Cap should be wheels up. Wiping out the gear or flipping over on your back can be very risky.

that landing an aircraft on ice is an activity closely akin to circus or stunt flying. Plain facts, unadorned for dramatic appeal, reveal a more interesting story—a true story which may help you in an emergency and in performing your mission when and if you ever fly in the Arctic.

Ice can be classified into one of three major categories: Land ice, sea ice and fresh water ice. Land ice also is known as glacier ice. It is formed by snow accumulating on a land mass to such thicknesses that the weight, pressure and seepage of melting water from the upper mass changes the snow in the lower mass to ice. Pressure from within the mass and gravitational pull cause tongues of ice to move outward from the mass. These tongues are known as glaciers. The icebergs found floating in salt water originate from glacier or land ice. They are chunks which have broken off into the sea from the main mass of land ice and have been carried away by current and wind.

Sea ice is any ice formed from salt water. Of the many forms of sea ice, large floes, which look like huge pieces of a jig saw puzzle, make the best landing areas.

Frozen leads are wide cracks which have opened in the ice and refrozen with a smooth surface. Shelf ice is so called because it extends outward from the shore to which it adheres, and may have been formed in part by the freezing of fresh water from the land. Immense pieces of shelf ice found drifting in the Arctic Ocean are known as ice islands.

Bay ice and fast ice are formed from salt water confined to sheltered bays or adhering to at least one or more shores. Pack ice is conglomerate ice found in the sea which has been broken up by wind, current or pressure. The pieces may float free or be frozen together. Both icebergs and ice islands are found in the far north pack ice.

Fresh water ice is found on lakes, ponds and rivers. Ice on most arctic lakes grows to great thicknesses and is stronger than salt water ice.

### Snow Cover Difficulties

Generally, wherever ice forms it is covered with snow, which must be removed or compacted for most operations. The snow cover makes it difficult to select an emergency landing spot on the ice. It hides the color and the small cracks which give some indication of ice thickness. Ice thickness seldom can be determined accurately from the air. (If you are so familiar with the area you are flying over that you know the local conditions influencing ice formation there, you can often estimate its thickness.)

However, you can obtain a good estimate if you can fly low enough over a place where the ice joins open water by judging the height of the ice edge above the water or from the thickness of an upended floe. Sufficient observations have been made during the past 10 years to forecast approximate average ice thicknesses for many areas at a given time of the year also.

In addition, sea ice suitable for emergency landings can be found in the Canadian Arctic from December through May, but the sea ice of the east coast of Canada is more difficult to estimate because its rate of growth and thickness is less than in central Arctic Canada. Fresh water ice forms somewhat earlier, but lakes usually are surrounded by mountains.

Greenland sea ice is generally treacherous because wind action breaks it up and sweeps it out of the bays before it thickens sufficiently, but in Greenland you have the ice cap available to you the year round.

Alaska is so mountainous that good emergency sea ice landing fields may be found only off the north and northwest coasts. However, in southeast Alaska, aircraft have landed in large fields of land ice.

In the Arctic Ocean, good floes of ice may be found at any time of the year and shelf ice is available along the Ellesmere Island coastline. Ski aircraft have landed safely on the winter ice of Ellesmere Island's Lake Hazen as late as July.

Early polar explorers such as Byrd, Amundsen, Wilkins and many others, including the Russians, used ice as landing areas as a matter of necessity. Their aircraft were equipped with skis and they judged the strength of the ice for landings by experience and guesswork. The bush pilots of Canada and Alaska have landed aircraft on ice for 20 years or more. To them it is a routine operation.

### Rescues Spur Interest

As a result of these successes, USAF interest in the use of ice for landing aircraft has increased markedly in the last decade. About 1946, after several successful conventional wheel landings on ice had been made for rescue purposes, interest developed in the possibility of using ice landing strips for special projects in arctic regions which could not be supported by surface transportation. But long-range transport aircraft were so large and heavy that operational people wondered if any arctic ice was thick enough and strong enough to support these great weights.

The Arctic, Desert, Tropic Information Center, Air University, USAF, had collected some data on ice-bearing strength from Russian and other sources during World War II. The Arctic Construction and Frost Effects Laboratory, Corps of Engineers, USA, subsidized by Air Force funds, began to study and experiment with construction and maintenance of airdromes on ice. Later the Snow, Ice and Permafrost Research Establishment, Corps of Engineers, USA, the U. S. Navy Hydrographic Office and the Air Research and Development Command conducted experiments on ice-bearing strength and on instruments for measuring ice strength.

The strength of fresh water ice at different temperatures is comparatively easy to determine. The strength of salt water ice is much more difficult to assess. As physical action within the ice constantly changes its strength, tests have to be made approximately every 12 days to measure its bearing strength. Based on these approximations some remarkable air transport operations involving ice landings have been carried out by the USAF in the Arctic.

The first of the large airlifts using ice landing strips was the Beetle Project of 1947, during which 1100 tons of supplies and equipment were flown from Canadian air bases to remote arctic locations to establish LORAN stations. The landing strips at these stations were on smooth bay ice. Most of the landings were made by C-54 aircraft grossing about 68,000 pounds, although some C-82 aircraft were used. The heavy equipment that could not be carried in a C-54 or C-82 had to be airlifted to Cambridge Bay, Victoria Island, N.W.T. An aircraft larger than a C-54 had never landed on ice and the thickness necessary to support a heavier aircraft never had been determined. Not enough data on ice strength were available to figure out accurately the minimum thickness required for aircraft heavier than 45,000-50,000 pounds landing weight.

### C-74 Lands Safely

General William H. Tunner, then Commander, Atlantic Division, Air Transport Command, made the decision to attempt a landing with a C-74 aircraft at approximately 130,000 pounds landing weight. According to existing data on ice strength at that time, a C-74 at 130,000 pounds landing weight would require at least 80 inches of young sea ice (sea ice less

Below 5000 feet on the edges of Greenland Ice Cap, ice is very rough and crevassed.

than one year old) to support it; and some estimates ranged upward to 123 inches, depending on the data used. A few authorities were certain that the 86 inches at Cambridge Bay would hold the C-74, but others were either dubious or cautiously preferred not to stick their necks out.

Although faced with such uncertainty, after consulting the best arctic ice authorities available to him, General Tunner made the decision to go ahead. The C-74 landed at a gross weight of 129,500 pounds without any noticeable effect upon the ice.

In 1951, the Office of Naval Research conducted a series of landings on the Arctic Ocean ice. They found that the exceptional smoothness and length of ice runways that can be found on the Arctic Ocean pack ice are such that any military land plane can be landed safely without benefit of skis or skids.

Most of the landings were made on newly frozen leads. The ice thickness of leads varied from a few inches to six feet. These pilots determined the ice thickness by observing closely the thickness of blocks of ice up-ended by pressure within the pack, by observing the snow cover and noting the color of the ice.

Before committing the aircraft to a landing, touch and go landings were made to test the ice and the validity of observations from the air. Snow cover varied from one to five inches. Drifts up to 18 inches were common, but were seen easily. Twelve success-


C-124s were used to airlift equipment to DEW Line. Over 700 landings were made at 22 different sites.

In center of photo is how a newly frozen lead would appear to you in an Arctic Ocean pack ice formation.

Of the many forms of sea ice, large floes make good landing areas. Note pressure ridges in foreground.

Ice island in Arctic Ocean during the summer. Rough sea ice, foreground, is the result of seasonal melting.

ful landings were made in 1951, and in the same year the USAF 10th Rescue Squadron also made several successful landings on Arctic Ocean ice for rescue training purposes.

In 1955, the Air Force was faced with the problem of airlifting heavy equipment to Distant Early Warning stations that form the DEW Line. These stations were located at regular intervals along the 68th parallel between the eastern Alaska boundary and the east coast of Baffin Island. The C-124 was the only aircraft capable of handling heavy equipment such as D-8 tractors weighing 25 tons each. Again, there was considerable uncertainty as to the ice thickness required to support the C-124, in this case with a landing weight of 168,000 pounds. Estimates of sea ice thickness to support this weight with an acceptable safety factor ranged from 70 to 109 inches. Headquarters USAF requested ADTIC to resolve the problem, particularly as the presence of ice 109 inches thick in the DEW Line area was very doubtful.

ADTIC organized an ice survey team of the best authorities on ice landings. This team was assigned to Tactical Air Command's Eighteenth Air Force, which had responsibility for the aircraft. Because of the lack of positive information on the bearing-strength of sea ice, the first landing of a C-124 had to be on an experimental basis.

### C-124 Experimental Landing

Cambridge Bay was selected for the experimental landing because prior experience provided more general knowledge of that area than any other. Ice thickness and strength tests indicated that the ice at Cambridge Bay should hold. After three days of testing, the ice team decided to attempt the landing and it was made without incident. The C-124 grossed 168,000 pounds.

This test landing provided the basic information that was necessary to accomplish the transportation of heavy equipment for the establishment of the DEW Line. Between 10 March and 29 May 1955, over 700 landings on ice were made at 22 different sites. Some landings were made on fresh water ice, but the majority were on sea ice. All were successful.

The DEW Line aircraft was the largest in history to employ ice landing strips. Some 22 strips were established in approximately two months. The only construction equipment required was two D-4 tractors for snow removal. Imagine the tremendous and time-consuming construction program necessary to build a similar number of the conventional landing strips any place else.

Prior to 1947, experimental work had been confined to fresh water and

Surface of the Greenland Ice Cap isn't suitable for wheels-down landings. This B-17 tried it in December 1948 and is still buried beneath the snow.

sea water ice exclusively. However, since that time, experimental work has been going on to determine the suitability of land ice for air operations. Most of this work has been carried out on the Greenland Ice Cap.

Land ice has the advantage over sea or lake ice in being more permanent and thus is potentially usable throughout the year. Also, it offers excellent operational possibilities for aircraft equipped with skis or skids. Landings have been made successfully with SA-16 and SC-47 rescue aircraft at elevations up to approximately 9000 feet.

An interesting incident concerning land ice operations on the Greenland Ice Cap occurred in 1948. The crew of a C-47 began a normal instrument letdown for an approach to Narsarssuak Air Base. The first indication they had that anything was wrong was when the plane came to a sliding halt at approximately 8000 feet elevation on the Ice Cap. Passengers did not have their seat belts fastened, but no one was injured or even seriously shaken up by the smooth landing. During World War II many other aircraft made successful emergency landings on the Greenland Ice Cap without injury to personnel.

This account of some of the major ice operations illustrates that aircraft landings on ice are not new and that the use of ice for aviation offers even more possibilities. Of particular interest to the flyer is, of course, the use of ice for emergency landings. The old question of whether to ditch or to bail out is still a controversial subject which cannot be settled in general terms.

It would be senseless to establish a policy that anywhere in the Arctic above the tree line you should attempt to ditch. The Arctic is too big an area and too varied in terrain and climate to lay down specific rules for every spot where an emergency might occur. But some generalizations can be made.

### Over the Ice Cap

As far as I am concerned, any time that you know you are over or close to the Greenland Ice Cap, there are approximately 637,000 square miles of emergency landing field available to you. The rule for landing on the Cap should be wheels-up. Although one or two successful wheels-down landings have been made, the danger involved in wiping out the landing gear or flipping over on your back is not worth the risk.

After you get down safely, even if you are not an ice cap survival expert, the AFM 64-5, USAF Survival Manual, will tell you what to do. And by remaining with your airplane, you have the all-important fuel for heat as well as material for shelter. That aircraft is useful.

For ski or skid aircraft, practically the entire Ice Cap above 5000 feet elevation is an ideal emergency landing field. Below 5000 feet, the Ice Cap terrain is generally crevassed or broken up by nunataks (mountains sticking out through the ice).

### Over the Ocean

The question of ditching versus bailout over the Arctic Ocean is highly controversial. However, the advantages of having the survival resources of the aircraft itself cannot be underestimated. The key to making the correct decision is probably visibility. If you can let down to minimum bailout altitude it is possible, with good visibility, to get a fair idea of whether the Arctic pack has any smooth spots within reach. Wheels-up landings are the best general rules here.

The Arctic Ocean ice can be extremely rough from pressure ridges or rafted sea ice. Old sea ice (ice more than one year old) is generally rough from differential melting during the summer and drifted snow in winter. Even the smoothest of ice may have snowdrifts of sufficient depth and density to wipe out the gear.

If a smooth field or floe of ice can not be located, a frozen lead may offer landing space. Even if the ice is recently frozen and comparatively thin, still it will offer some support to the aircraft. The chances of the aircraft breaking completely through are slim, for the wings will hold it up. If you have a choice between a frozen lead and comparatively smooth, old sea ice for an emergency landing, the latter is probably the best choice, for you can be certain the old ice will hold.

In the event of a bailout, your chances of being found depend on the accuracy of your reported position. If you bail out over pack ice, your survival gear, crew or passengers are likely to become separated and each man may be faced with an individual survival problem without adequate survival equipment.

If the ground or surface is not visible from minimum bailout altitude and unless you know exactly where you are and what the surface beneath you is like, bailout is your best bet. The Greenland Ice Cap is an exception to this rule.

From November through May, numerous lakes and salt water bays in the Canadian Arctic offer ideal emergency landing strips. Unless you are sure that the snow cover on the ice is so shallow that it will not wipe out your landing gear, both the visibility and wheels-up landing rules should apply. You may cuss yourself after landing on your belly to find that you could have made a wheel landing and saved the plane, but at least you have the consolation of having played it safe.

As you can see, many factors go into deciding whether to bail out or crash land and each specific case has different factors to consider. But in any event there is a lot of ice in the Arctic which may save your life, if you find yourself in trouble. ●

# WELL DONE

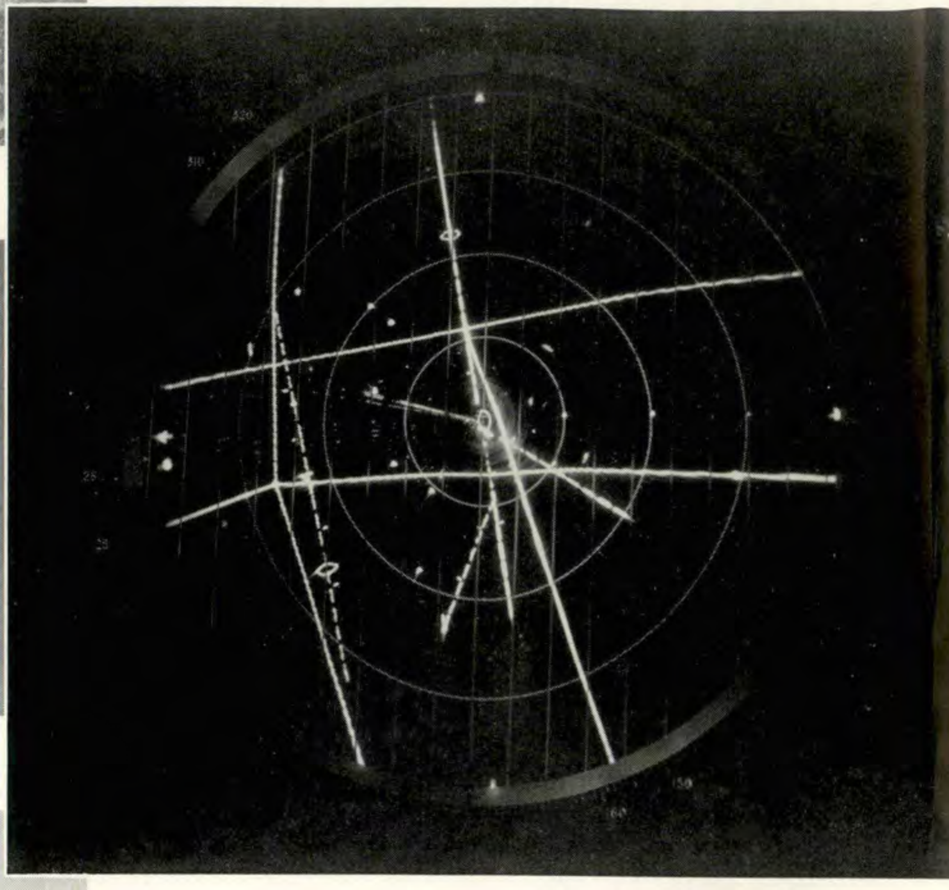
## 1st Lt. Donald E. Weeden

**496th FIS 86th FIW Landstuhl, Germany**






A flight of F-86s, a C-124 and a B-25 are illuminated clearly on a video map of RAPCON radar scope. Visible too are range legs, fan markers and homers.



# Ozone Expediter

**One of the answers to the traffic congestion problem is RAPCON. Here's how it does a safe job for you.**

HIGH OVER AMARILLO, a flight of three F-86s streaked toward Oklahoma City. Three hundred miles east of them, a lone C-124 reported over Tulsa and gave his ETA for the Tinker range station. Simultaneously, over the Ardmore range, a B-25 out of Vance AFB asked for the weather at Tinker.

Since 0200 hours, murky clouds had skimmed incessantly over the wet runways at Tinker. Visibilities had peaked sporadically at a mile and a half. A slickered airman leaned into the cold, biting wind as he went to measure the low-hanging overcast.

Inside a large, darkened room, the eerie glow from the amber-colored radar scopes in the RAPCON Center at Tinker cast strange shadows over the faces of the controllers. Only the sound of an infrequent position report interrupted their idle chatter.

It was early in the morning and things hadn't picked up yet; still the sweep hands of the scopes searched endlessly for any moving target.

Suddenly, a red light on the en route controller's electrical panel blinked. At the same time, two other red lights flashed on. The Amarillo, Tulsa and Ardmore radio range station operators now were reporting the Tinker ETAs of an inbound flight of three F-86s, a C-124 and a B-25, respectively.

With the flashing of the lights, the Radar Approach Control Center or

RAPCON facility at Tinker AFB was in business. This facility is one of three joint USAF/CAA Radar Approach Control Centers now in operation and its job is to expedite IFR traffic in the Oklahoma City terminal control area.

This RAPCON Center is a combination Air Route Traffic Control center and Approach Control facility. It has the authority to control all air traffic in its designated area. The RAPCON Center at Tinker has direct telephone contact with Ft. Worth, St. Louis, Kansas City and Albuquerque ARTC Centers and receives essential information on inbound aircraft, including altitudes, speeds and estimated times that aircraft will arrive in the Oklahoma City area. It is not to be confused with military RAPCONs which control traffic only over their own bases.

Many know a little about RAPCON's function, but few are familiar with its physical layout. All of the equipment is housed in a rectangular room about the size of a small handball court. Two long control consoles, opposed to each other, fill the room. Seven controllers carry on their duties at these consoles.

At one console is the flight data position panel, the en route controller's panel and the supervisor's panel. Located at each position along this console are duplicate sets of the 22 available radio frequencies.

Across the aisle are located the radar scopes. In sequence are the arrival and departure controller, the feeder controller and the precision radar approach controller. They too, stand guard over the 22 frequencies.

Perhaps the most important man in the entire center is the supervisor controller. He watches the scopes and keeps track of clearances. In case of possible bottlenecks, he can issue appropriate instructions for re-routing traffic to keep things running efficiently and smoothly.

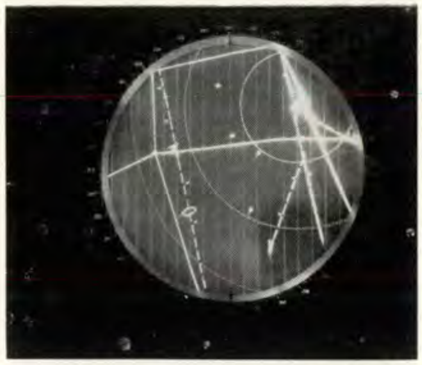
What does RAPCON mean to a pilot on the ground, to one who has awaited a long-delayed IFR clearance? It means almost immediate takeoff permission, climbout instructions, a switch to a center UHF or VHF frequency and a heading to fly which will shuttle him in between the prevailing traffic.

To a pilot flying in a congested air traffic area, RAPCON means separation without unnecessary re-routing or holding.

To a jet pilot, who is low on fuel, RAPCON means a controlled penetration letdown without delay, a turn on final and a precision approach radar run. (PAR is gradually replacing the letters GCA in radar parlance. Also, the old terminology of PPI has been discarded and ASR, Air Surveillance Radar, is now being used.)

What should you know about this facility that can accomplish this expediting of departing, en route and arriving traffic? At present, there are two categories of RAPCON installations. Many Air Force pilots are familiar with the facilities at Hamilton, Langley, Westover and Wright-Patterson Air Force Bases. They control military air traffic in their respective localities and are classified as full RAPCONs. Interim RAPCONs, scheduled to be upgraded later, are at March, Andrews, Loring, Otis, Eglin, Tyndall and Offutt Air Force Bases. There will be 53 of these installations in use in the next two years.

There are three important joint USAF/CAA full RAPCON Centers interspersed with these military facilities. These are located at MacDill, McChord and Tinker Air Force Bases. The equipment of all of the centers is owned and maintained by the Air Force and operated by AACS personnel, except for the three joint facilities. They are operated by CAA personnel. However, the Precision Radar Approach Section of the centers is operated by AACS personnel.



Some RAPCONs are able to direct landings at nearby airfields by offsetting scopes.

As far as a pilot is concerned, there is hardly any difference between an Air Force operated RAPCON and a joint USAF/CAA RAPCON. Essentially, both have the same radar equipment and use the same procedures and terminology.

Actual RAPCON procedures will vary slightly with localities, but a briefing on the center at Tinker will familiarize you with some of the procedures used, the layout of the radar equipment and an explanation of the controllers' positions and duties.

To highlight this innovation in air traffic control, let's follow what takes place after you file a Form 175 for an IFR flight. First, we'll use the long-established method of filing and

Controllers working at two main control consoles direct air traffic expeditiously 24 hours a day.

Follow an IFR flight plan through the Center at Tinker. Left, distances are double checked for accuracy before flight data position controller, right, begins computer check on ETE and enters it on progress strip.

being cleared by an ARTC center over leased telephone lines and then we'll file, using RAPCON.

You are flying from Tinker to Wright-Patterson AFB. The dispatcher hands you the carbon copy of the 175 and you saunter out to your aircraft. Meanwhile, this dispatcher picks up a telephone and calls the en route controller at Ft. Worth Center on a leased line and the approach controller at Will Rogers Airport. Also, Tinker tower is notified of your IFR flight.

While you are taxiing out to takeoff position, Ft. Worth is clearing your flight plan through the St. Louis center, all by telephone. Also, within his own center, the en route controller coordinates your flight plan and the approach controller must determine your takeoff instructions, climbout instructions and first compulsory reporting point.

If you are fortunate, in a short time the flight plan that you submitted comes back over the telephone circuit approved. However, due to other traffic or departure clearances at near-by bases, you may have a long delay, there on the ground.

The phrase "There will be an indefinite delay" from a tower operator about this time is enough to start the ulcer factory in your stomach to working overtime.

Now for a RAPCON treatment. The dispatcher wishes you a "Bon Voyage." As you stroll out of operations, he picks up a telephone and calls your flight plan to the RAPCON Center. Also, Tinker tower is read in on the act. The tower operator calls the center when you ask for your taxi instructions.

In the RAPCON Center, when your flight plan is received by the flight data position controller, he enters the necessary information on a flight data strip. Sitting beside him is the departure controller. Next to the departure controller, along the electrical panel console, is the en route controller. Immediately they discuss and clear your flight plan within the Oklahoma City and St. Louis areas.

By the time you have taxied out to takeoff position, your clearance is ready. You call Tinker tower and he requests that you channel to one of the 22 UHF/VHF frequencies guarded by the center. Since the radar sweep hands pick up any moving target in a 50-mile radius, up to 20,000 feet, around the Oklahoma City area, they can approve your flight plan and issue climbout instructions.

Having all pertinent traffic "painted" on his scope as aircraft fly into the area, the departure controller has you climb out on a specific heading, and then turn to another predetermined heading at a given altitude. Next, without hesitation, he fits you into the prevailing traffic at your altitude.

No delays using telephones. Delay with incoming traffic is minimized. No sweat about somebody reporting where they think they are. They're either there or they aren't. It usually happens that just about the time a pilot is ready to pick up the mike to tell the center he is over a fix, the controller confirms it beforehand. All pertinent traffic in the area is under surveillance. That's why RAPCON is so efficient at expediting air traffic.

When you're en route, it's the same smooth story. Remember the inbound F-86s, the C-124 and the B-25, who were converging on Tinker? By following them in, you can see how RAPCON handles three different types of aircraft at the same time, without a hitch.

Once notified in what direction and approximately at what time traffic will enter their area, the controllers bend to their work over the scopes. Every little blip is pinpointed, con-

Feeder controller, left, turns over aircraft to the precision approach radar operator for landing.

From flight data position, clearance is given to pilot over one of 22 radio frequency channels available.
Operator gives vector headings to departing aircraft as coordinator keeps tab on other planes in area.

firmed and followed with intense and precise accuracy.

Knowing that the F-86s probably will want to penetrate at 20,000 feet, the center contacts any slower moving traffic that might interfere with a penetration letdown at Tinker. These aircraft are conveniently vectored to another heading or altitude. This can be done with several aircraft at the same time. By having the F-86s at 20,000 feet, there is no delay over Tinker for the start of their penetration.

Meanwhile, from the other side of the scope, the C-124 looms into sight. When 25 miles out, the pilot is given an off-airways heading to fly and permission to let down to minimum altitude. His target on the scope moves slowly away from the traffic. It is easy to keep track of him because every time the sweep hand makes a complete circle, it shows the aircraft's exact position clearly and distinctly.

Now the B-25 becomes a blip on the bottom of the scope and the arrival controller sets his forefinger on the face of the dial to keep this new track under constant surveillance.

"Oklahoma City Center, Air Force Jet 52368 in procedure turn."

"Roger, 52368, continue your letdown. We have you in radar contact. Report completion of procedure turn inbound."

Sitting beside the feeder controller, who has the F-86s on his scope when the penetration begins, is the AACS precision approach radar technician. The feeder controller taps him on the shoulder to indicate that he is turning the F-86s over to him. Acknowledging by a nod of his head, the sergeant speeds up his azimuth and altitude sweeps on the scopes.

"Oklahoma City Center, Air Force Jet 52368, completing procedure turn, over."

"Roger, 52368, this is your final controller. How do you read?"

"Five by five."

The sharp, incisive voice of the technician begins the delicate task of bringing the three F-86s down the glide path. Within a minute or so, the F-86s break out of the overcast and land without a hitch.

The C-124, meanwhile, has been vectored onto his base leg.

"Air Force 19111, we have you seven miles northeast of the Tinker range. Continue your heading of 250 degrees. This is your base leg. Your gear should be down and locked."

"Roger, Oklahoma City Center, this is 19111."

In the interim, the B-25 contacts Oklahoma City Center and without any delay, is worked into the letdown sequence and follows the C-124 down the groove and over the runway for a landing.

Previous to the implementation of RAPCON, two, and possibly all three aircraft would have had to execute some type of holding pattern. Telephone conversations with different control agencies, interphone discussions with GCA or possibly departing IFR clearances could have slowed the orderly flow of traffic. RAPCON, by the use of its radar eyes, has eliminated these delays.

One operator can handle safely three aircraft in the landing pattern at any time. Since there are three of these independently controlled scopes in the center, nine aircraft can be directed safely within the area. Also, it is possible by off-centering the scopes to direct takeoffs and landings at Will Rogers Field, 12 miles away.

Varying slightly from a joint USAF/CAA facility are the military RAPCONs. They deal primarily with military traffic around their area.

Such is the case at March AFB. Through an agreement with the Los Angeles ARTC, the March RAPCON controls all IFR departures and approaches to March and Norton Air Force Bases.

Placed into operation a year ago, this RAPCON has controlled jet bomber missions with such precision that takeoffs with only one minute separation in minimum weather conditions are common practice.

By following precise departure plans the technicians follow the B-47s relentlessly on their scopes as the big swept-wing birds take off and climb out on predetermined headings. If one wanders too far from its planned route, a call from RAPCON alerts the pilot's attention to this fact.

Slower aircraft are controlled in their climb in race track patterns over different fixes to eliminate takeoff delays once a mission has been started.

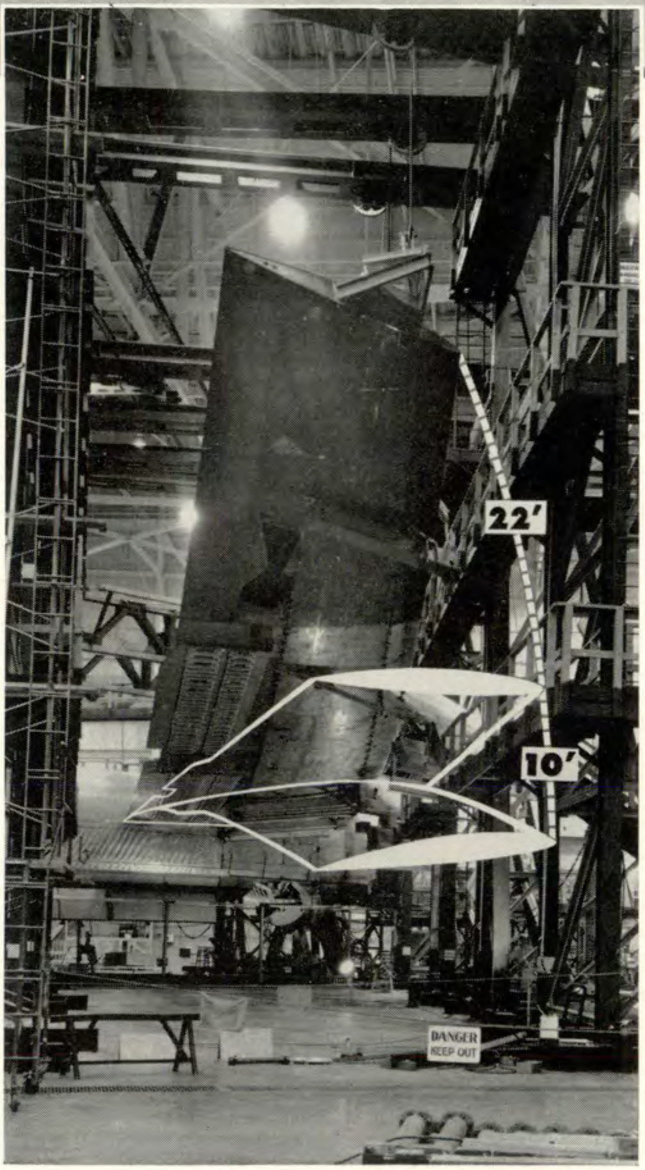
Handling a gaggle of B-47s inbound consists merely of following established approach plans. Once the RAPCON has contact with them over a designated radio fix, it is a matter of bringing them "down the chute" with five-minute separations.

In case of radar failure, all an operator has to do is to call the ARTC center and standard separation procedures will go into effect immediately to issue clearance.

Anyway you look at it, RAPCON is here to stay. It's one of the answers to the traffic congestion problem and it can do the job safely. ●

# Keep Current

NEWS AND VIEWS




**Fire Simulator**—Simulators have proved themselves successful in training pilots and now ARDC has come out with a new aid in fire fighting.

Modeled after four operational aircraft, the B-36, B-50, B-45 and the F-86, these trainers are constructed of steel plate and rest on beams supported by solid concrete foundations.

The steel trainers can easily withstand the extreme temperatures encountered when standard aircraft gasoline or jet fuel is burned in open air. These temperatures can reach over 2000°F. for short periods.

To provide realism, all escape hatches, gun positions, fuel lines and fuel tanks are built into each trainer. The points at which the fire fighting crew must make forcible entry into the aircraft are covered by replaceable sheet aluminum.

In a typical training run, 200 to 1000 gallons of condemned high octane aviation or jet fuel are used. The fuel is spilled on the ground around the trainer and directed by hand valves within the trainer so that the fire pattern closely resembles an actual crash fire.

In addition, a variety of fire conditions, such as might result from ruptured fuel lines, can be duplicated by control valves. This training method is much superior and provides more realism than the previous system in which derelict aircraft were used. ●

Left, this illustration depicts the extremes of upward and downward deflection to which the B-52 wing was subjected in load tests during the wing-bending phase of the static test program. Deflection was 22 feet above and 10 feet below normal unloaded position, far exceeding any which might be encountered by the plane in severe weather.

Right, the long range F-100C has bomber as well as fighter capabilities. Suspended under its wings are 500, 1000, 2000-pound bombs.

Left, with two large T-49 turbo-prop engines replacing the four jet engines in the inboard pod position, an XB-47D leaps into the air.

Below, landing downwind, this C-123 shaves a 50-foot barrier marker as USAF operational suitability tests are started at Eglin AFB.



Protective paper still covers the canopy and windshield of the first TF-102A to come off the line. This combat proficiency trainer has a wider nose section than the F-102A to allow for side-by-side cockpit.

*The idea for this article originated when the author was reviewing past accidents in an attempt to determine where future efforts should be concentrated for the most effective accident prevention. He reviewed the last one hundred T-33 accidents in the Flying Training Air Force, and came up with a pretty good preview of what to expect in the future.*

*While the figures concern only T-33 accidents in FTAF, the article is presented in such a way that it is applicable to any type of aircraft in the Air Force. Read it and do a little soul-searching . . . if you are a believer in the law of averages and in cold facts, you may find your future discussed below.*

# What are

# the Odds?

Major Clyde K. Voss, Hqs FTAF, Waco, Texas

I DON'T KNOW the odds against your having an accident in the near future, but I can quote you some rather accurate figures concerning which category you will fall into if you do prang your T-Bird.

### Odds Are 100 to 21

The chances are 21 out of 100 that if you have an accident, you will undershoot or make a hard landing. So, unless you deliberately analyze each of your patterns and landings, and then decide to go around when things aren't just right, you are a candidate for this group.

### Odds Are 100 to 16

Sixteen more of these one hundred T-33 accidents also will be on or near the runway. To be more specific, 16 will either overshoot or run off the runway for various and sundry reasons, such as tires blowing out by over braking to avoid the runway barriers. We all can avoid the statistics here if we use the barrier at times like these rather than try to avoid it. Two pilots have hit the stanchions just to avoid the cable! That's skill?

### Odds Are 100 to 12

Twelve hot rocks out of that 100 will be tooling along when suddenly they learn something that you can learn right now; i.e., it won't run without fuel. A couple of these steaming stones just won't preflight the aircraft properly (tiptank caps loose). Another couple won't know that with electrical failure, the main wing and leading edge fuel is not available. The others will simply fail to turn the switches on (most likely while flying in formation).

### Odds Are 100 to 8

Eight of these 100 pilots won't look around enough. You guessed it—midair collisions! Do you look around enough just because you haven't hit someone yet? Of course not. To look around enough, you must be constantly alert and deliberately search the sky, not just sleepily gaze out into it. There are probably 100 aircraft in the air around you each flying period. How many can you see at any one time? One or two? That leaves you just about 98 to look for.

### Odds Are 100 to 7

Seven of the 100 will leave mobile controllers (smoking flare guns in hand) slack jawed as they "slide 'em in." What else? Gear up landings, and these are all pilot error. Two of these heroes will pull their pesky gear up prematurely while dreaming of a double Immelmann off the deck, no doubt. Strangely enough, these deals that leave the controller slack jawed, seldom have the same effect on the old man.

### Odds Are 100 to 7

Sad and unnecessary though it may be, seven of the 100 will stall or spin in. Four of these accidents will happen in the pattern. If you prefer to avoid being in this category, know your spin recovery so you can do it automatically, know your airspeed at all times, recognize a high speed or accelerated stall and when you overshoot final, take it around.

### Odds Are 100 to 7

No one knows why, but another seven of these 100 pilots will violate one or more regulations or perform some kind of unauthorized maneuvers. The majority of these accidents will result in fatal injuries. (The primary cause of two of these accidents will be listed as "Undetermined." We will suspect hypoxia or hyper-ventilation, but it's hard to prove. You won't be one of these if you follow the oxygen procedures taught in the training program.) Most common among these will be overstressing the aircraft, probably by pilots who do not know that an aircraft limited at 6G can be overstressed at 4.1G, if those G are pulled in a rolling maneuver. Buzzing is getting out of style fast these days, but there's always someone who hasn't heard the word. Not too long ago, civilians stood in awe as "Dashing Dan" zoomed past in his flying machine. Now-a-days the base commander's phone is ringing before our hero even realizes he's flown through the power lines.

### Odds Are 100 to 5

Five of the 100 accidents will be forced landings due to engine failure. None will be fatal, but several could be prevented altogether. Maintenance personnel play the big part here, of course, but they must depend to a great extent on the pilot, particularly on his knowing and observing the engine limitations. Your write-ups are the only clue to how things went on the flight, so observe closely and write up accurately and completely. Finally, know your airstart and forced landing procedures and you probably won't get hurt.

### Odds Are 100 to 4

Four accidents will result from some other type of materiel failure. Half of these will again be brought on by stresses which pilots can reduce. Resist the urge to operate at the maximum and treat your aircraft at least as respectfully as you do your automobile. It would take every cent a captain makes for over 13 years to pay for one T-33. If your car cost that much, how careful would you be? All Uncle Sam asks is that you use your best judgment.

### Odds Are 100 to 3

Three accidents will result from maintenance error, though again the pilot possibly can eliminate or reduce this number. For example, one of these will be reversed control cables. It's "Maintenance Error" all right, but notice the pilot's checklist where it says "Before Starting Engine," item #2 "Flight Controls — free and proper movements." The obvious point is: Use your checklist. Approximately seven of the accidents referred to elsewhere in this summary can be avoided by a proper preflight.

### Odds Are 100 to 3

Three accidents will result from becoming lost. Actually, becoming lost is not too uncommon nor too serious, normally. However, these three persons will not make use of the multimillion dollar communications and direction finding network provided for them until they are too low on fuel to get home. Know and use the "lost procedures" when you first need them, not after it's too late. If you are lost and no one knows it, you'll never get any help.

### Odds Are 100 to 2

An untold number of pilots will inadvertently jettison their canopies. Two accidents will result. All will be pilot error—accident or not.

### Odds Are 100 to 1

Only one T-33 will land gear up because of mechanical malfunction of the landing gear. This is a good indication of the reliability of this aircraft, for during this period of time, almost one million accident-free landings will be made.

### Odds Are 100 to 1

One accident will be caused by the aircraft hitting some unmarked obstruction. Look around, and see what you look at. Report obstructions.

### Odds Are 100 to 3

Last, but not least, three ingenious individuals will either think of a new way to have an accident or will choose one of a hundred other "approved" methods. One old favorite is to stopcock it in flight to practice airstarts, only to find that it won't start. Possibly someone will even find something to taxi into.

By taking just a couple of minutes to analyze the situation you can deliberately avoid the bad spots. You naturally use more caution walking across a busy street than you do on the sidewalk, so it should be natural to use your utmost skill and judgment when flying in the "danger zone," so to speak. For example, we can see that:

- About 45 per cent of the T-33 "danger zone" is on the runway, and mostly during the landing phase. Obviously, only your best is the minimum required at that time.
- About 20 per cent of the accident potential will be the result of the pilot's inattention to his business in flight and preflight. (Fuel, midair collisions, flying into other objects and so forth.) What better advice than the old standby, "look around?"
- About 15 per cent of these accidents will require faultless use of emergency procedures. Get out your Dash One and make certain that you know all of the emergency procedures perfectly.
- The seven per cent attributed to violations and other such things is simply unnecessary.
- Five per cent is attributable to maintenance and materiel.
- Approximately eight per cent of the potential is from ignorance about equipment and normal operating procedures. Here's where the little things really count. Radio and air discipline, attention to briefings, good health, proper foods, plenty of sleep and all the little items that go to make a sharp pilot, pay off here. Check the odds, take your choice and then bet your life. ●

Twelve out of every hundred accidents involving jets result from fuel starvation.

Undershoots or hard landings will account for twenty-one out of every hundred accidents.

During the landing phase, you must be especially sharp for this is called the "danger zone."

# George Turns Tiger

John Harper, Lear, Inc.

AUTOPILOTS HAVE BEEN in aircraft for a long time. The bomber and cargo boys have come to regard them almost as an extra pilot; especially on long missions. But what about the auto-pilot installation in fighter type aircraft? Are they worth while or not?

I thought of this when I received a report last month that a fighter-interceptor squadron at Chitose Air Base has joined the growing number of ADC squadrons in requiring that the autopilots be in commission on all alert aircraft. The order originated with the operations officer. He proved to the satisfaction of virtually everyone at the base that the climbout can be made faster and that a higher speed can be maintained at altitude by use of the autopilot.

Still another recent report shows that operations officers are not alone in their enthusiasm for this equipment. The pilot who was high scorer for CADF in the recent interdivisional Rocket Meet at Yuma, and who tied for high score of the meet with 5000 points out of a possible 6000, reported that he "always used the autopilot on his F-86D, at least until getting a lock-on."

Such reports are becoming increasingly common, and these particular remarks sum up the points where this bundle of animated hardware can help you most—In pilot fatigue relief, in consistently producing maximum aircraft performance and in search and tracking precision.

For various reasons, however, these points are not yet universally accepted among fighter pilots. Many of them feel that the autopilot deprives them of the privilege of flying the airplane. Some claim they can fly a mission better manually and a few are concerned unduly about the probability and consequence of autopilot component failure.

In the early days, when autopilots had no maneuvering capabilities and were quite large and heavy, they were used only in transports and bombers. Fighter aircraft had little need for these autopilots and could ill afford the large weight penalty. In World War II, when fighters were called upon to perform long-range escort missions, autopilots were installed in some of these escort aircraft to relieve the pilot during the cruising portion of the long flight. The concept was to deliver him over the target without undue fatigue, in good physical condition to defend the bombers against enemy fighters.

Following WW II, an autopilot featuring maneuverability was introduced and definite strides were made toward reducing size and weight. As the all-weather interceptor concept became more clearly defined, the requirement for a maneuvering autopilot was established for aircraft in this class, particularly those models designed for a single crewmember. The Civil Aeronautics Administration reports that in 1954, 134,000 instrument approaches were made by military aircraft; a 44 per cent increase over 1953. Probably a good portion of those involving fighter aircraft were made with assistance from the autopilot and approach coupler. Present-day autopilots are well suited for this type operation.

Today, there are autopilots capable of precisely controlling an aircraft through complicated weapon delivery maneuvers and the carefully planned recovery methods associated with them. These systems are expected to meet the requirements of the one-man strategic bomber.

Let's face it, gents, the autopilot and its little brother, the damper, are here to stay. Not even day fighters are immune to the black box plague. Supersonic performance, and the aerodynamic characteristics which make it possible, have compromised stability and control to the point where some type artificial stabilization is required, namely, damping systems or stability augmentors.

In this article, we are discussing the Lear F-5 autopilot, as installed in the F-86D, and the things it is intended to do for you . . . the pilot, navigator, radarman, gunner and radioman all rolled into one. However, most of the things we say will be applicable to any maneuvering autopilot.

To illustrate the servo loop principle, a simplified block diagram of the pitch control system is shown in Figure 1. The outer loop carries signals from the gyro for corrective positioning of the control surface, and these error signals disappear when the gyro senses that the airplane's attitude has been appropriately changed. The inner loop stabilizes control surface position through continuous monitoring by position-indicating devices known as follow-ups. (Auxiliary signals, as from the controller and approach coupler, merely cancel some of the gyro signal before it gets to the amplifier and thereby change the system zero point.)

These two controls form the simple basis for practically all the old "pilot relief" autopilots, and are used to


This little black box is the F-5 controller.


Above, control box, as installed in F-86D. Below, pilot demonstrates fingertip control.

stabilize the airplane at a selected attitude of flight. By adding a controller, it is possible to maneuver the airplane to an extent limited by the range of the controller. The old manual synchronizing or needle matching has been eliminated by automatic synchronizing, and automatic stabilizer trim is provided during autopilot operation. These features preclude any changes in pitch attitude when engaging or disengaging. Neither roll synchronizing nor trim is provided in the present system.

Besides the inherent safety aspect of the automatic trim and synchronizing systems, each servo is fitted with a slip clutch. All servo torques must be transmitted to the aircraft controls through these clutches, which are set to keep the maximum G, or yaw angle, within the safe range during any conceivable autopilot malfunction. The slip clutches are designed to permit the pilot to overpower the autopilot if necessary. These safety factors practically eliminate any concern over what may happen in case of a malfunction close to the ground during the final approach as long as the autopilot is monitored closely, with one hand on the stick.

In short, the equipment seems complicated only if you try to look at all of its functions at once. Separately, each function is as simple as the instinctive and proportional reaction of your hand on the stick when you read an attitude or azimuth change on your instrument panel.

Now let's go through an ordinary interceptor scramble flown under instrument conditions. We'll see what you, the pilot, are required to do and how your autopilot cannot only help you with many operational details but even increase your aircraft's range and endurance. This, of course, increases the margin of safety on a tactical mission.

Less than five minutes from the moment the scramble order is received, you are raising the gear handle and flipping on the autopilot. At 300 feet, on instruments, the autopilot handles the mechanics of flying the airplane while you manage the operation with a cool head.

"Quinella, this is Lootless four-one, airborne at 23, request vector."

"Lootless four-one, this is Quinella. Turn left, vector 240, angels 35. . . ."

While acknowledging this transmission you set the degree of left bank that you want with the autopilot turn knob and adjust the pitch trim wheels to obtain the Mach number for best climb. As the aircraft heading approaches 240 degrees, the turn knob is rotated smoothly back to detent and pitch attitude is readjusted to maintain climbing Mach number. Slight pitch attitude adjustments are required, as Mach numbers tend to increase with altitude, and heading changes are made smoothly and accurately by the use of the turn knob in response to GCI control.

You are now at "Angels 35," painting the bogey on the TV set while the autopilot is holding the assigned GCI vector and the selected pitch attitude, both within one degree.

"Lootless four one, this is Quinella, bogey at eleven o'clock, 15 miles—PUNCH!"

"This is Lootless four-one, JUDY!"

You manipulate the radar hand control, release it and you are locked on. The target dot may now be followed by the use of the autopilot turn knob and pitch command wheels. When and if the point is reached where the required maneuvering rates exceed those available on autopilot control, you merely disengage and complete the run manually.

Following the run, and still on autopilot, you set up the vector and altitude assigned by GCI for your return to base. Since the inbound ILS course is within 90 degrees of your heading back to base, you request a straight-in automatic ILS approach from GCI. The necessary preparation for this approach requires only checking that your ILS radio receiver is ON and tuned to the correct ILS frequency.

Now GCI control has maneuvered you into a position 30 miles out on the ILS beam at 7000 feet, 300 knots and on the inbound ILS heading. At this point the localizer needle will be somewhere near the center and the glide path needle near the top of the ID-249. You engage the approach coupler localizer control and maintain 7000 feet until the glide path needle drops to the center. At this point you engage glide path, decrease engine RPM and extend dive brakes to gradually reduce speed during the descent on glide path control. The aircraft will nose over automatically and after two or three oscillations settle down on the glide path.

At 2000 feet above the terrain, holding about 175 knots, you extend landing gear and flaps, close the speed brakes and set your engine at 81 to 83 per cent to stabilize at 150 knots on the glide path. You are given landing clearance by the tower at the outer marker, so you just sit there in your office. Remember to carefully monitor the approach coupler operation on your instruments and be ready to take over manually at any time. Also, the automatic coupler always will attempt to keep the aircraft on the glide path. If you fail to keep enough power on, conceivably the coupler could stall the aircraft out.

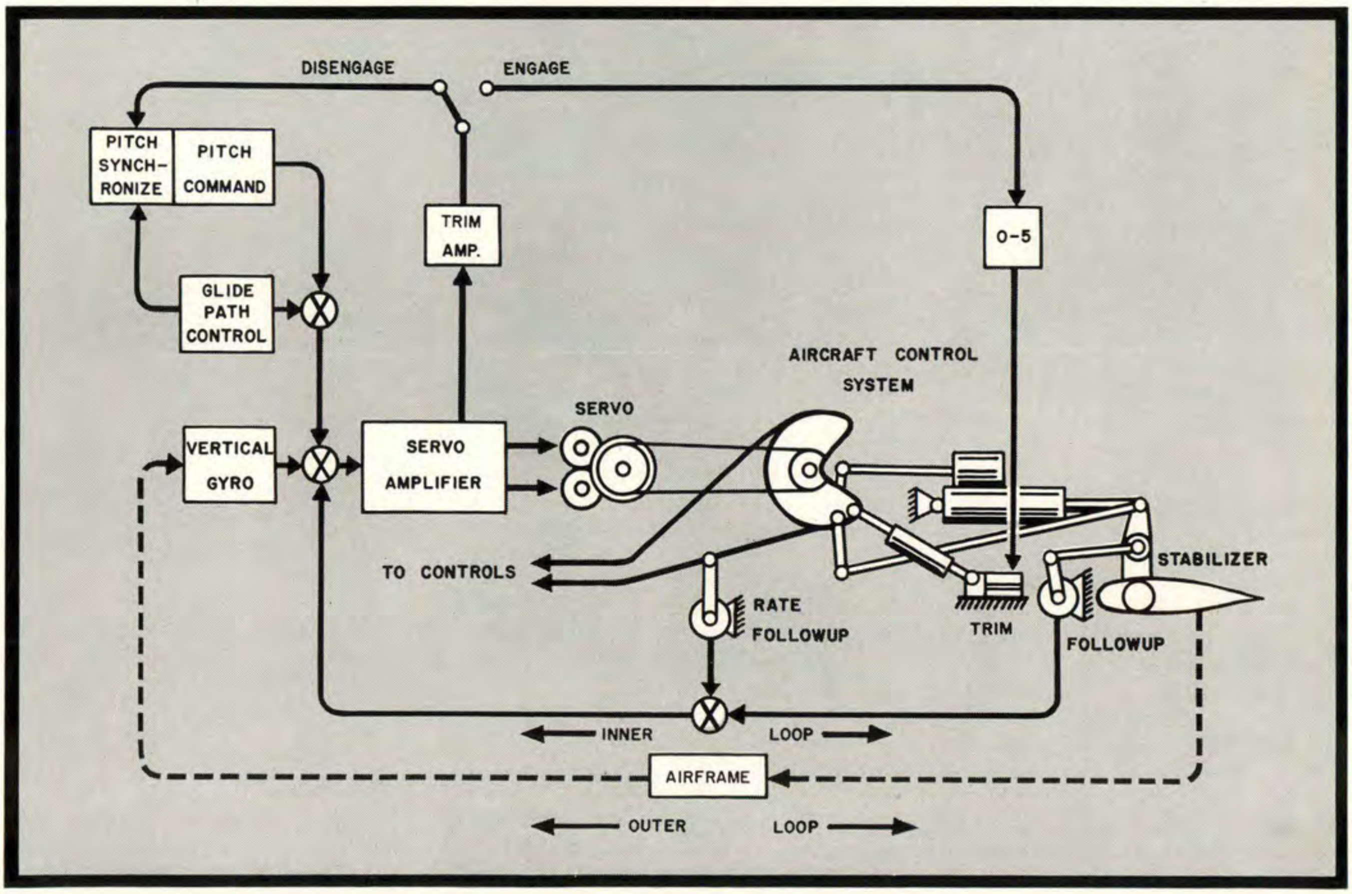
You break out of the clouds over the middle marker at 200 feet and with the runway in sight you take over manually, extend speed brakes and land.

Sounds easy, doesn't it? Well, it should be just that easy, *if* you have practiced this operation enough to know how to handle the autopilot and to know exactly what to expect of it and *if* your autopilots are receiving proper maintenance.

The F-5, or any autopilot, has natural limitations which are not necessarily the same as yours or the airplane's. For example, the maximum bank angle attainable with the turn knob is between 45 and 50 degrees. This is plenty for most applications, such as IFR penetration, GCI climbout and search, but may not be enough to follow the E-4 steering dot through phase 3 unless the run is set up perfectly to begin with. The loss of altitude during turns can be controlled easily by the pitch knob after a few hours flying on autopilot control. Autopilot technique must be developed by practice just as manual piloting technique is developed.

The F-86D simulator is quite useful in this regard if its shortcomings are known and their effects carefully considered. These simulators lack automatic stabilizer trim on autopilot, and although pitch attitude is synchronized, stick position is not. This results in a stick jump on engagement and disengagement, but the autopilot will hold the engagement attitude and the airplane will return to it after disengagement, in contrast to normal autopilot operation.

Fig. 1. This block diagram shows how the pitch control system works.



It is impossible to overpower the autopilot in the simulator since the manual control system is disconnected entirely during autopilot flight. Responses to pitch command and roll trim vary excessively over the speed range and do not correspond to the airplane installation. In spite of these discrepancies, the simulator will help develop individual autopilot technique and procedures.

Good autopilot maintenance starts with the pilot, just as airframe or engine maintenance does. The pilot must know how the autopilot should operate and then must write up complete and accurate Form 1 discrepancies. "Autopilot Inoperative" should never be used unless it is completely inoperative and cannot even be engaged. When autopilot discrepancies are encountered during flight, a little bit of testing should be done, time permitting, to get as much information as possible for maintenance.

The maintenance department must necessarily provide for periodic checking of the autopilot system, preferably during the regular checks. Calibration settings and follow-up outputs are the very minimum items that should be checked during every minor inspection, and a complete system check and set-up should be accomplished during every major inspection. This system minimizes the number of discrepancies between inspections and assures improved autopilot operation overall.

To accomplish this, both pilots and maintenance personnel must have a basic technical knowledge of the system and be thoroughly familiar with its operation in the air and on the ground. Autopilot technical representatives are assigned to most F-86D bases and two F-86D qualified pilots are employed by the manufacturer to visit all bases in the U. S. on a rotating basis. All of these personnel have been given thorough training on the theory, maintenance and operation of the F-5 autopilot, and the two pilots are well acquainted with its utility in the F-86D aircraft. The tech reps are there not only to assist maintenance personnel but to help pilots become familiar with the theory and operation of the F-5. If you are in doubt about something in the autopilot, ask your tech rep. If he doesn't know, he'll certainly find out.

What changes and improvements can be expected in future autopilots? General improvements in autopilot response and control accuracy have been made in the last few years and can be

*The author flew fighter aircraft during WW II. Leaving the service in 1945, he graduated from the University of Michigan in 1948. He then worked for the National Advisory Committee for Aeronautics for four and a half years. Assigned by Lear, Inc., as project engineer and test pilot for the F-5 autopilot, Harper is well qualified to write on this subject.*

seen in the autopilots flying in prototype aircraft and in modifications to existing autopilots. In addition, several features have been developed which will extend automatic flight control to functions requiring accuracies which cannot be maintained by flying manually.

*Altitude Control*—Different methods of automatic altitude control have been in use for a number of years on a variety of aircraft, but so far the only indication of automatic altitude in F-86D aircraft has been the button on the approach coupler control panel. Experimental installations have been flown in the F-86D and a modification is now planned which will include provision for altitude control. The altitude control signal is introduced into the system in the same manner as is glide path control.

*Stick Steering*—This feature is available for aircraft now in the prototype stage and is being retrofitted to some old systems. This, of course, provides for control of pitch and roll through autopilot by use of the airplane's primary control column and is considered a necessity in systems intended to be flown at high speed at very low altitude.

*Automatic Weapon Delivery* — Weapon delivery techniques presently being developed require control accuracies which cannot be achieved consistently by the pilot. The automatic fire control system now installed in F-86D aircraft is the forerunner of similar systems which will take a bigger slice of the complete interceptor mission, possibly on a programmed basis and partially ground controlled. Similarly, systems are being developed to control the light bomber throughout the approach, delivery, escape and return with extreme accuracy. They provide also a platform from which the pilot may navigate by celestial means, and rest between times.

*Mach Number and Airspeed*—These systems are not difficult to incorporate in an autopilot system, but have not been a requirement until recently. Mach control is very useful in an airplane whose climb schedule approximates a constant Mach number. Both will be useful in aircraft designed specifically for high altitude operation which are red-lined at a comparatively low indicated airspeed. Automatic climb control will hold the red-line airspeed until it is equal to the Mach number for best climb and then switch to Mach control.

*Heading Selection and VOR Beam Guidance*—These are related systems and are now being flown in a production commercial version and in an F-84E flight test system. Heading selection permits the pilot to pre-select a heading and initiate the turn by pressing a button. The beam guidance uses a mixture of the selected heading signal and the error signal received from the VOR. This system has been test flown in one F-86D using an ID-249A selector as a heading selector. Wind drift is correctible.

Where does this leave us airplane drivers, you ask? Well, there are at least two good reasons why the pilot cannot be completely replaced for years to come.

- Remote control range is limited to line of sight at present and is expected to be so limited until a new communication or observation concept is devised. Therefore, piloted aircraft must be retained for medium and long range interceptions and attack missions. In addition, tactical missile ranges cannot be increased appreciably before the economical size limit is reached.
- The aircraft and airborne equipment required for many missions is becoming such a large investment that it is not economical to leave this investment unattended. A pilot will be required to monitor the automatic equipment, to make decisions during the conduct of a mission and, in the event of equipment malfunction, to control the vehicle manually.

Missile applications will, of course, increase, and they may cut into the pilot's realm to a certain extent, but there will always be a place for the human touch. ●

# the Good Old Daze

**This story starts way back in the middle '40s and does not involve any supersonic aircraft. Still, its flying safety message applies today.**

IT WAS BACK in the middle '40s after the European and Pacific wars had been won. At that time I was one of the many pilots who thought if an aircraft could fly, I could do as well flying it as anyone else. What a misled, egotistical fool I was, which you will plainly see as this story unfolds. I was fresh out of combat and was sure that since flak and enemy fighters were passé, flying would be just a breeze.

I was assigned to an organization in a western state to which were attached many subordinate units scattered throughout that area. My duty consisted mainly of flying "the Old Man" and his staff to visit or inspect those units. That alone kept me pretty busy. We had one C-45 assigned to the headquarters and its maximum utilization was, at best, far short of the flying required to accomplish our mission. So finally, we received authorization to have one additional aircraft assigned. This plane, a B-25, finally was delivered in the late fall of the year. It was ferried to us, completely equipped for combat, with the exception of a bombsight. Why that piece of equipment was not included, I will never know, because the airplane was equipped for firing rockets, guns and even for launching torpedoes.

Nevertheless, we had the problem of modifying the beast so it would be adaptable to the job for which it was assigned. This problem multiplied itself many times before the conversion was complete, but through the judicious application of uniform procedures, such as scrounging, midnight requisitioning and politicing, we had a B-25 ready to transport our people.

Well, we rolled her out on the ramp ready and raring to go, but now the only trouble was that we had no pilots who had flown or had experience in the B-25. So there we were with a nice, shiny airplane with no one to fly it. However, as luck would have it, there was a newly arrived pilot on the base who had been an instructor pilot in the B-25. He was not assigned to our organization, consequently we had to persuade his boss to permit him to check out two of our pilots. I was one of the fortunate two.

". . . so there was a nice, shiny airplane with no one in the squadron to fly it."


By this time, November was upon us, and as usual, Thanksgiving was approaching. As many readers will remember, back in those days, when a holiday rolled around everyone made the supreme effort to get home for the festivities.

It so happened that my home was on the East Coast, along with about seven others in the outfit. We all decided that Mom's Thanksgiving turkey would be much better than that served by our G.I. chefs. So from those seven, a committee of seven was appointed to talk me into a trip eastward for the holiday. After a heated discussion and many twists of my arm, which lasted every bit of 10 seconds, I condescended to oblige, if the boss man would approve and if I could be checked out in the B-25 before the holiday. The boss gave his approval, but we were having difficulty in tying down our instructor, so the checkout ride was the big sweat.

Finally, the day before Thanksgiving, we made arrangements for our instructor to give us the check-out ride. The other pilot and I had studied and restudied the tech orders on the aircraft and were fairly familiar with every procedure and working part involved in operating the airplane. All we needed was flight experience.

By this time we were chomping at the bit to fly this bird, but, as usual, our instructor pilot was busy that day and didn't show until late in the afternoon. As a result, we had time for only a few stalls and three landings before darkness overtook us. It was decided before takeoff that since time was so short, only one of us would fly in the left seat. So, who do you think got that privilege? Right. The one with the highest rank, which I was not. I stood on the flight deck behind the two pilots and watched. At the end of the day, however, both of us possessed a valid certificate stating that we were qualified to fly the B-25. So, with that, I was ready for the holiday cross-country flight—on paper, that is.

With all the minor details taken care of, we all met that Thanksgiving morning at 0400 on the flight line. I was the only pilot in the group. There was only one other flight crew person with us, the engineer. We were all ready to go when we discovered that the aircraft had not been refueled since the flight on the previous day. So after much running and calling hither, thither and yon, we managed to get the fuel trucks to the plane, and completed refueling operations.

At approximately 0630 we taxied into position and received clearance for immediate takeoff. When we gained sufficient speed to be airborne, I thought, "Boy, how do you know that you can get this thing back on the ground in one piece?" For that I had no answer and too little runway left to chop throttles and abort, so on we merrily roared.

Once airborne, I knew that we were to head east, but that was all. I remembered suddenly that I had forgot-ten to obtain charts or draw up a flight plan. We searched the plane for maps, but none were to be found. We did, however, find a current Radio Facility Chart and it just so happened that the airways led to the base of first intended landing.

The weather was beautiful; not a cloud was in the sky and the sun had just risen. We were doing fine since the old faithful bird dog was pointing the way from one radio range to the next. After about two hours of clear weather flying, suddenly there appeared ahead and below, the dreaded forms—CLOUDS. We tooled on, with a safe margin between us and the undercast. This margin, however, was mysteriously short-lived. The milky puffs were gradually coming up to our altitude.

So I took normal action to correct the situation by nursing the airplane higher and higher until we were at 10,000 feet. At this point, I guess I did the only correct thing during the entire trip. Since there was no oxygen on board I would not go higher. By remaining at this altitude we were soon in the soup. Any normal person would have called a ground station for further clearance long before this, but as you've probably guessed, I was not normal that day.

So there I was on instruments in a terrible snowstorm. I soon figured that we were not likely to run out of the bad weather, so I thought that it might be a good idea to let down and try to get under the clouds. By interpolating the field elevations given in the Radio Facility Chart, I guessed at how low we could fly without doing some spring plowing in the dead of winter. Down, down, down we went to what I figured to be about 700 feet above the terrain. Sure enough, every now and then we could see the ground so I climbed an additional 300 feet for safety. Strange how that word should appear in this story.

Shortly there appeared a large body of water below us which shook me no end. I was afraid that we were over one of the Great Lakes and if this was true, we were really lost. But, thank goodness, we were soon over land again and could see the blur of a city below us. In short order old "Bowser the Bird Dog" took a 180-degree turn, telling me that this was the point of first intended landing. Back to my trusty Radio Facility Chart I went to find the distance and bearing from the radio station to the field. Using this

You have heard of it raining "cats and dogs," well, this snowstorm could easily have been referred to as "snowing elephants and hippopotamuses."

information and applying the solution of a rough time—distance problem I knew that we should be over the field —and what do you know, we were.

The tower was much relieved to receive our call and gave me landing instructions, but by that time the field was lost in the snowstorm. If a cloudburst could be referred to as "raining cats and dogs," then this snowstorm could easily have been referred to as "snowing elephants and hippopotamuses."

Luckily, we found the field again through systematic blind search and I set up a close-in rectangular pattern. As soon as I turned on the crosswind leg the field was lost from sight again. By timing each leg of the pattern I hoped to make a perfect rectangle and be lined up with the runway on the final approach. Right again, dear reader, I was not.

I was about 500 yards to the left when visibility was good enough to ascertain our exact position in relation to the runway. I racked her up to the right in an effort to line up with the runway. As a safety factor, I maintained an airspeed of 150 mph, so when we were over the runway I still had too much speed to set her down. I lowered full flaps, but we were still too fast to make the landing. I gave her full throttle and called for gear up. The engineer pulled up the gear all right, but also pulled up the full flaps and we cleared the fence by what seemed to be only a foot or two. On the next attempt I was more fortunate. The runway was dead ahead and I had sufficient time on this try to reduce airspeed for the first landing I had ever made in a B-25.

After securing the aircraft and chewing out the engineer for retracting full flaps all at once, I decided that we would not attempt to reach our final destination for that holiday. Everyone else agreed to this, so we decided to stay right there until the following Sunday.

After having a rather mild holiday we proceeded to the field to prepare for our scheduled return flight. This time I obtained maps for the entire United States with routes drawn to every field within range of the aircraft. I was briefed properly and we arrived as planned.

If Major (he must have been a lieutenant then) Rex Riley and his good looking secretary had gotten wind of this comedy of errors, he could have published a series of comic books rather than a one-page poster. Fortunately, for some unknown reason, my violations were not cited, but the many nightmares I have had of that flight and the many hours of afterthought have taught me to be more respectful of aircraft, flying regulations and flight planning.

Now I don't dare even fly around the flagpole without a detailed flight plan and sufficient maps to help me navigate to an emergency destination. This experience certainly did much to make me more conscious of the need for a flying safety program to educate and keep pilots abreast of new developments and to apply the accepted and proved principles of safe flight. I do not recommend a similar escapade for pilots to become more mature in their profession and even if anyone should be so ignorant as to undertake such, I am thankful that our people and facilities have improved to such a state as to prevent them from doing it. ●


From the classics to a pair of galloping dominoes—most anything is grist for the mill in this squadron's accident prevention program.


*We all know that flying safety is a never-ending thing. You can't just go and get a shot of it once a year and expect to keep your accident potential down around the zero mark. If you are not up to date, if you do not keep abreast of the latest procedures and techniques, you are a flying Form 14 looking for a place to really happen.*

*Now whether you realize it or not, there is at least one fella around your base who is trying to make it easy for you. He is working like a trooper so that you can get all of the latest information required to keep you from becoming a statistic.*

*I think we all go along with the idea expressed in the old adage "The best place to look for a helping hand is at the end of your arm." Still, a little assistance from the FSO can go a long way. He has access to the information that is so essential to you as a pilot.*

*Believe it or not, many FSOs have trouble keeping pilots in a flying safety mood. Here is a story about one such FSO who, through imagination and hard work, has come up with a real, first class, flying safety program every day of every month.*

*A cigar box, a pair of dice, a slip of paper and a twist of the wrist. Simple little things, aren't they? Believe it or not they are one way to spell flying safety. You don't believe it? Read on, MacDuff, and see. It is just another example of how an FSO helps you to help yourself.*

## Imagination can make a flight safety program. And sometimes it takes only ...a

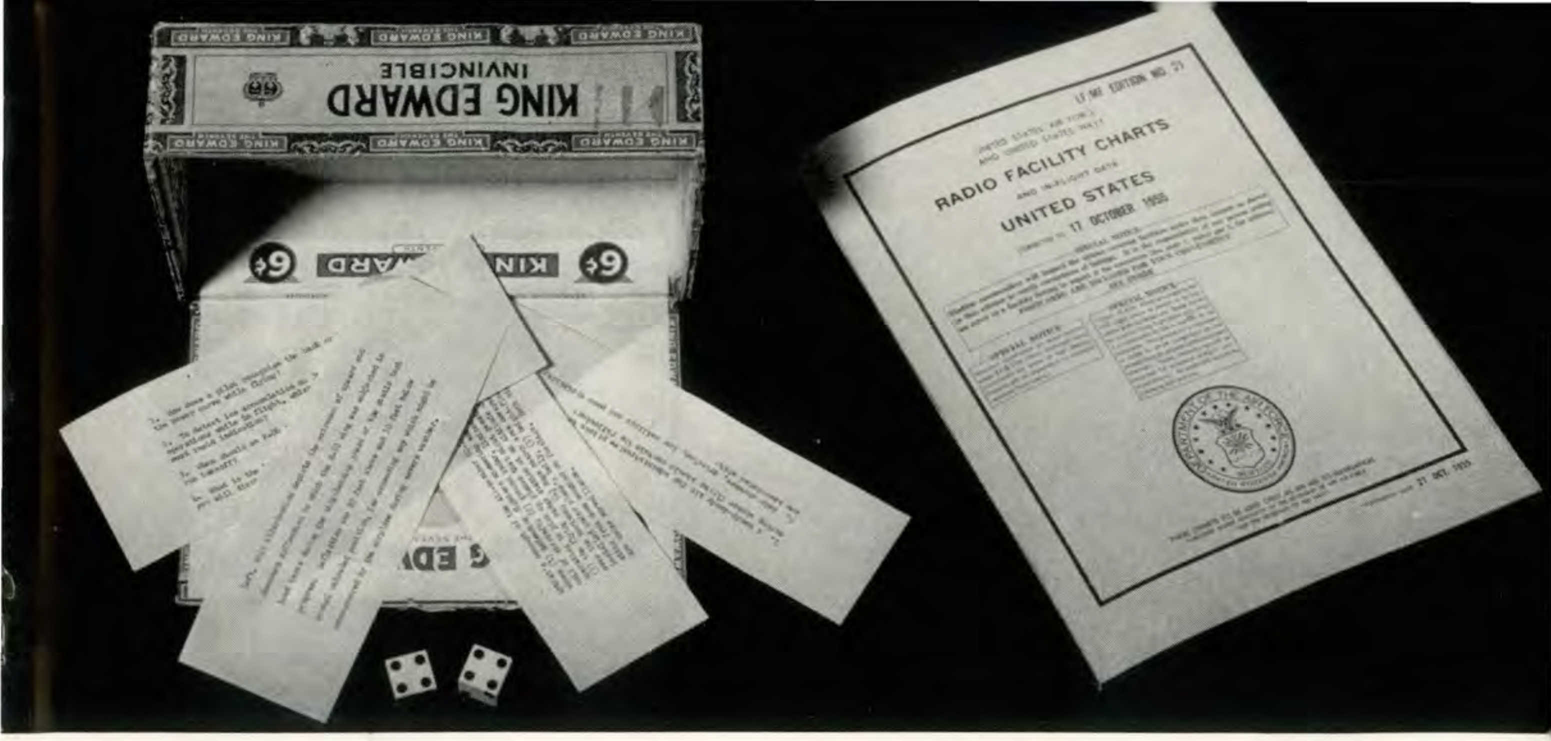
EVERY MORNING in the 468th Strategic Fighter Squadron, Turner Air Force Base, Georgia, there is a pilots meeting. Capt. Lloyd R. Leavitt, FSO, opens up the lid of his Fly Wise cigar box, rolls a pair of dice, picks up a slip of paper and kicks a highly aggressive flying safety program off to a fast start.

This little gimmick of rolling the dice is a good twist. The dots on one of the dice stands for a particular flight of the squadron. The dots on the other dice stands for a member of this flight. The slips of paper cover practically every sentence of the Dash One. Also thrown in are innumerable questions on the Fac Charts, Supplementary Flight Information and various phases of weather.

Throw in 30 pilots about equally divided between old heads and new types and you have an intensive effort to excel in knowing the F-84F. There's only one answer. They realize that they must really know their aircraft in order to remain professionals at their jobs.

But this is only a third of the story. Perhaps equalling their approach and

Trend board helps pilots check history of squadron aircraft through a summary of write-ups, corrective actions and appropriate remarks.




# roll of the

attitude toward flying safety is another tool which they use to perfection. A trend board is kept up to date in the briefing room. This is more than an ordinary eye-wash trend board. It's this squadron's bread and butter board.

This trend board includes the history of each aircraft. Here the past history of write-ups, corrective action or appropriate remarks can be witnessed by all pilots. It becomes a matter of personal interest to all the pilots as to what is presently wrong with the bird, what has been wrong with it, whether the ailment is a recurring disease or if some specific trend is starting to develop.

To these jet guiders, history means that if 25869 has been a "hangar queen," what remedial action has been taken to right her? They are downright persistent about these recurring squawks.

Another good angle that the 468th uses is having the Indians help the Chief. Meaning that Capt. Leavitt, who is leader of Flight D, has each member of his flight assisting him. One handles the incident reports. Another carries the duty of maintenance records. Next is an officer in charge of daily questions. The fourth member is squadron representative to the wing standardization board. The fifth is ground safety officer with special reference to policing the ramp for unassimilative articles which might be gulped up into the airscoops. The sixth lieutenant troubleshoots aborts and malfunctions.

Still another method is used to keep flying safety uppermost in the minds of the jockeys. An "Obscure Quotes from Obscure Pilots" board outside Ops causes a momentary pause when entering the building. It's a take-off on historical quotes. They are worded into flying phraseology. Hamlet really takes a beating sometimes.

The words "just routine" are regarded as the first step to an incident, and after an incident an accident might occur. So a stuck canopy, unusual engine noise or vibration in flight, or any of a dozen little items that are not normally associated with an "F" when in tip-top shape is cause to alert the FSO. The individual plane crew chief is read into the act. Then the line chief. How many emergencies have been prevented by this constant safety attitude on the part of every pilot is only a matter of conjecture, but you can bet it's plenty.

The 508th SF Wing, commanded by Col. Gerald W. Johnson, has a hand in the program, of course. A couple of wing FSOs, Captain Joseph Ross and Donald James, spend the better half of each day on the line, while Capt. John Fritz, wing standardization board, keeps the lads well clued-in on techniques and SOPs.

Well, there you have it. The cigar box, marked dice, slips of paper and an entire squadron of pilots who vie with each other as to knowledge of the F-84F. An every-morning study of a trend board that is more than a chart on a wall, a talking over of any trend that is developing to nip it in the bud and a thoroughness about their job puts them in the "professional" class.

The 468th concept of flying safety is to treat the just routine cases with kid gloves. It's a free Air Force and all rights on the ideas used by the 468th are not reserved. ●

# REX SAYS

I HAD A near-miss that involved frost, clear ice and a miscalculated freight manifest that shook me to the marrow of my bones. In fact, whenever I tell it to others, I still get a bit queasy.

I was flying a C-47D in South America and had been delayed on the second leg of my scheduled run because of fog. There was a considerable amount of freight on board.

That evening I was contacted by a representative of the U. S. Government, and he asked if I could take on a couple of thousand pounds of freight for him to my next stop. I did some mental calculations and said yes.

Now comes the hairy part. The field was one of these jobs that sets in a nest of hills like the bottom of a coffee cup. It was during the winter season and the temperature was hovering around the freezing point.

I arrived at the field at 0400 hours and, along with the copilot and crew chief, scraped loose the accumulated frost that had formed on the wings. We figured it would blow off when we started takeoff. I checked the form F after it had been recomputed by the freight agent, and climbed over many boxes en route to the cockpit.

The runway was 6500 feet long and made of concrete. There was an intersecting runway about 3000 feet from point of takeoff. It's a good thing I remembered this.

As the aircraft started to roll, the copilot told me that the remaining frost was blowing off the wings, so I continued the takeoff. The ship was very sluggish, but considering the load we had, this figured, so I just let 'er roll.

Out of the corner of my eye, I saw the 300 foot intersection go by and the tail had not even started to fly yet. I shoved forward on the control column and the tail came up, but promptly returned rapidly to the runway again.

This was enough for me. I aborted and came to a shuddering halt just inches from the end of the strip. I taxied back and parked.

Know what I found? A good bit of the frost on the wings and tail had not blown off. A quarter-inch of clear ice covered all of the flat surfaces. Evidently it was caused by a heavy dew that froze prior to the formation of the frost. A re-weighing of the cargo revealed that the freight loader had figured the added cargo using the metric scales. Weights shown in pounds actually were kilograms and the plane was 4000 pounds overweight.

All in all, I guess I was indeed lucky. If there had been no frost, or if the dew had not frozen on the aircraft, or if the weights had been correctly figured, I probably would not be here to discuss this near-miss. Any one of the three factors would have allowed the ship to become airborne, but the rate of climb would have been nil. In addition, the reactions of the aircraft would definitely have been seriously impaired. And remember, this base was surrounded by hills, with very high mountains nearby.

Can you see why I still break out in a cold sweat when I think of this near-miss?

***REX SAYS****—The old Gooney may make up for a lot of mistakes but this lucky chap was stretching things a bit too far. Glad he's still around to bring out a good winter axiom—the frost on the pumpkins in November can still be on the dew in January.*

★

A VERY DISTURBED and shaken pilot recently called a Flight Service Center to report a flight of fighters which had buzzed dangerously close to his aircraft. Their approach had been so fast and sudden that evasive action was impossible. Further conversation with the pilot revealed the reason for the "reckless" maneuvers of the fighter aircraft. They were making a high speed bomb run in an established and well defined restricted area. When confronted with this, the reporting pilot expressed surprise. He had not been aware that a dangerous and active restricted area lay across his path of flight.

Unfortunately, this is not an isolated case. Similar incidents are happening with alarming frequency. In some instances pilots are not even aware that only the vigilance and skill of a fighter pilot had saved their lives. The pilot of an F-84F graphically described such an incident.

"I was in a 60-degree dive, indicating 415 knots over Plum Tree (Plum Tree Range, R-49), when the flight commander called a break for me. I looked up and all I could see was a large four-engine aircraft. I discontinued my run and took the number from the aircraft which was on a heading of approximately 20 degrees at 10,000 feet. Had my flight commander not called this bogey, a mid-air collision surely would have taken place."

Only the alertness of the flight commander prevented this from being a major air disaster. The next bogey may not be so fortunate.

In another instance, a twin-engine aircraft flew through this dive bombing range. Two F-84F aircraft were in the middle of a high altitude dive bombing run when this plane suddenly appeared under them. Only quick action upon the part of the lead fighter pilot prevented a collision.

And here is the payoff. Just one hour later, another twin-engine aircraft flew through the range during another bombing run, at approximately the same altitude and heading.

In one month, a total of five violations were made on the Plum Tree Island Bombing Range (R-49) during dive bombing training. Or to put it another way, five pilots were caught and had violations filed against them. Undoubtedly, other planes slipped through unobserved. Of the five, two were airliners, and the other three represented different branches of the military service.

Why do pilots fly through restricted areas when hazards to flight are known to exist? The stock answers to this question are: "I forgot." or "I've flown through that area before without any trouble." (Sounds strangely familiar to the infamous last words, "No sweat—this is my home station.") But the classic reply is, "What restricted area?" None of these answers are acceptable by violation review authorities who are generally of the opinion that lapse of memory and ignorance of directives are inexcusable.

Don't compromise the safety of your passengers, crewmen and aircraft. Check en route prohibited, restricted, and warning areas. A list of those areas is contained in current Radio Facilities Charts.

If you must make a flight to a base within a restricted area, obtain prior clearance from competent authority. Your proposed entry should also be coordinated with the command responsible for controlling the restricted area. And don't forget to check the

# REX SPECIALS

*Occasionally, I receive material not concerned with the incidents that normally appear in this section. But when information other than near-miss reports comes up that is especially important, I will run it as a special part of REX SAYS.*

*This short article on the inclined turn and bank indicator was written by George H. Purcell, an employee of the Flight Control Laboratory, WADC.*

ON THE F-86D, F-100 and F-102 aircraft, a problem has arisen because the turn and bank indicator is mounted on an inclined section of the instrument panel. Tilting the face of the dial upward has made it easier to see and read, but has seriously reduced its performance as a standby instrument. It appears that the instrument's indication during partial panel operation (where the turn and bank indicator is the only gyro instrument used), might be confusing to the pilot. This applies particularly to the F-86D and F-102 where the instrument is inclined about 15 degrees. On the F-100, the panel is inclined only about 10 degrees and the effect is less pronounced. But, even here partial panel operation under IFR conditions would be exceedingly difficult, at best.

Since the basic mechanism in this instrument is a gyroscope, the indication it provides is influenced by the angle of mounting in the aircraft. It was designed to show rates of turn correctly when mounted on a vertical panel. When it is inclined in a manner to tilt the face upward, the needle is affected adversely. It is deflected, not only by the turn rate, but also by a roll rate, due to the angle of instrument installation. Thus the needle gives an erroneous reading. At a 15-degree inclination, about 26 per cent of the roll rate is measured; while at a 10-degree inclination about 17 per cent is measured. Since roll rates are generally much higher than turn rates, it is obvious that a large proportion of the indication at any instant can be due to rolling.

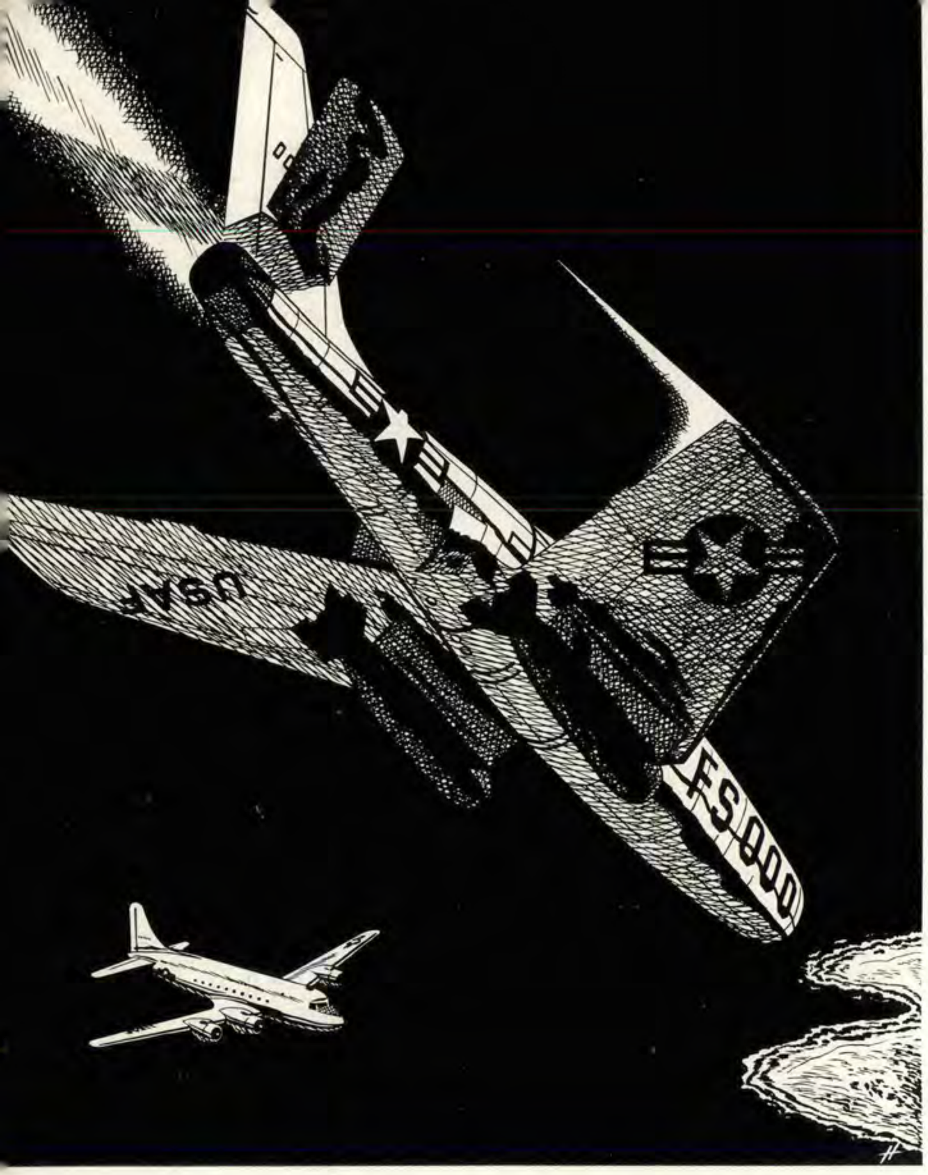
For example, assume that the pilot is on instruments and that the attitude indicator is inoperative, making it necessary for him to rely on the turn and bank indicator. Let's assume further that he desires to make a turn to the left from straight and level flight. The pilot starts this turn by moving the stick to the left. As the aircraft begins to roll, the turn and bank indicator erroneously shows a turn to the right, because it is sensitive to rate of roll. When the pilot sees this he naturally moves the stick further to the left, thereby increasing the rate of roll to the left and consequently increasing the indication on the instrument of a turn to the right.

During this time, the bank angle to the left is increasing, causing the turn rate to the left to increase. This provides an input to the indicator tending to cancel the erroneous indications caused by the rate of roll input. However, if the pilot tries hard to control the aircraft with reference to the indication, it seems probable that the aircraft could be out of control before this compensating input would be effective. Rough air could be expected to aggravate this unusual flying condition.

It should be emphasized that the characteristics described, apply to the instrument only when it is being used as a substitute for the attitude indicator. If the attitude indicator is operating properly and is used as the primary, basic flight instrument, then the turn and bank indicator should be perfectly satisfactory for holding prescribed rates of turn. The reason for this is that after establishing a constant bank, the roll rate is zero and therefore the input of roll signal to the indicator is zero.

The above comments are based on computations, limited flight tests and unsatisfactory reports from organizations using the F-86D. More thorough testing both in flight and using flight simulators is being performed at WADC. More exact and quantitative data on details of this problem can be expected. The possibility of inclining the gyro mechanism in the instrument case in the direction to compensate for this effect also is being investigated. Action already has been started to move the instrument back to the vertical position in the F-86D and probably this change also will be made in the F-100 and F-102.

In the meantime, pilots should keep in mind that the turn and bank indicator can give confusing indications on the three aircraft listed above.



Remember, that aircraft participating in restricted-area maneuvers are simulating actual combat capabilities. So beware and stay clear.

NOTAM file for special information pertaining to hours of operation and type of activity in progress. Additional instructions for entering restricted areas can be found in the Special Notices Section, Radio Facilities Charts.

Remember that bombers and fighters participating in restricted-area maneuvers are simulating actual combat capabilities. Disruption of their missions may delay vital tactical projects for days as well as expose personnel and equipment to unnecessary dangers. Consider these factors the next time you plan a flight.

***REX SAYS****—The gent who sent me the above well put-together narrative is an ops officer in a Flight Service squadron. His comments concerning these violations make a lot of sense to me. The pilots involved in these incidents are really asking for trouble and, if they keep on disregarding restricted areas, someone is going to get it. The worst part of the whole deal is that all five had passengers and crewmen with them. All restricted, prohibited and warning areas are available to a pilot in his Fac Chart; there can be no excuse for not using it.*

*It all goes back to a point that seems to need endless repeating—Plan Your Flight!*

★

I'LL BET THE manufacturers of the T-33 didn't know they had a built-in magnifying glass when they sold the T-Bird to the Air Force.

As I was patrolling the flight line one hot summer afternoon, I took a second look at the rear seat of a '33 and saw a blaze coming from the instrument flying hood.

Fortunately, it didn't have a real good start and the fire department extinguished the blaze quickly. After this episode I made the rounds of the maintenance shacks. It was agreed generally that the old Boy Scout method of making fire with a piece of glass wasn't what Lockheed had in mind when they stuck the canopy on the T-33.

***REX SAYS****—Old Sol bore down in this case. The remedy . . . keep the canopy cover in place. I might add, this is the third or fourth time this has happened in T-Birds.*

★

YOU KNOW, it's one thing to see a jet go by, but it is something else to hear one go by. I had this happen to me one day while I was flying just west of Gila Bend, Arizona, on a DVFR clearance on Red 9 Airways at 8000 feet.

I had the side window cracked in my C-47, as we were trying to suck the hot air out of the cockpit. I was figuring out my ETA for San Diego and the copilot was doing his hitch at the aircraft's controls.

I heard a SWISH! I looked over at the copilot and asked, "Did you see it?" There was no mistaking that it was a jet.

He looked sort of ashen-faced while he related that it was a jet fighter on a collision course and that it had gone over the top of us at no more than "25 or 30 feet."

I'd seen a lot of jets go by me while plodding along in a Gooney but this was the first time I had ever heard one. The copilot had no time to maneuver from the time the jet was sighted until it was gone.

I wonder if the jet pilot was just playing around or whether he didn't see us? Either way it was much too close for comfort. I know two things.

First, that we were at the right altitude and second, that if the two aircraft had met head on at somewhere near 700 miles per hour, someone would have been hurt.

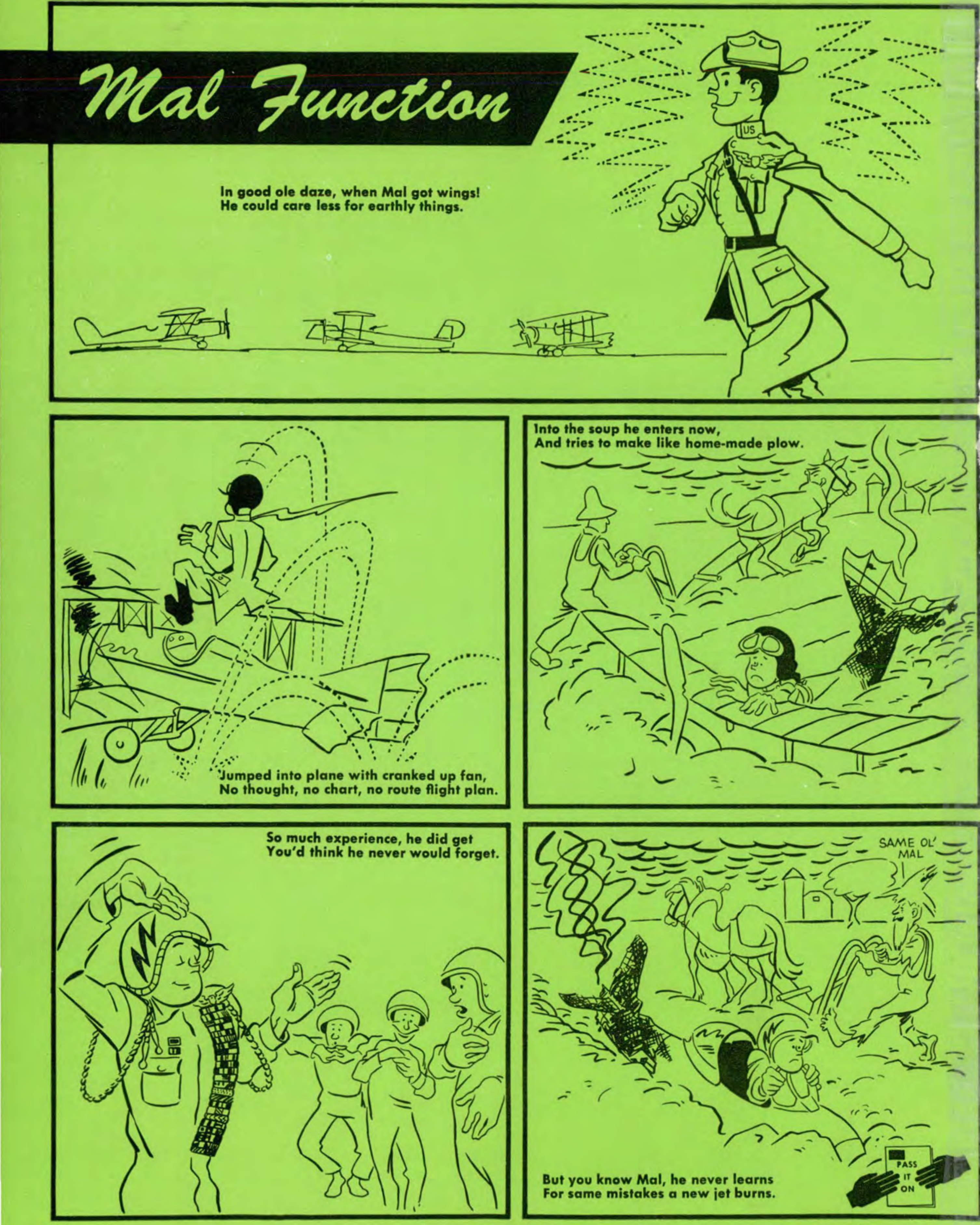
***REX SAYS****—Far too often we all hear about some near head-on collision. When do they happen? During VFR flying conditions. Looks as if some jet lad had no business Maching along at this altitude. Heck of a way to use up JP fuel, I might add.*

# *Pole with a Purpose...*

We finally found a man who knows what it is like to be top man on the totem pole. In fact, this lad knows all about totem poles. He built one.

Perhaps built is not the proper term; let's say he hand-carved one. Why? To keep people in the Alaskan Command flying safety conscious.

Lt. Tex Lane, 10th Air Division FSO, is the handy man with the axe, knife, adz and saw. His finished product, the result of many gallons of midnight oil, took around 1700 hours of after-day labor. It looms at the entrance to the main gate of Elmendorf AFB as a reminder to all who enter that flying safety and accident prevention are everyone's business. The monthly safety records of both jet and reciprocal engined squadrons flank the pole. Here is one more example of another flying safety job well done.

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