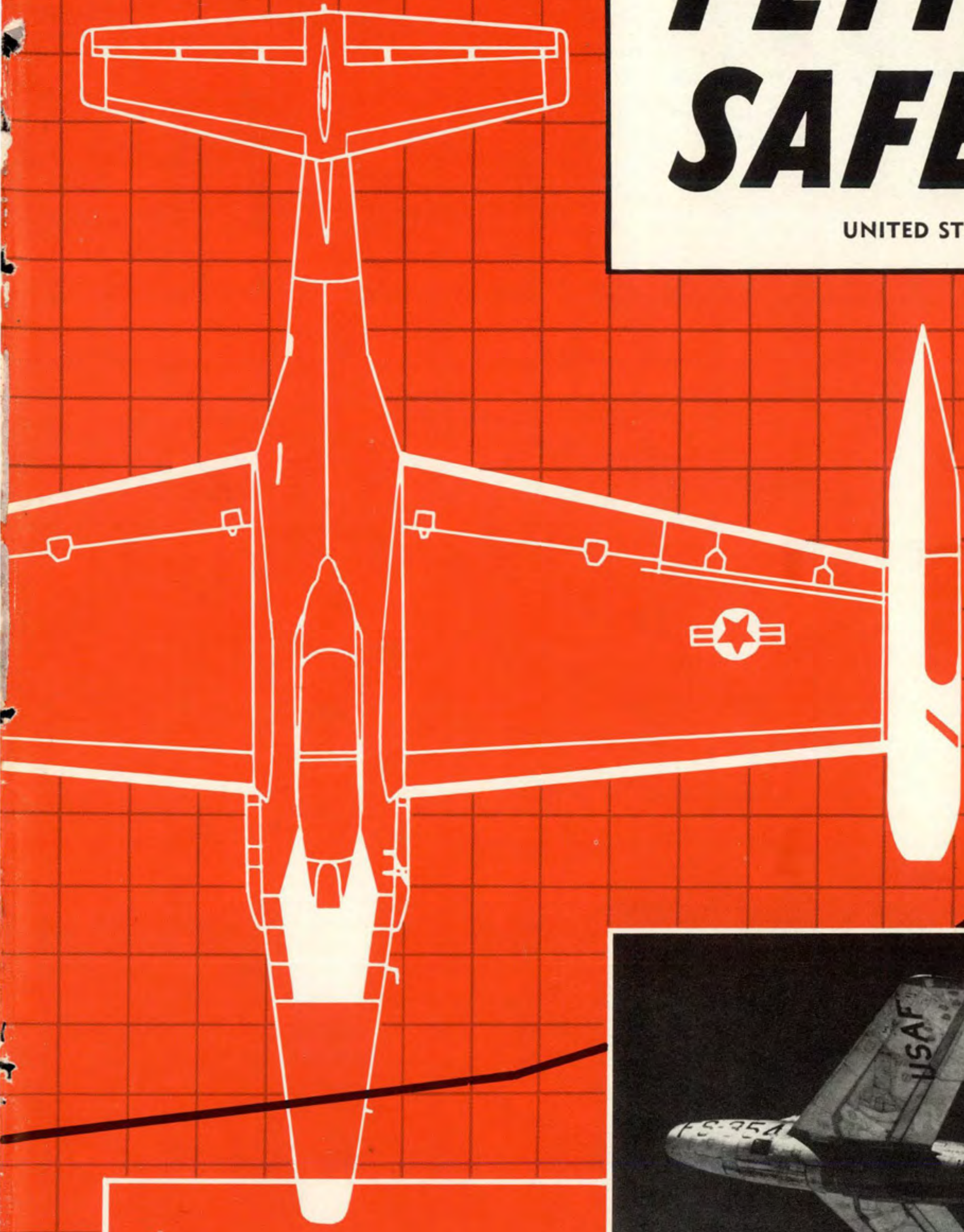
MAY, 1954

FLYING SAFETY

UNITED STATES AIR FORCE



YAW

. . . High Speed Flight Characteristics

FLYING SAFETY

VOLUME TEN
NUMBER FIVE

Department of the Air Force
The Inspector General USAF
Major General Victor E. Bertrandias,
Deputy Inspector General

★ ★ ★

Brigadier General Richard J. O'Keefe
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

★ ★ ★

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Major Chuck Yeager glides the X-1A in for a landing after test flight. Story on page 14.

CONTENTS

SUBSCRIPTIONS

FLYING SAFETY magazine is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

★ ★ ★

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in FLYING SAFETY magazine. Contributions are welcome as are comments and criticisms. Address all correspondence to the Editor, FLYING SAFETY magazine, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PUBLICATION 62-1

Yaw Law

For many years, aircraft designers have toyed with the idea of introducing a true swept-wing design. As airspeeds have increased, so too have the problems that crop up near the sonic wall. Buffeting, aileron buzz, pitch-up and other allied ills have accompanied attempts to squeeze more speed from our aircraft. The logical question then was, will a swept-wing design solve some of these problems?

Some manufacturers firmly believed that maximum performance could be achieved with straight wing aircraft. Others were of the opinion that a swept-wing design was the answer. As a matter of fact, both schools of thought have merit.

As we have progressed further into this swept-wing business, certain flight characteristics have manifested themselves that bear careful consideration. One particularly undesirable trait evolves around stall tendencies when the aircraft yaws. This is more pronounced in some types than others, i.e., fighters vs. bombers and consequently the Directorate of Flight Safety Research decided that a definite study of this and other conditions was warranted.

Accordingly, a series of questions was submitted to the various aircraft manufacturers throughout the industry. In general the questions covered the following:

☆ *In which maneuvers or attitudes are swept-wing aircraft exposed to loss of control because of difference in airflow over the swept-wing as compared to airflow over a straight wing?*

☆ *What are the effects on control when operating multi-engine swept-wing jets with engines inoperative on one side or with partial power on both sides?*

☆ *Is yawing the most significant or the only maneuver which should be avoided?*

☆ *What degree of yaw (or other maneuver) is considered dangerous in swept-wing aircraft?*

☆ *At what speeds is yawing considered dangerous on swept-wing aircraft?*

☆ *What corrective, preventive or precautionary action is recommended for safety?*

This is the first of two articles dealing with the problem of straight-wing vs. swept-wing design as submitted by various manufacturers.

This is the first of two articles, written by aeronautical engineers, on problems facing designers in the swept-wing field.

Republic, Northrop and Bell engineers prepared this article.

By A. Kartveli, Vice President-Chief Engineer

Republic Aviation Corporation

In reply to *Flying Safety Magazine's* request for an article on swept-wing flight characteristics, the following comments are submitted. The questions as listed are taken up in turn.

• In which maneuvers or attitudes are sweptback wing aircraft exposed to loss of control because of the difference in airflow over the swept-wing as compared to airflow over a straight wing?

Probably the most important maneuver that is of importance to the pilot is symmetrical pitch. Many of the current swept-wing aircraft have a pitch-up problem that is the direct result of a swept-wing configuration.

Swept wings, in general, lose their lift first on the tip sections at high angles of attack or from shock-induced separation at high speeds. Thus, as the wing lift concentrates inboard, it moves forward on the wing panel, causing the airplane to pitch up. The resulting changes in downwash flow from the wing to a horizontal tail placed above the wing chord plane further increase this pitch-up effect.

Many types of fixes, such as wing fences or slats, are used today to alleviate or cure this problem. A number of them work well at low speeds during landing and takeoff, but do little to fix the high speed pitch-up problem. Current design practice indicates that locating the horizontal tail below the wing chord plane will cure the problem. The wing pitch-up is compensated by a favorable pitch-down moment from the horizontal tail. Practically all of the latest fighters being designed by all companies will have this favorable tail location. Until the time when these planes are in use, the amount and regions of pitch-up should be investigated cautiously by all pilots, as it will vary between different designs and amount of fixes used.

Pitch-up is not a loss in control problem but rather a change in stability or trim change. The longitudinal control system, elevator or all-movable tail, does not lose effectiveness during pitch-up. If the pilot anticipates and uses his control system correctly, he can control it.

As stated above, flow separation inherently starts at the wingtips of a sweptback airplane. Thus, conventional ailerons located in these regions will lose effectiveness at lower wing lift coefficients than those on a straight wing aircraft. Therefore, this effect should be carefully investigated by each pilot in a swept-wing aircraft. By landing faster and by avoiding extremely high lift coefficients in clean flight, he can avoid most of these difficulties.

At normal angles of attack, the control surfaces of swept-wing airplanes lose less effectiveness with the same increase in Mach number or dynamic pressure than do straight-wing control surfaces. Since swept-wing airplanes are capable of much higher airspeeds, it is a popular misconception that loss of controllability is greater for swept airplanes at low and moderate angles of attack.

• What are the effects on control when operating multi-engine swept-wing jets with engines inoperative on one side of the fuselage only, or

with partial power on one or each side?

This question is not applicable to any of Republic's airplanes, and will not be discussed.

• Is yawing the most significant or the only maneuver which should be avoided?

Yawing is not particularly significant or necessarily to be avoided if the pilot knows his airplane's limits and characteristics. Crosswind landings and takeoffs are about the only times yaw, or rather sideslip, is required of modern swept-back airplanes. At these times, yaw cannot be avoided but must be controlled.

• What degree of yaw (or other maneuver) is considered dangerous on swept-wing aircraft?

Any degree of yaw, pitch or roll that cannot be controlled by the normal use of the control surfaces is considered dangerous. The degree varies widely between various swept-wing designs and again must be explored for each particular airplane. Swept wings have much more roll due to yaw at high lift coefficients (low speeds) than do straight wings. A certain amount of roll due to yaw is desirable. By proper design of negative rather than positive wing dihedral on a swept-wing airplane, the excessive roll due to yaw may be reduced. However, negative dihedral must be used with discretion in order to avoid a destabilizing roll due to yaw at high speeds.

• At what airspeeds is yawing considered dangerous on swept-wing aircraft?

As previously stated, takeoffs and landings are the only maneuvers that require yaw. It is at these higher lift coefficients that swept-wing roll due to yaw is greatest and aileron effectiveness possibly reduced. Therefore, swept-wing fighters cannot be landed at the same speed in as great a crosswind as can straight wing airplanes, unless the design practices indicated below are followed.

• What corrective, preventive or precautionary action is recommended for safety?

Because a swept-wing airplane cannot inherently attain as high lift coefficients as a straight wing airplane, takeoffs and landings will be at somewhat greater speeds. The greater forward speeds reduce the crosswind angles to help the situation. Furthermore, larger and more effective ailerons and the negative dihedral used in correctly designed swept airplanes relieve the situation.

If the pilot has a powerful rudder that is capable of skidding the airplane to large yaw angles, he must be careful near the ground not to exceed an angle at which he can hold the wings level with the ailerons. Conversely this can be helpful if the rudder is used correctly. That is, the rudder at low speeds is very powerful in raising a low wing.

At low speeds, dynamic lateral stability may be somewhat worse than on straight-wing aircraft. Also, because of the trend toward high fuselage inertia and flight at high altitudes, a dynamic lateral stability problem may occur in cruise flight. Usually this problem is classed as annoying to the pilot and reduces the effectiveness of the plane as a steady gun platform.

Normally it is not classed as dangerous, as this "dutch" rolling tendency doesn't diverge. The pilot, by corrective control action, can usually stop the motion and in cases where he cannot, an automatic yaw damper is used in the design. ●

By Wm. F. Ballhaus
Chief Engineer
Northrop Aircraft, Inc.

The chief handling quality problems that arise because of wing sweep-back are:

- The tendency of the airplane to pitch up abruptly at high angles of attack.
- A decrease in aileron effectiveness at high angles of attack.
- A large increase in dihedral effect at high angles of attack.

The pitch-up tendency and the poor aileron effectiveness of swept-wings are caused by the outward spanwise flow of low-velocity air near the surface of the wing, an effect which increases in magnitude as the angle of attack of the airplane is increased. In the case of pitch-up, this low-energy flow tends to separate from the upper surface of the wing near the tips, rendering the tip portions of the wing ineffective compared to the apex portion, and resulting in an abrupt nose-up pitching moment.

If conventional trailing-edge type ailerons are located in this low-energy spanwise flow region, it can be seen that the aileron effectiveness will tend to decrease as the angle of attack of the airplane is increased, because of the increased severity of the spanwise flow with increasing angle of attack.

A swept-wing inherently shows positive dihedral effect even if the amount of "built in" dihedral is zero. A simple explanation of this is shown in Figure 1.

When the airplane is sideslipping to the right as shown, the relative wind strikes the left wing panel very obliquely compared to the right wing panel.

Because of this asymmetry, the lift on the right wing panel is much greater than that on the left panel, thus creating a very large rolling moment to the left. It has been found that the magnitude of this rolling moment increases with an increase in angle of attack of the airplane.

A further consideration in the handling qualities of swept-wing aircraft is the effect of aspect ratio. In general, the higher the aspect ratio the more pronounced are the detrimental effects of sweep, because the spanwise flow effects are accentuated. On the other hand, highly swept-wing aircraft of very low aspect ratio introduce a directional instability problem caused by the severe sideflow effects on the aft portion of the wing and on the vertical tail. The directional instability of this particular type of airplane occurs only at very high angles of attack, and may or may not be readily controllable by use of the rudder control by the pilot, depending on how fast the rate of divergence becomes.

Specific answers to enumerated questions presented by a representative of the D/FSR on his visit to Northrop, 15 February 1954, are as follows:

- Maneuvers which may result in loss of control of swept-wing aircraft can be separated into two types: those involving the abrupt longitudinal pitch-up, and those in which sideslipping occurs when the airplane is at a high angle of attack.

The abrupt pitch-up tendency occurs during high G dive recoveries and high G turns. It is especially dangerous because a pilot's reaction time may be too slow to apply corrective elevator motion before a destructive G load has been imposed on the airplane structure.

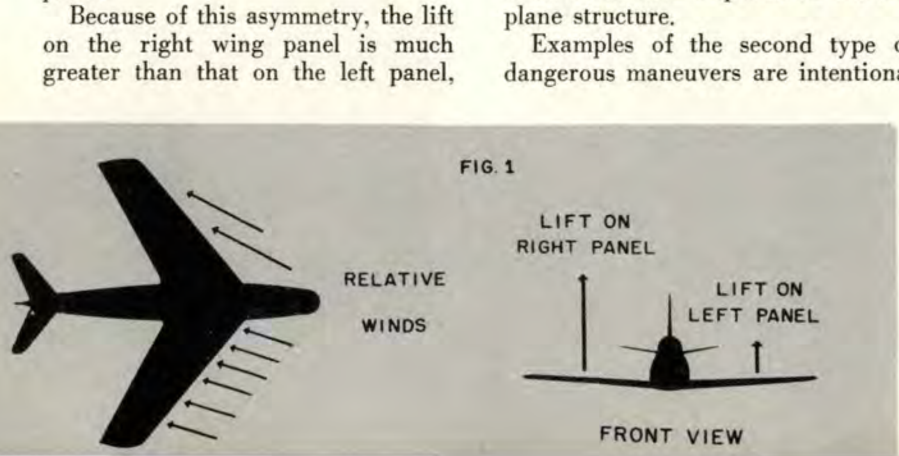
Examples of the second type of dangerous maneuvers are intentional sideslipping in the landing approach, and sideslipping when pulling high G normal acceleration. These maneuvers are hazardous because the sideslip creates a large rolling moment (due to the high effective dihedral of the swept wing) which requires considerable aileron deflection to balance out, and leaves little additional aileron motion for margin of safety.

- On multi-engine swept-wing aircraft, the loss of an engine on one side may or may not result in a serious control problem depending on the particular design and the pilot technique involved. If the sideslip angle is allowed to become too large, the pilot may have insufficient aileron control to prevent the airplane from rolling, as explained above.
- The abrupt pitch-up tendency in high G maneuvers is probably the most dangerous characteristic of the swept-wing airplane as far as pilot-aircraft safety is concerned. The sideslipping maneuver can also be very significant in this respect, because of the possible loss of lateral control at low altitudes, say, during a landing approach.
- The permissible degree of sideslip as far as flying safety is concerned would vary within large limits for each particular airplane. An arbitrary scale for *intentional* sideslips would perhaps be defined as follows: five degrees maximum sideslip when in the landing approach; 10 degrees maximum for any maneuvers at high angles of attack, and 15 degrees absolute maximum under any condition.
- Based on the above discussion, it is indicated that sideslip maneuvers would be more critical at low *indicated* airspeeds because of the associated high angles of attack.
- Recommended preventive or precautionary action:

With regard to the pitch-up tendency of swept-wing aircraft, it should be expected that the manufacturer provide sufficient alleviation, either in the form of aerodynamic fixes, control force or control deflection G limiters, to prevent the pilot from inadvertently overstressing the airplane. Pilot indoctrination and training in this particular handling characteristic is, of course, an important aid here, but may prove to be inadequate for some aircraft designs.

With regard to sideslipping, the precautionary action is for the pilot to avoid large sideslipping maneuvers in swept-wing airplanes. ●

FIG. 1



By S. W. Smith, Chief Airplane Engineer
Bell Aircraft Corporation

Changing the aerodynamic properties of aircraft by incorporating wing sweepback has resulted in differences in flight characteristics between swept and straight winged designs.

In addition, many of the general problems of high speed flight have been attributed to swept-wing planforms because they have been discovered and are continually encountered by operational swept-wing aircraft. While certain flight characteristics are caused by wing sweepback, for the most part sweepback is just one of many factors that may alleviate or aggravate the existing flight characteristics of a specific design.

The performance advantage of swept-wing design lies primarily in delaying the flight Mach number at which the drag rise occurs by reducing the effective Mach number, which is roughly perpendicular to the wing leading-edge. Furthermore, sweep causes a more gradual increase of drag rise and reduces the zero lift drag below that for straight wings. This latter drag effect is somewhat offset by an increase in drag because of lift.

The same geometrical characteristics that reduce the effective Mach number reduce the amount of lift obtained with a given angle of attack, thereby requiring higher angles to support a given lift or weight for swept than straight wings. An example of this is the high attitude angles required when landing highly swept aircraft.

One consequence of sweepback is that the wing tips carry a larger proportion of lift than do straight wings. Sweepback also generates a spanwise flow in the boundary layer which causes undesirable thickening of the boundary layer as it flows toward the tips. This promotes early flow separation at the wing tips with attendant loss of lift. The center of pressure, therefore, moves inboard along the quarter chord, which is a forward movement for a swept wing. This forward motion of the main lifting force causes a noseup motion known as pitch-up. An added difficulty arises when the tip stall does not occur symmetrically, resulting in unbalanced lifts and drags that cause corresponding rolls and yaws.

Recovery from the pitch-up depends upon rapid reversal of the control surface. However, just as sweep decreases the lift variation with angle of attack of the wing, sweep decreases the lifting or controlling capacity of a control surface with deflection. Hence sweptback control surfaces require more deflection for a given maneuver that do straight surfaces.

Many things can be done to relieve the effects of tip stall such as washout, camber, fences, chord-extensions and varying airfoil section. It may also be observed that effectiveness of control surfaces will vary with location and trailing edge contour. It should be apparent that no generalizations can be made about sweptback aircraft to the amount of pitch-up to be expected, when it will occur, or the amount of control deflection that will be required to control it.

As Mach number becomes transonic, changes occur in the flow characteristics over an aircraft which cause an aft movement of the center of lift, a reduction in the effectiveness of the control surfaces, shock waves and changes in many separate aerodynamic items that combine to change the overall flying qualities.

Two transonic effects that accentuate the effect of pitch-up and increase the amount of control necessary for a desired maneuver are the rearward movement in the center of pressure from the quarter to half chord thereby making the airplane more stable and the diminishing of control effectiveness. Each item requires the use of more surface deflection transonically and supersonically than subsonically. Center of pressure shift also causes longitudinal trim changes when traversing transonic Mach number region.

Many aerodynamic characteristics are interrelated in their effect upon an aircraft's flying qualities. Such aerodynamic items as dihedral effect and weathercock stability which are largely affected by sweepback, are as much influenced by factors such as aspect ratio, area, location, thickness and taper. Since many aerodynamic items must be combined to determine matters of as much significance in flying the airplane as lateral and longitudinal dynamic stability, it is an unwarranted oversimplification to attribute these resulting aircraft motions to the degree of sweepback.

Other problems of high speed flight are those of wing heaviness and of buffet at low lift, both of which are related to shock waves on lifting surfaces and subsequent flow separation. When the shocks on each wing are not symmetric as might be caused by a yaw angle or a wing rigging asymmetry, the separation will be greater on one wing, thereby requiring aileron to hold up the wing. The separated flow will cause a buffet whenever its frequency corresponds to a natural frequency of a structural member in the flow field. The effect of sweepback both softens the shock effects and reduces the Mach number range of its occurrence by delaying the onset Mach number while having little effect on the terminating Mach number of about one, when the shock moves to the trailing edge.

Most of the above high speed characteristics cannot be categorized solely by the degree of sweepback of the wings, since they are characteristics of specific aircraft that include other design features that have equal importance with sweepback in determination of the overall flying qualities. Only those phenomena associated with spanwise flow can be attributed directly to sweepback. ●

Fit to Fly

"He who treats himself has a fool for a doctor."

By H. G. Moseley • Colonel USAF (MC)
Chief, Medical Safety Division
Directorate of Flight Safety Research

This month we are presenting two examples of individuals who were involved in aircraft accidents. One was fatal. Both of these cases are true. We believe that they represent food for thought.

★ ★ ★

IT WAS a clear morning. The kind of a day that makes you want to fly. The sky was blue and the surface wind was little more than a warm breeze. A wonderful day to be alive.

The captain was being very careful with his flight planning. He cross-checked the strip map against the latest Radio Facility Chart. Ranges were changing rapidly these days and he had discovered early in his career that one could never depend entirely on a map.

Then he examined the NOTAM file. Nothing to worry about. One en route air base reported construction on runway two-four and six. One range was carried as unreliable. No sweat today. This would be VFR anyway.

He carried the form 175 into weather. The forecaster was busy getting a C-124 crew squared away so the captain studied the winds aloft charts and mentally selected an altitude that looked favorable. In a few moments the forecaster was finished with the Globemaster pilots and turned his attention to the captain. This was an easy clearance. A very few thin scattered alto-cumulus at 20,000 and nothing else. Scrawling his signature on the forecast, the weather officer said, "Good Luck. See you later." and turned to the next crew.

The captain spent another couple of minutes rechecking his flight plan. Everything appeared okay. He had no doubts as to his personal ability as a pilot but he did have a healthy respect for his aircraft and this T-33 was not forgiving of poor flight planning as a conventional aircraft with large fuel reserves.

Picking up the carbon copy of the clearance, the captain walked out to his plane. Again he checked carefully. The machine was clean. The crew chief walked with him as he made the preflight walk-around.

"Everything looks okay," he said to the sergeant.

"She's a good one," replied the crew chief as he helped the captain adjust his parachute.

The sergeant said "she" subconsciously as men have always said "she" when they spoke of fine ships. And she was a good plane, down to every flush rivet, down to the strength and precision of every stringer and former. She should be good; thousands upon thousands of manhours had gone into her perfection and now for hundreds of hours she had carried her pilots safely and comfortably from one end of the country to the other.

This morning she was ready for another mission. That this was to be her last flight was not her fault. The captain had wilfully ignored one vital check. As a result, both he and "she" were destroyed. One moment they were cruising straight and serene. Then they entered a gradually steepening dive to the earth. There was never a change of power setting; not even the simplest attempt to alter the tragic course. Human control had lapsed.

To understand this strange case one must go back a year or two. That was when the captain first noticed that something was wrong. It was evening and he was sitting down reading the paper when it happened. If he had been asked to explain what was wrong, he probably would have said he felt something turning over in his chest and that he felt a slight choking sensation. After a few moments it was over, completely gone. Outside of a bit of perspiration on his brow he was perfectly normal. He did not think anything more of it. Not just then anyway.

However, as time went on he began to have additional attacks of this strange sensation in his chest and twice in recent months he had blacked out completely for a few moments when these spells came. He was afraid that one might happen some day when he was driving. He may have been afraid to think what might happen if he had a spell while flying. Unfortunately he found out. It was too late then.

What is inexplicable is that he never went to his flight surgeon. Even on his annual physical examination he denied any trouble or abnormal physical condition. It may be that he thought his trouble insignificant. It is more probable that he was afraid the doctor would ground him. And that is what would have happened in this case.

The flight surgeon would have told him that he had trouble with his heart, and probably given it some name such as "paroxysmal tachycardia." How long this man would have been grounded we do not know. Perhaps permanently. Certainly until the cause could have been found and eliminated. One thing is certain, the flight surgeon would have saved his life.

Fortunately, there are only a few pilots who delude themselves into thinking they can fly while seriously ill or while suffering from an unpredictable physical hazard. However, between serious or hazardous illness and good health, there are a variety of conditions and a multitude of strange cases.

For our second example we have selected a true story of a lieutenant with a headache.

This case took place in one of our southwestern states and in the winter. The lieutenant, who was a new arrival at the base, was living in an off-base cottage of dubious elegance but which did suffice as a temporary shelter for the officer and his family.

The weather was cold and for several days it had been necessary to keep the windows closed and an open gas heater burning both day and night.

For several mornings the lieutenant had noticed a headache when he arose. It was a rather nasty headache associated with some dizziness, but it usually left before noon. He wondered what his trouble was and thought perhaps it was due to a cold that had been plaguing him for about a week. He was partially right at that.

To help in knocking out the cold, he procured some anti-histamine pills. He had heard and read many cure-all claims for this type of self-medication. Now he was taking one of these pills every four hours. He wasn't sure if they helped very much or not. He did know, however, that he was not feeling very well.

Here we can see an accident just looking for a place to happen. There was one more significant item building up toward the accident in which he was to be involved. That was his oxygen mask. It didn't fit very well. In fact, when he turned his head it leaked rather noticeably near his chin.

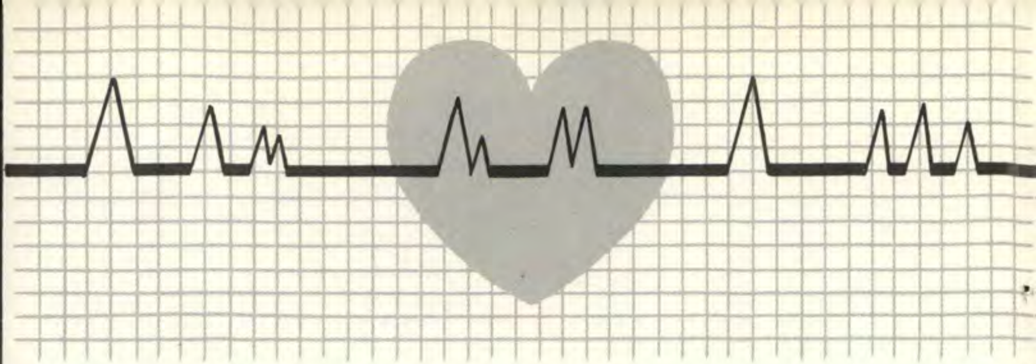
This officer was a walking medical museum of reasons why one should not fly. To start with the simplest of his afflictions, the cold from which he was suffering could have been reason enough to ground him. Further complications evolved around a serious case of carbon monoxide poisoning. We'll get to that a bit later. It's enough to note here that the lieutenant ran out of luck all of a sudden.

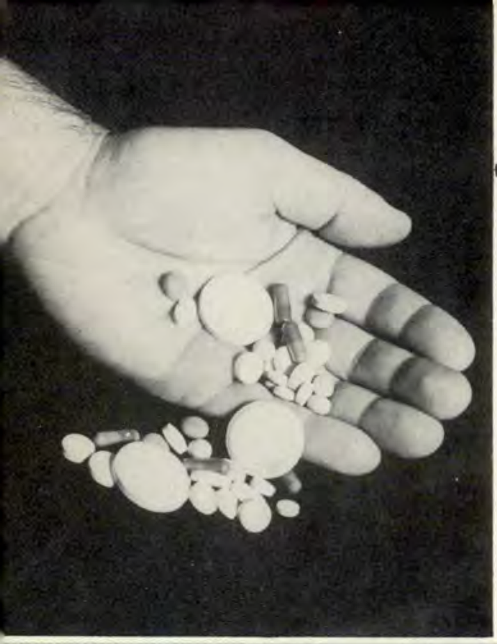
Incredibly, this pilot, saddled with a cold, under the influence of hypnotic drugs, suffering from carbon monoxide poisoning and afflicted with an ill-fitting oxygen mask, started his jet and took off for a high altitude mission.

What is still more incredible is that this lieutenant flew to over 30,000 feet, cruised there for a while and then brought his plane down for a landing. He was groggy and bleary-eyed to be sure but he still possessed the fundamental rudiments of flying technique. He landed the plane short and wiped out the gear. He, himself, was unhurt.

It was not until the next morning when the effects of his various poisons had worn off, that he was mentally alert enough to grasp the seriousness

Suffering from a cold and hypnotic drugs, the pilot landed the aircraft short, wiping out the gear.





Self medication is often harmful. Be sure to see the Flight Surgeon if you're sick.

of the previous day's conduct and probably wonder at whatever guidance it was that brought him down safely.

From a medical viewpoint, whether or not an individual should fly with a cold depends on many factors. However, in general it may be said that if the cold is mild usually there will be no ill effects from flying. But if the cold is severe, and especially if it is of the type known as a head cold, serious consequences may occur, particularly if the flight is being conducted at a high altitude.

Pilots have suffered serious ear conditions from flying with a cold and there have been cases where pilots and crewmembers have experienced such excruciating pain from sinus trouble during rapid descent that it was difficult to maintain consciousness.

The actual decision as to whether or not the lieutenant should have flown with his head cold should have been made by the flight surgeon. In this case, however, the cold was certainly the least of his physical troubles. The treatment the lieutenant was giving himself was a far greater hazard to flying than the cold itself. You probably have heard the saying that "he who treats himself has a fool for a doctor." It's just dangerous business. That body of yours is a delicate and complex machine.

Some of the so-called cold pills contain a drug which is medically known as anti-histamine. This is the type the lieutenant was feeding into his system. For some people, particularly those whose colds are associated with allergies or hay fever, this type of treatment may be very beneficial. However, like all drugs it should be taken carefully. Furthermore, the anti-histamines have an added property which is known as being hypnotic. In other words, it causes drowsiness and lack of mental alertness.

Even under normal conditions those drugs should be taken judiciously and under the supervision of a physician. We must remember too that any anti-histamine is not compatible with flying. Current regulations state that no one should fly within 24 hours after taking such medication.

You'll remember that our lieutenant's troubles first started from a series of headaches. The man himself might have been able to realize the cause of his troubles if he had thought back to his cadet training days and recalled something about the lectures on the dangers of carbon monoxide. He might have remembered that carbon monoxide is a toxic gas and that even a small amount, such as may come from incomplete combustion in a faulty gas heater, can produce dangerous physical symptoms.

Certainly he should have been aware of the dangers of inadequate ventilation in his own home. And, if he forgot all of this, he should have remembered the symptoms of carbon monoxide poisoning. We all had it drilled into us time and time again. Remember them? Headache, dizziness, weakness, sometimes nausea and vomiting and then, if too much of this gas is inhaled, stupor, unconsciousness and finally, death.

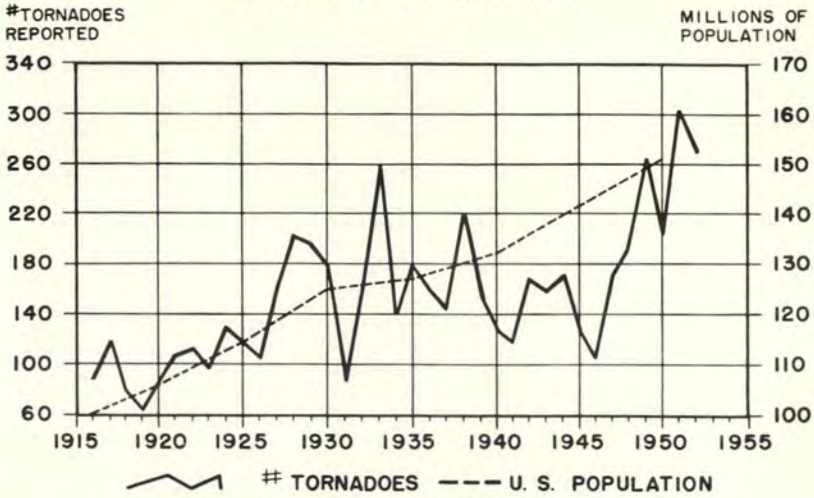
The reason that carbon monoxide is so deadly is that it may be taken up by the blood very easily. In fact, it is absorbed by the blood over 200 times more readily than oxygen. It doesn't take long to put one out of the picture.

What is particularly hazardous about carbon monoxide poisoning and flying is the effects of altitude. As in the case of this lieutenant, an individual may have only part of his blood saturated with carbon monoxide and still be able to walk around, although not feeling too well. However, when pilots go to altitude, they encounter conditions where there is less and less oxygen or less and less atmospheric pressure to push the oxygen into their blood. When the reserve of oxygen carrying power is compromised by being partially occupied by carbon monoxide, stupor or unconsciousness may occur very easily.

The striking thing about all accidents attributable to poor physical condition is that they are 100 per cent preventable. Maintaining good physical condition and giving reasonable concern to health is such a biologically sound principle it's strange that some people attempt to evade it.

No one will ever be censored for turning to the flight surgeon in times of doubt. On the contrary, the strength of the Air Force depends on healthy and willing personnel. Self-appraisal of illness or injury has never proven of any value to the Air Force or the individual; it has cost us both lives and dollars. ●

TORNADO REPORT FREQUENCY CONTRASTED WITH U.S. POPULATION



This is the critical time of year for one of nature's most violent killers, the tornado. You can help to . . .

Tame the Twister!

THE year 1953 was characterized by an unusual number of tornadoes in the United States — 454 were reported and that's an all-time record. Such tornado activity has accounted for severe loss of life and property.

It is interesting to note that although 1953 appeared to have been a banner year, it may be pointed out that all the government weather services have joined with the Atomic Energy Commission in denying that atomic tests in the spring of that year could be responsible for the increased number of tornadoes reported.

The number of tornadoes reported each year from 1916 through 1952 is given in the accompanying table. In view of the apparently increasing trend, it was decided to plot the population increase in the U. S. over the same period and this is shown as a dashed line. The most plausible explanation for the roughly parallel increase in tornadoes and population is that the population growth in the Middle and Southwest has resulted in an increased number of tornado reports from this tornado-prone area.

You may remember a few short years ago when two separate tornadoes hit Tinker AFB. The damage was tremendous and the cost went clear out of sight. It was right then that the Severe Weather Warning Center's system of forecasting tornadoes was conceived by two local weather officers.

The basic mission of the Center is to warn Air Force bases whenever the possibility of a tornado exists in a particular area. The Center is, in effect, an advisory service. Once they spread the word, the local weather officer has to grab the ball and carry it until all danger is past.

Forecasting where a tornado will hit, with any degree of accuracy, is virtually impossible. However, the mere fact that an area has been declared in the "possible" class is enough to set the wheels in motion. The life of these monsters is relatively short (about one hour average) and that leaves little time to do more than properly secure a base and let 'er blow.

A particularly interesting pamphlet, titled "Tornadoes and Related Severe Weather" was published by the Air Weather Service on 15 February 1953. This booklet may be found in every Air Force weather office and should be consulted by key personnel in tornado areas. There's a wealth of information available in the little publication.

Commanders and weather officers should establish a very close liaison at stations where the big blows may strike. The Severe Weather Warning Center issues what they call Progressive Alerts over the AWS teletype circuits and all installations within the suspected area are kept informed of the tornado's progress. However, once again, it is the base weather officer who must watch local conditions carefully.

You may wonder how you as a pilot can assist in the tornado warning program. Here are a few suggestions from AWS. Keep them in mind if you find yourself flying in an area that looks suspicious:

☆ If you note any activity that makes you suspect tornadoes are close by, pay particular attention to the *type* of clouds in that area. Normally, heavy cumulonimbus build-ups will be in evidence.

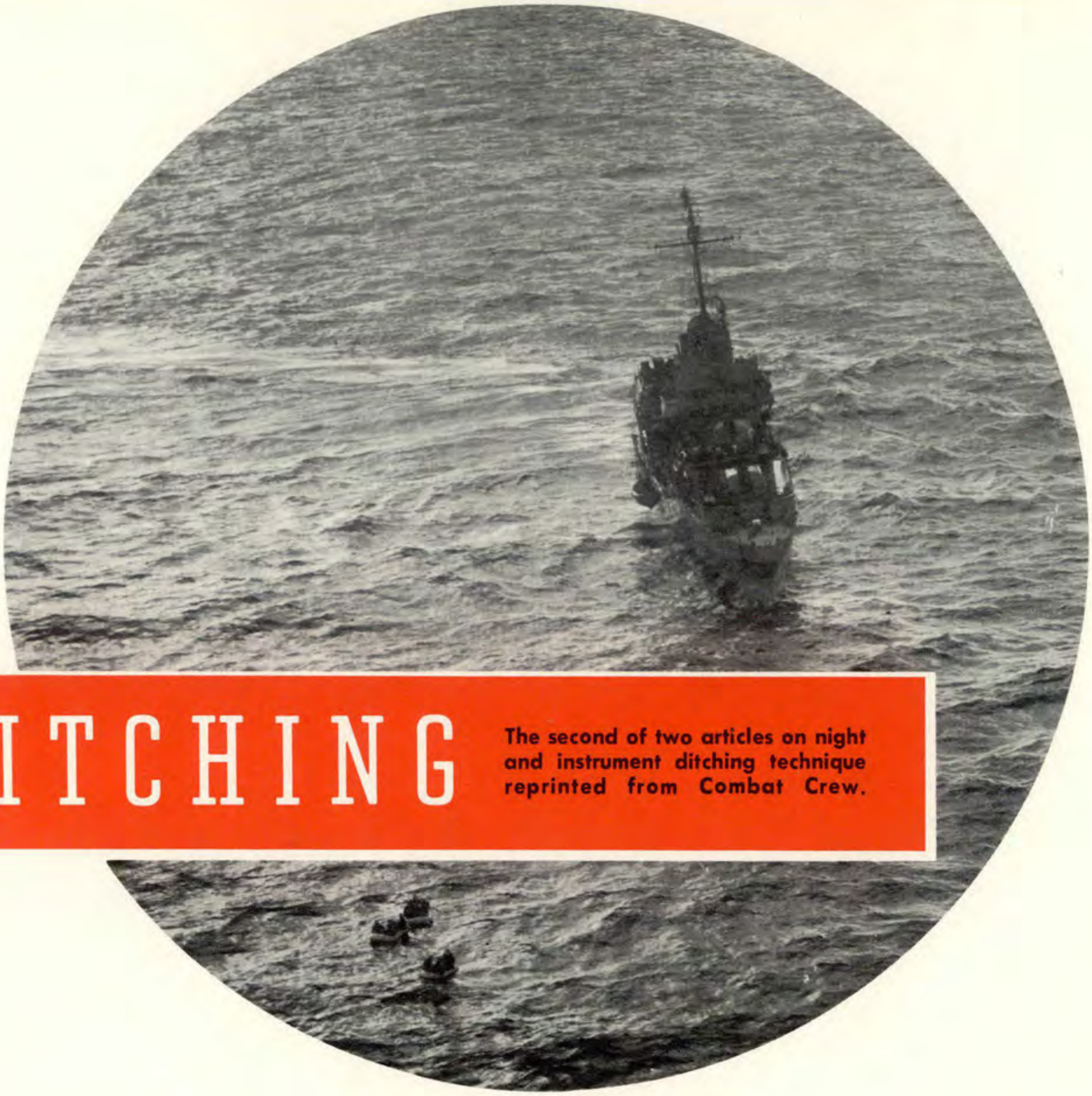
☆ If possible, get a good reading on the wind at your altitude, speed and direction.

☆ If you encounter hail (which is very possible in a tornado area) attempt to evaluate the size of the hail and note, insofar as possible, any structural damage. Structural damage will be in direct proportion to the size of the hail encountered.

☆ Note the degree of turbulence you encounter both on entering and leaving the suspected area.

☆ Call the nearest radio facility and give them the information as soon as possible. In addition to the above information, be sure to include your aircraft type and your airspeed. And at your first stop, give the local weather officer a thorough briefing.

Believe it or not but this kind of information will prove of real benefit to the AWS people. Until the day comes when specially instrumented aircraft and trained crews are available to track these storms, *you* can do your bit in assisting in forecasting the paths of these home wreckers. ●



DITCHING

The second of two articles on night and instrument ditching technique reprinted from Combat Crew.

By LCDR John M. Waters, Jr., United States Coast Guard

IN SOME instances, the pilot of a stricken aircraft faced with a potential ditching may be fortunate enough to have a surface vessel in the vicinity. During daylight he can ditch alongside and expect to be retrieved in short order. At night, unfortunately, very little help in ditching can be expected from the average merchant vessel because of its lack of facilities and unfamiliarity with a pilot's needs.

The ocean station vessels operated by the U. S. Coast Guard have been given extensive training in procedures for the ditching of aircraft, and a heavy training program has been scheduled for them this year.

As each vessel reports in to Bermuda for her 25-day tour of duty, personnel are given lectures, drills, at-sea training with aircraft and flights as members of aircraft crews. This is to acquaint them with the requirements of aircraft in distress. During a recent eight-month period, 16 ships were processed through this program. In the final exercises of the training period, they were required to locate a lost aircraft by means of electronic aids, vector it to the ship and assist the landing by radar with a simulated 300-foot ceiling and one-mile visibility, in addition to providing illumination for the final approach. This program is conducted by aviators who rotate between the ship and the aircraft so they may constantly check the progress from both sides of the picture.

This training has already paid dividends. Recently a Coast Guard cutter assisted a lost aircraft to Bermuda and a landing at the airport when the weather was 300 feet below field minimums. The aircraft had less than an hour's fuel remaining upon arrival over the island. Had the first two approaches failed, they were going to ditch the plane beside the ship which was lying five miles off the island. Fortunately it got in on the first pass.

The facilities and capabilities of these ocean station vessels with their modern electronic equipment are not generally known by pilots. They can be of tremendous help, not only in helping when an aircraft is in distress but in giving timely assistance which will prevent an emergency from developing. We divide the problem of assisting distressed aircraft into the following components:

- Establish and maintain rapid and reliable communications.
- Locate the aircraft.
- Steer it to the ship or to a safe alternate.
- Provide weather and sea condition information.
- If IFR, provide a radar assisted approach or radar assisted ADF approach.
- Provide flare illumination for ditching.
- Rescue and care for survivors.

Familiarity with these components is of vital importance to pilots using these facilities and will make for more effective operations by the OSVs.

Rapid and Reliable Communications

In addition to guarding the aeronautical frequencies, the ship is in continuous communication with its operational commander in New York and the Rescue Coordination Center there. As a result, if a pilot initiates a distress call to an OSV, the RCC is immediately advised, and they in turn throw the entire rescue organization into action. A pilot will probably initiate a distress call through his ground control station. Once an emergency is declared, no effort is spared to assist him. The nearest OSV proceeds toward him and naval and merchant vessels as well as passing aircraft are diverted to help. Within ten minutes after his call, rescue aircraft will be airborne and proceeding to a pilot's assistance. The high-frequency direction finder net will commence taking bearings on his transmissions as he talks and will fix the position accurately. This is all dependent on reliable communications.

Locate the Aircraft

One of the most effective navigational aids, and one that is always available, is the OSV's radio beacon. It usually can be picked up at about 150 miles and enables the aircraft to home to the vessel.

Another extremely reliable aid is the ship's radar, and this is effective at 50 to 70 miles. We hope shortly to have even better equipment. If the aircraft has a defective ADF, or is unable to pick up the ship's radio beacon, the ship can take bearings on the aircraft with the ship's direction finder on any frequency between 200 and 1750 kc. These bearings are not for normal navigational service, but only for emergency use.

Many aircraft flying the ocean are unable to transmit in the low frequency band. In case of emergency, distress signals may be transmitted on 500 kc by attaching the Gibson Girl antenna to a trail or fixed antenna of the aircraft and cranking the Gibson Girl. This will transmit an SOS, enabling bearings to be taken. If none of these aids can be used, the plane should furnish the ship with a Loran or celestial line of position, if possible, or any information on weather that may allow the ship's aerographers to estimate its position.

In the meantime, the high frequency direction finder net will be taking bearings on the distressed aircraft as transmissions are made, and will be furnishing the SAR commander with this information. If you are in distress, and working a ground radio station on one of the normal aeronautical frequencies, radio fixes are being plotted on you by the HF/DF net, often without your knowledge.

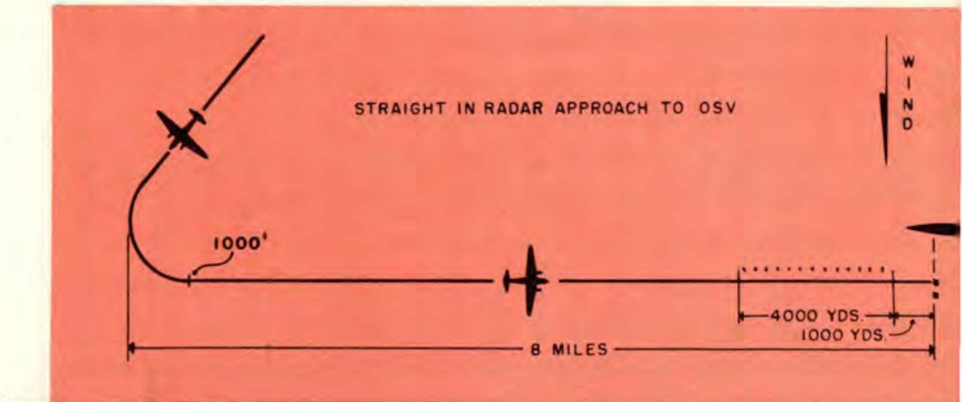
Once a fix has been obtained, the aircraft is given a heading to bring it to the ship. When the aircraft is first detected on radar, it will be tracked for a few miles. If the course and speed as plotted agree with those that the aircraft is flying, the pilot will be given a 90-degree turn for about three minutes for positive identification. Once identified, he will be vectored to the ship.

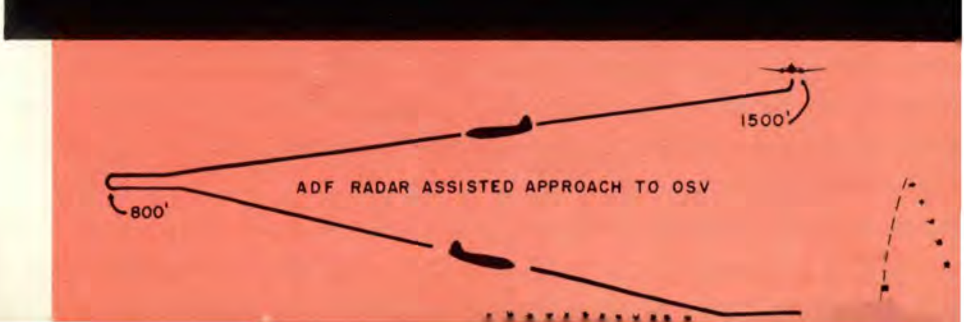
While inbound, the ship will give the weather and sea conditions at its position. On the basis of this, the pilot should advise the ship what his intentions are, and, if he intends to ditch, on what heading. If possible, use true headings rather than magnetic when working a ship, as it greatly simplifies their problem. If it is necessary to steer magnetic, however, they will give all headings in magnetic. The selection of ditching heading is a command responsibility of the pilot, and we discourage ships' captains from recommending one unless specifically requested by the pilot.

While the aircraft is inbound to the ship, all necessary information on type of approach to be used, illumination procedures, instrument approach procedures and the number of people aboard should be exchanged so that no delay is involved when the plane reaches the ship. In most cases of ditching, there will be time enough to plan logically. If the case is urgent, the ship must know the selected ditching heading as soon as possible so as to commence laying sea lane markers when the aircraft is 15 minutes out.

Marked Sea Lane

If the ditching is to occur under night or instrument conditions, a sea lane consisting of a single row of float





lights is laid out. These lights are 200 feet apart and the line extends for 12,000 feet under IFR conditions, and 6000 feet under night VFR conditions. This sea lane aids in lining up for approach, in judging altitude, in marking the ditching spot and in making contact and in shifting from instrument to visual flight.

The ship will be lying upwind of the sea lane so that her high altitude flares will be over the sea lane during the middle of the burning period. At first, our doctrine called for the aircraft to touch down beside the sea lane, just as it would on a lighted runway or seaplane landing area. This has met with great disfavor from many of the airline pilots and some military pilots, due to the possibility of gasoline from ruptured tanks being ignited by the open-flame float lights. To overcome this objection, we moved the ship 1000 yards beyond the last sea-lane float light so that the ditching occurs well clear of the burning float lights.

Once the sea lane lights are laid and the ship takes up position to the side and 1000 yards beyond the sea lane, the pilot can begin his approach. If the night is clear, approach will be the same as an approach to a lighted runway. When the aircraft is five miles from touchdown, illumination with high altitude mortar flares and star shells will commence.

Radar-Assisted Approach

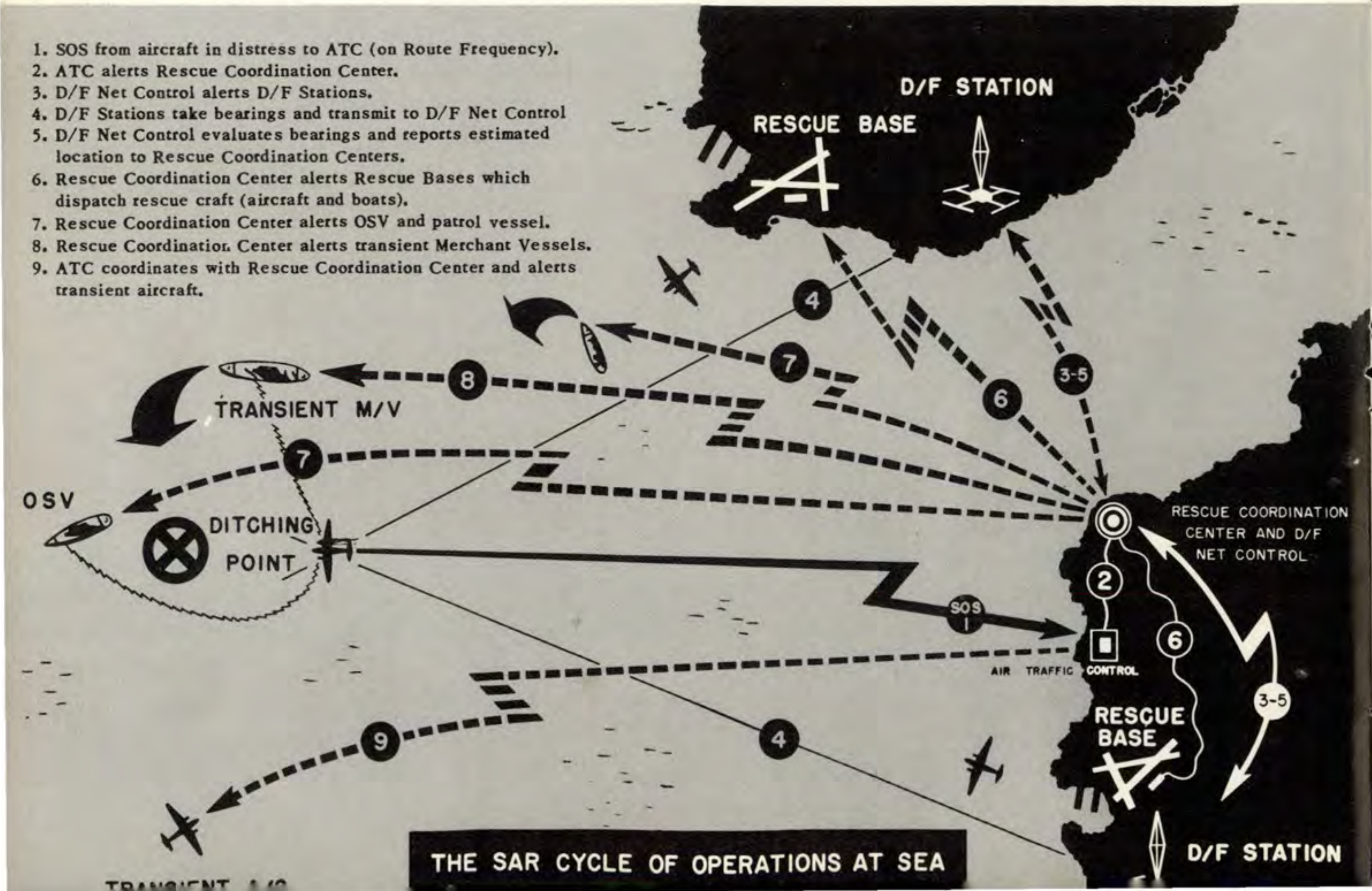
If instrument flight conditions prevail, an instrument approach must be made. We utilize three different types of approach: the pattern radar approach; the straight-in radar approach, and the radar assisted ADF approach.

Each has its advantages and shortcomings. If the aircraft is able to maintain altitude, and has sufficient fuel, we can utilize a pattern approach. The aircraft is vectored over the ship at 2000 feet. It is then turned onto the four-mile initial leg of the pattern and the pilot is instructed to descend to 1500 feet. When four miles from the ship, the plane is turned to its downwind leg and the pilot instructed to descend to 1000 feet. (When we refer to downwind leg here, we mean the leg which is the reciprocal of the ditching heading and not necessarily true downwind.) The plane is then turned on base leg and told to descend to 800 feet.

During the approach thus far, the pilot has been given headings to steer, a constant flow of information on his position with relation to the ship and altitude assignments. The approach is being made on the air search radar, and as the ship has no means of determining the height of the aircraft, altitude assignments are made as recommendations.

As the aircraft approaches the final leg, it is turned on final heading eight miles from ditching point and the pilot is told to descend at his own discretion. This will normally be at about 300 feet per minute. Headings and ranges to touchdown are given until less than a mile from the ship. When the airplane is four miles out, it is picked up on the surface search radar which is more accurate than the air search, and this radar controls the plane during the critical last four miles.

Usually contact can be held until the aircraft is within 1000 yards of the ship, at which point the pilot already should have made visual contact. If the aircraft is below the base of the overcast when two and a half miles from the ship, the pilot should be able to see the sea lane float lights and can follow them to the ditch point. As the aircraft reaches a point five miles from the ship on final approach, the ship begins illuminating with high altitude mortar flares and continues



THE SAR CYCLE OF OPERATIONS AT SEA

this illumination until after the plane is ditched and personnel are evacuated. These flares ignite 1000 feet in the air, and each produces 80,000 candle-power. Because about four are burning at all times, 320,000 candlepower is available for ditching.

The pilot should touch down just short of the flares, and must under no circumstances overshoot, or he will pass from an area of bright illumination into darkness and will be blinded. If any error is to be allowed, the pilot should land short.

If the aircraft is short on fuel, losing altitude or some other factor makes an immediate ditching imperative, we can use a straight-in radar assisted approach instead of the pattern approach. Once radar contact is made, we commence vectoring the plane direct to a point eight miles from the ship on a bearing which is the reciprocal of the selected ditch heading. We advise the pilot to descend so as to be at 1000 feet at the turning point. As he arrives at the point, we turn him on final and the procedure is the same as in the final leg of the pattern approach.

Recently, we demonstrated radar approaches of this type to a large group of military and air line pilots. One experienced commercial pilot objected when the controller aboard the ship gave two 10-degree course changes to the plane when it was within two miles of the ship and below 200 feet. Other pilots agreed with him, and we believe this objection has much validity. We intend, during exercises this year, to give the pilot his last instructions on heading when he is three miles out, even if he is off to the side of his track line. We believe that it will be better to put the aircraft in on a good heading with wings level than to risk turns on the water, even if the illumination may not be as satisfactory.

The accuracy of radar approaches varies with the state of training of the ship, but on the average compares favorably with that which would be possible on a radio-range approach. The shipboard Combat Information Center personnel are well trained. They are expert plotters and radar personnel, but they are not aviators.

During training periods, they receive thorough ground work in aviation procedures so they will know how to best assist the pilot in distress. Nevertheless, in any radar approach a certain amount of control is taken from the pilot and placed in the hands of the surface radar controllers. In an effort to avoid this, the Coast Guard developed a third type of approach—the radar assisted DF approach.

Any pilot holding a valid instrument rating has performed numerous ADF approaches. This procedure could be used easily to make an ADF approach on the radio beacon of an OSV except for the fact that our low cone is at the same position as our landing point. This can be overcome easily, however, if continual radar ranges are available to the pilot. The procedure evolved is as follows:

The distressed aircraft homes to the OSV on ADF. When within radar range, the ship will assist the aircraft in homing-in, and will prepare the sea lane as described previously. When over the ship, the aircraft tracks outbound on a heading which is the reciprocal of the selected ditch heading, and descends so as to be at 800 feet when completing the procedure turn. Procedure turn is made four minutes out. The aircraft then homes to the ship on the selected ditch course, letting down in order to make contact before reaching the ship. To assist the pilot, the ship feeds him constant radar ranges and will also advise him if he is to the left or right of his intended course line.

Illumination will commence at five miles, as previously described. During this type of approach, selection of heading and altitudes is a responsibility of the pilot, and the ship assists with range information only. Control remains in the cockpit.

This procedure does have the disadvantage that a defective ADF will adversely affect the approach, and atmospheric disturbances will often throw the needle off. This was proved conclusively during exercises when the ADF needle of an aircraft, making this type of approach to the ship, pointed to a nearby thunderstorm instead of the ship's beacon, and a missed approach resulted.

During all instrument approaches, a pilot should bear in mind that prior to reaching the illuminated area there is a string of lights 12,000 feet in length that will guide him to the ditch point if he establishes visual contact over the sea lane. It is recommended, that on any type of instrument approach to an OSV, the pilot keep his ADF on the ship's beacon as a double check on the vectors being given by the ship. ADF can be used also to make an approach to a merchant vessel if the merchant vessel will transmit

signals on a low frequency. Transmissions should be 20-second dashes as the ADF needle functions best on continuous tone signals.

High altitude mortar-flare illumination will commence when the aircraft is five miles out on final. For an approach under instrument conditions, this is the only illumination provided, because of certain technical considerations. For an approach under visual flight conditions, however, we provide high altitude mortar flare illumination beside the ship in the same manner as for an instrument approach, and, in addition, provide another area of illumination 3000 yards farther ahead by means of star shells from a five-inch gun.

The only purpose of the star shell illumination is to provide a visual horizon and ditch spot in case the aircraft overshoots the illuminated area beside the ship.

Rescue of ditched personnel is much too broad a subject to be taken up in detail here. This is a matter of good seamanship and will depend on the conditions prevailing at the time. Rescue normally will be accomplished by ship's boats and rubber rafts, or the ship will lay alongside the survivors and drop rubber-suited swimmers into the water to help. In either case, the ship will be only a few hundred yards from the aircraft when it ditches, and help will be available in minutes. Evacuation of the aircraft is a matter for the aircraft's personnel to handle, and normally help cannot be expected from the ship in accomplishing this. The ship, of course, will maintain illumination while the aircraft is being evacuated.

In summary, no matter how black the night or how stormy the weather, the situation never is hopeless if aircrews know what to do and do it promptly. Search and Rescue units stand ready day and night to assist anyone in distress anywhere. It is hoped that no one reading this article will be forced to ditch; however, if assistance is needed, remember: help is never far away. ●

Keep Current

NEWS AND VIEWS

Secured in the bomb-bay of a specially modified B-29 mother ship, the X-1A is being towed to the propellant tanks for fueling.

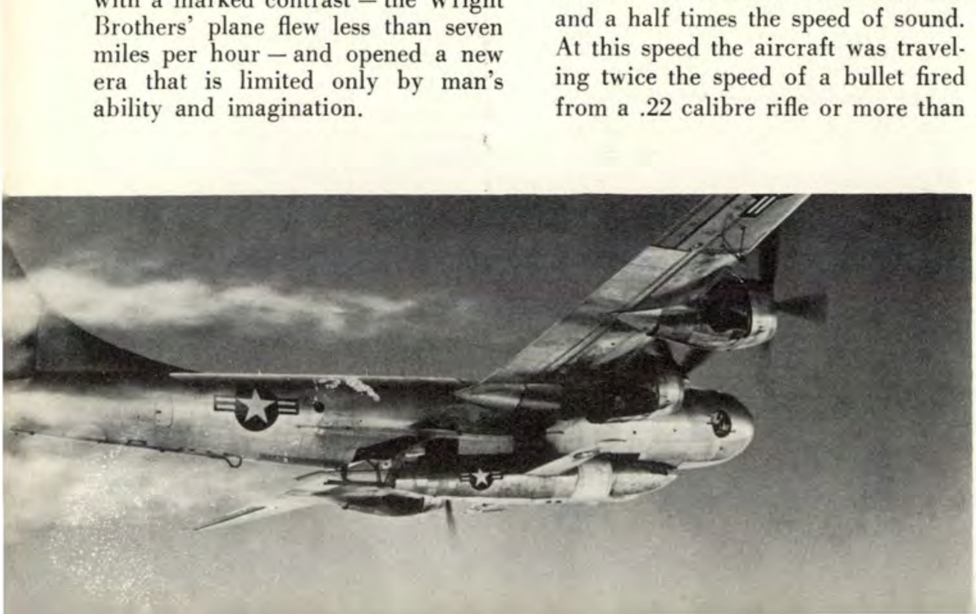
THIS month, FLYING SAFETY brings its readers a picture story of the rocket-powered X-1A on a test flight. A research aircraft built for the USAF by Bell Aircraft Corp., the X-1A was flown on 12 Dec. 53 by Major Chuck Yeager, the world's "fastest man," at over 1600 mph.

The record flight of the X-1A ended the first 50 years of powered flight with a marked contrast — the Wright Brothers' plane flew less than seven miles per hour — and opened a new era that is limited only by man's ability and imagination.

Barreling through the sky at 70,000 feet, Major Yeager, a top Air Force test pilot who made the first supersonic flight six years ago, earned the right to the title of the "fastest man in the world." After being dropped by a B-29 mother ship at 30,000 feet, Chuck gradually poured on the power, climbed to 70,000 feet and flew the X-1A at more than two and a half times the speed of sound. At this speed the aircraft was traveling twice the speed of a bullet fired from a .22 calibre rifle or more than 300 mph faster than any airplane had ever been flown before.

The X-1A is the fifth of the X-1 series built by Bell, and is essentially the same plane as that designed in 1945. It is five feet longer than the original X-1, has a larger fuel tank and is equipped with a turbine pump to force-feed the rocket fuel, an alcohol-water mixture and liquid oxygen, to its four rockets.

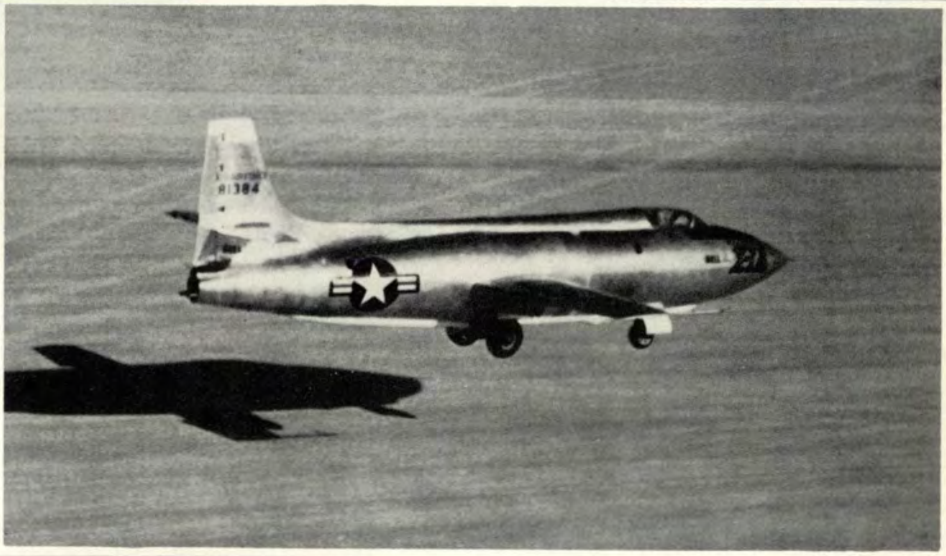
The four rockets develop 6000 pounds of thrust and supply full-powered flight endurance for 4.2 minutes. ●



Mother ship prepares to launch X-1A. White band forward of X-1A wing is frost caused by condensation on liquid oxygen tanks.

Above, the X-1A is not a tactical aircraft. It uses the sky as a giant wind tunnel to solve problems of high speed. Below, fuel exhausted, the X-1A glides in to Edwards AFB.

Above, dropping clear of the B-29, Yeager fires the rockets and the X-1A begins record flight, attaining airspeed of over 1600 mph.



Above, after flying at 2½ times the speed of sound, X-1A lands on dry lake bed.

Lawrence D. Bell, President of Bell Aircraft Corporation, congratulates Major Yeager on his record breaking flight in the X-1A.

AIR FLOW DEFLECTED DOWN AND AWAY FROM RUDDER.

THE "C" AROUND YOU

By Sammy Mason, Flight Test Pilot, Lockheed Aircraft Corp.

WHEN I was first asked to do a story on spinning the F-94C, by FLYING SAFETY, I wondered what there was to tell. After all, I reasoned, the Pilot's Operating Instructions cover the subject adequately and I was sure the magazine didn't want a rehash of the dash one. Still, the Director of Flight Safety Research had asked that the spin characteristics of the "C" be analyzed, so there must be a reason behind such a request.

You know, it's funny how many angles a man will come up with when thinking seriously on any given subject. The more I thought about spins in the F-94C and the more I reviewed the Operating Instructions, the more I realized that although the manual is complete insofar as basic principles are concerned, there are still some fine points worth considering.

About the only way I can lead into a piece like this is to discuss some typical spins. After riding through several hundred in any one type of aircraft, they become almost commonplace, but still, I'm of the school that believes that every flight and every maneuver will teach something new, so let's run over some typical spins in the F-94C.

I don't care whether you're going to fly a Maytag Messerschmitt or a Starfire, the first thing you must do is to complete a thorough preflight check of the plane and make certain that all loose objects are tied down in the cockpit. This is especially vital when you are planning any acrobatic maneuvers, including spins.

We've all had our share of odds and ends flying around the office unexpectedly, such as bucking bars and wrenches and it just isn't fun. So — I say again. Make that preflight check complete and thorough.

Okay, so we've completed our ground checks, fired up the plane and have climbed upstairs to about 25,000 feet. Everything is going along fine and we're ready to do some spins.

First things being first, we clean up the cockpit, trim the plane for level flight and then clear the area carefully. Remember how your instructor taught you to roll that old PT around before you started any acrobatics? You made certain that you had plenty of air around you that was not cluttered up with other airplanes. This is a two-way proposition. You don't want to spin into some poor, unsuspecting soul, and by the same token, you could get a bit irritated if someone came clobbering into your cockpit. So, clear the area carefully.

Now, let's put our F-94C into a normal entry, spin and recovery. Believe me, it's a simple maneuver and I feel you're going to enjoy it.

We'll make this first one nice and clean. Let's check. Gear, flaps and dive flaps all tucked in? Okay, now throttle back to Idle and pull the nose up slightly. Like any jet, the plane seems slow in decelerating but as the speed falls off we start easing the nose up, even more. Nothing extreme, mind you, just a nice clean stall.

The "C" is a kindly aircraft and gives you a lot of warning before it finally pays off. You'll feel it begin to shudder a little and it's right then that we'll feed in plenty of stick and rudder. Remember, this baby is truly spin resistant and it takes a bit of serious effort on your part to get it to heel over and slip into that spin.

You'll note that the rudder forces are rather heavy, especially when we have it trimmed for forward CG, and then as we actually get winding up in the spin, the control forces will increase. By that I mean the forces necessary to hold the plane in the spin. At the same time we begin to encounter a lot of buffeting, mostly tail buffeting. With that forward CG, I prefer not to wind up over a couple of turns for it takes a lot of control pressure to hold her in the spin, and buffeting will increase.

Now to stop it. One easy and sure way is just to release all control pressures. That's all there is to it. You relax and the plane stops spinning right now.

There's been a lot of discussion recently as to various spin recovery techniques. Apparently there are several schools of thought on this subject. However, as far as I'm concerned, stick full back is important while using the rudder to effect a spin recovery. Understand now, I realize that any good airplane will recover from a spin unassisted, but, to stop that rotation right on the button, lead with the rudder and after rotation has stopped, release that back pressure. The NACA people too, recommend this procedure and take it from me, it works nicely.

Again I repeat, trim means a great deal insofar as recoveries are concerned in the '94C. With aft CG you can actually hurry things by pushing the stick forward but with CG trim ahead, you'll find that the back pressure is so heavy, merely releasing it will bring about a responsive reaction. The stick will pop ahead on its own accord if you give it a chance.

The discussion of ailerons in spin recovery still crops up now and again. I do not recommend using aileron in the 94C, in fact, I'm against that practice in almost every airplane I've ever flown.

Actually, in the 94, with a forward CG condition, use of aileron doesn't hurt anything but it may speed up the rotation a bit if you use aileron with the spin.

At aft CG we have a different picture. Aileron control against the spin has a tendency to flatten it out a lot and will louse up the rudder and elevator control a great deal. Then too, if you get a spin stopped while still holding in aileron pressure, the chances are good that the ship will flop and spin in the opposite direction. So remember when you have an aft CG condition, keep the ailerons in neutral.

Actually, in discussing forward and aft CG positions, I am trying to brief you on any possible spin condition you might encounter. Normally, the only time most pilots will fly the F-94C in an aft CG condition is after the nose rockets have been fired. If no rockets are carried, ballast or dummy rockets are installed to maintain forward CG position.

Here's another good thing to remember — and, this applies to most aircraft, especially if the CG is aft. If you are a bit early on the stick when effecting a spin recovery and haven't given the rudder time to take hold and stop the rotation, then you are very likely to experience a momentary speedup in rotation. This can be disconcerting to a new pilot and has probably led to some premature ejections.

Just to prove my point, I've deliberately cranked the F-94C into a spin and then pushed the stick clear forward while continuing to hold hard rudder with the spin. The plane begins to revolve like the well-known button and there is no indication of a recovery. She just keeps on boring around. Some airplanes will get real nasty under these conditions but fortunately that does not apply to this one. All you have to do for recovery is pull the stick way back, feed in opposite rudder, and *after* it takes effect ease the stick forward.

You've all heard of getting out of phase in handling controls. Well, that can happen in a spin recovery attempt. You yank, pull, push, panic and eject! 'Tain't necessary. Just get back in phase and try again. Remember, feed in opposite rudder to the direction of rotation and keep the stick back. Rotation will stop. Then release back pressure for a normal spin recovery.

Now here's another point to remember which applies to any well designed airplane. If you get in a spin with full tips and the CG is well aft, and all of a sudden get in such a hurry to stop the spin that you leave opposite rudder poked in, well, in all probability, the plane will stop spinning, pause for a second or two and then flop the other way. Maybe you'll say that's elementary stuff, and you're right, but, I've known some real sharp guys that forgot elementary stuff and wound up permanently dead.

You're probably wondering how long it takes for the "C" to stop spinning under normal conditions and in clean configuration after recovery control pressure is applied. That's an easy one. Allow about one-eighth of a turn and you'll be right. It's that quick.

If you decide to wind up this plane with a lot of garbage out, such as gear and flaps, about the only real difference you'll note is the increased oscillation; the aircraft oscillates toward the horizon on the average of once per turn. This is especially true if you make the entry on the fast side. On the first turn the nose will tend to come up pretty high and then as you progress into the spin, a dampening effect occurs and every turn will find the nose lower. Of course center of gravity enters into the picture too. The further aft the CG, the higher the nose will ride for a while. In spite of this, recovery is the same as any spin and just as rapid. With dive brakes out rudder is not quite so effective.

Maybe you're wondering about the altitude loss in a spin. Actually that depends on configuration and altitude. At 25,000 feet, for example, with all the garbage in, you'll lose about 5000 feet or so in a two turn spin. This includes recovery. With gear and flaps extended you'll actually rotate faster and consequently the altitude loss per turn will be less. At lower altitudes the loss is almost cut in half, say from 15,000 or thereabouts.

I guess it's the same old question but someone always inquires about flat spins. Does the F-94C tend to get into flat spins? My answer is an emphatic NO. I've been able to force a flattening effect by crossing controls but the bird won't stay there long so we can scratch that problem. It doesn't exist.

On the subject of asymmetrical configuration as related to spins, my advice on the F-94C is the same as with any airplane with an uneven wingtip loading. Don't spin 'em. If you do accidentally and recovery is not effected within a turn or two — drop the tanks. Cheap insurance!

When I first started to get my ideas on paper, I didn't intend to get into the subject of inverted spins. My

Sammy Mason is particularly well qualified to discuss the F-94C spin characteristics for the simple reason he ran the tests. Incidentally he flew the T-33 spin tests, too, so probably he knows more about spinning these two Lockheed products than any other individual.

Sammy has been flying for 19 years and has piled up something over 8000 hours. His jet time is about 1500 hours and he got that in three years as test pilot for Lockheed.

As a member of the old Tex Rankin Air Show, Sammy has been known to make ladies faint and strong men shudder with his acrobatic maneuvers. Today, however, with 5 8/9 children, he is confining his flying activities to the more gentle art of testing the new blowtorches.

reason for thinking this way was because the F-94C makes the same kind of an inverted spin as any other good airplane. However, the more I've thought about that subject, the more convinced I became that a few tips might be extremely valuable to a new pilot. For, although inverted spins are a prohibited maneuver in the 94C, sometimes a pilot enters one inadvertently. If any of you new boys get some help from the following ideas, it will be worth covering this subject.

For the experienced pilot I do not feel that the inverted spin presents any particular problem provided he initiates recovery upon recognizing it as such. The '94C does have a control reversal, similar to many other airplanes. You can work the stick up to a certain point where it will become neutral or negative. Then it'll want to go forward on you. At that point watch out. The airplane will continue to spin even after pressure has been released. Recovery is sluggish and it is possible that you could aggravate the situation until an uncontrollable condition developed.

Until a pilot has experienced an inverted spin, he'll probably be a bit leery of it. When the first one occurs you may wonder which rudder to use for recovery, which way the plane is rotating and so on. Actually, there's not much to it.

The best advice for the beginner is to forget whether the plane is spinning right or left. Merely push rudder against the way the plane *appears* to be turning and hold the stick back in your tummy! If the spin has not been prolonged or aggravated that will stop it, but fast.

You've always got to consider the possibility of slopping into an inverted spin from some acrobatic maneuver, such as stalling out on top of an Immelmann. Fortunately, the F-94C is just as spin resistant on its back as right side up and here again, you've got to work to make it spin, either side up.

Here's another thought to tuck away for future reference: *If you ever get into an inverted spin, you can recognize it at once because both your hands and feet will be pulling away from the controls.*

Incidentally, that is why I feel that although this business of holding the stick back while using recovery rudder in a spin may have been overstressed somewhat, it's still good business. Figure it out. Right side up or inverted, if you can just kick rudder against the apparent direction of rotation, the spin will stop and you can then complete the recovery from either type of spin, as the case may be. I say this because sometimes normal spins, in some planes, can get violent enough to fool the embryo pilot. I don't feel that this latter statement applies to the F 94C, but it's worth remembering.

That's about all I have to offer on inverted spins except this: Unless a new pilot has a few demonstrated while in flying school, the chances are good that he'll not recognize the fact when he suddenly goes from a right side up to an inverted spin. Here's the reason why:

For the sake of discussion let's say this pilot is making a normal spin to the right. Everything is going along okay until he starts the recovery. At this point he fouls up. Let's see what happens.

He applies left rudder against the spin but does not wait long enough for it to take effect. Before rotation stops he shoves the stick forward and is startled to note that the spin is speeding up. A split second later the aircraft goes into an inverted spin. Now, the rudder he was using to stop the erect spin is holding the plane in an inverted spin. Confusion reigns supreme!

If he doesn't get wise, but fast, he's going to run out of sky and luck at the same time. Maybe someone should have told him that he would feel the pull *away* from the controls in an inverted spin.

I would like to re-emphasize one point on erect spin recovery technique. It is really important *not* to use the stick ahead of the rudder, and personally I wouldn't use it simultaneously. If you do come in first with stick the aircraft may wind up for several turns before it wants to recover. The reason for this is that as you use forward stick pressure, you deflect the airflow in such a manner that it misses the rudder. And the rudder is the primary control for stopping the spin.

So keep the stick back until the opposite rudder is in and has taken effect.

I guess that's about all I have to cover on spins. If I've sounded like a primary instructor it wasn't intentional. However, I would like to leave you with this thought: Remember how you used to do snap rolls in light planes? This spin recovery procedure is just the same. ●

ANYMOUSE and his hairy tales

IT'S a well known fact that every one of us learns something from every flight. Any day that you return from a hop into the blue and decide you've learned nothing new, that, brother, is the day you'd best turn in your wings.

So what does this lead to? Well, recently we've been watching a new program swing into action. It's a real deal, dreamed up by our sister service, the U.S. Navy. They call it the ANYMOUSE plan. And it's already starting to pay off.

Basically, the idea evolves around the theory that a close shave with the grim reaper will probably teach a guy *something*. If he can pass on a bit of this new knowledge to the next man, then both will benefit. But how to get this information in the mill?

There are very few intrepid souls floating around the area who willingly admit they've been dopes. Nevertheless, it's conceivable that some of the up-and-locked experiences could, if properly disseminated, prove of real aid to the next fellow.

Right here is where the anonymous report type of form can pay rich dividends. Admittedly the USAF doesn't have such a gimmick yet, at least not Air Force-wide, but it is worth thinking about. It's working well for the Navy and taking hold fast. Why not for us?

The USN encourages its pilots to submit narratives of near accidents or harrowing experiences. The idea is to allow pilots to remain anonymous and still encourage submission. Hence the "Anymouse" form.

It has been said that we learn only by experience. Probably this is quite true, but, if we can profit by close calls that happened to the *other* guy, then we've taken another step forward toward greater flying safety.

Most of you are familiar with old Grandpaw Pettibone. He usually selects a couple of real dillies from the Anymouse reports for his two-page spread in the *Naval Aviation News*. Needless to say, his pages are "must" reading for every pilot who gets hold of that splendid publication. And that goes for Air Force as well as Navy personnel.

Just in case you've never seen the Anymouse form, we're reproducing a copy on this page. The Navy furnishes franked envelopes with each sheet, thereby eliminating the necessity for scrounging in your secretary's desk and, since they are self-addressed, they encourage submission of reports.

The thought has occurred that all Air Force organizations could well profit from a similar plan. In addition to unusual incidents, special emphasis should be placed on hazardous conditions encountered in flight. Also, unmarked obstructions, communications failure or breakdown, inadequate NOTAM service and allied subjects could prove extremely helpful for the next fellow.

Both SAC and MATS have a comprehensive incident report system which is utilized in their respective flying safety programs.

FLYING SAFETY would be tremendously interested in receiving comments on these systems or any new system created within the USAF.

As an interim measure, there's no reason why a comparable reporting plan cannot be worked out at group or wing level. You could do your own organization a lot of good that way, and any time an especially hairy tale showed up, we'd be very pleased to receive a copy. Might just fit in our program too. ●

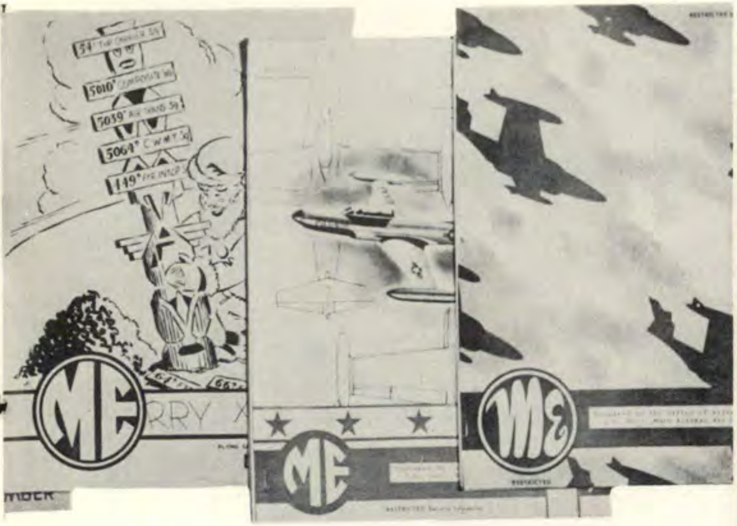
"ME" for YOU!

IT ISN'T too often that we have an opportunity to hand a pat-on-the-back to a sister publication. However, having survived growing pains for a full year and still showing every indication of normal development, "ME" deserves a tip of the hat. And, that doesn't imply that this little squib is written in the first person.

"ME" is a very real magazine, developed by personnel within the Alaskan Air Command and aimed at the problems peculiar to that theatre. A few cover sheets are reproduced here and you'll note that they represent hard work and lots of talent.

As FLYING SAFETY personnel are well aware, it's a never-ending job to dig up good material for publication. It's a greater job to analyze each article, make sure of the facts, determine how each may be best presented and finally, examine all statements for Air Force policy (just the facts, ma'am).

One of the outstanding jobs being accomplished by "ME" is the constant hammering away at safety of flight aspects within the Alaskan theatre. This is no one-man job by any means. Everyone from the commander to



An alert, aggressive flight safety program pays off for the Alaskan Air Command.

the pilot gets in his two-bits worth through the medium of the magazine.

It's a case of come one, come all. The RO with the hairy tale or the crew chief with a new gimmick both get a chance to speak their piece in "ME." Just as long as the subject is slanted toward greater safety in the air or on the line, it's a welcome addition to each issue.

Unlike its stateside counterparts, "ME" is not blessed with modern printing plants or fancy reproduction aids of any sort. Instead, the Editor, A/1C Bill Johnson, has to bird-dog the copy, edit the material, cut the stencils and crank the duplimat machine by hand. Then, after breaking a few icicles off the stapler, he pounds 600 copies together. This we might add, is no small chore.

As if all this were not enough, the editor now doubles in brass and assumes the title of distribution manager, mushing his way from door to door, passing out copies to about a dozen different squadrons. We don't know for sure, of course, but we'll take bets that between issues he probably pulls KP and CQ.

One of Editor Johnson's biggest headaches came from the guardians of the purse strings. He wanted to use color inside the magazine. They said NO. It seemed like a losing battle at first until he hit upon the idea of using colored stock for the covers and vari-colored sheets inside. It worked, too. Now he has the color when needed. He still cranks out the publication with black ink and the whole magazine looks like a professional job any way you slice it.

You are apt to hear all manner of stories about arctic flying. How tough it is. How peculiar the climatic conditions are. How the pilot nicely coming in VFR finds himself blinded by ice fog within a matter of seconds. The accounts, the legends, even the misconceptions are legion.

Okay, a lot of this is true, but some of the tales are pure bunk. That's where "ME" comes into the picture and helps the newcomer a great deal. The magazine has been found the ideal medium to dispel some of the completely untrue tall stories that are thrown at the new arrival in the Territory. We all tend to fling the well-known bull a bit and sometimes such yarns can do a lot more harm than good. "ME" lays it on the line. The articles are handled in readable and, at the same time, meaningful language. What's more, they do not attempt to hide the moral; they blast it right out in the open.

The other helping hand on the staff of "ME" is Dr. Ira E. Chart, who is the official Historian for the Alaskan Air Command. To him, flight safety is a pleasant avocation — and, at the same time, a challenge.

With the approval and backing of the command inspector general, he and A/1C Johnson have teamed up together to make the magazine a living reality.

When one considers the flying conditions in the Alaskan theatre, the various types of terrain that must be taken into account and the "open air" maintenance that is carried on, then the real value of a good safety publication is readily recognized.

On the anniversary of the first year of publication, FLYING SAFETY extends a Happy Birthday to "ME." ●

the BAD and the Beautiful

PILOT error caused 51 per cent of all USAF accidents in 1953. Obviously this figure is too high and should be lowered. This article, while outlining several accidents caused by pilot error, also relates contrasting incidents which illustrate how a pilot's knowledge of an aircraft and emergency procedures can cut this percentage to the minimum.

There is a right way and a wrong way to do almost everything, and this certainly applies to the operation of aircraft, particularly from a flying safety viewpoint. The accidents and incidents outlined here are examples of good and bad flying technique in similar types of aircraft. Notice that the outcome of each usually rested with the capabilities and knowledge of the pilot.

Landing The T-6

The following two incidents are not exactly the same but both occurred in T-6s and at night. One illustrates good flying — one does not.

A student pilot was on a solo navigation mission when, approximately 15 minutes after takeoff at 8500 feet, the engine missed a few times and then quit. The pilot advanced the mixture control to full rich and shortly thereafter the engine restarted. Thinking that the difficulty had been over-leaning, the student re-established his heading and altitude. The engine soon began running rough and cutting out again. He then enriched the mixture, used carburetor heat, checked the primer and used the wobble pump. None of this had any effect and all instruments were checked and read normally. The pilot called the tower and made his difficulty known as he turned back toward the field. He maintained altitude although the engine ran rough intermittently. A power letdown was accomplished over the field and a close-in, 360-degree overhead approach was made. On the 800-foot base leg when the pilot closed the throttle the engine cut out completely. The student then made a successful, gear - down, dead - stick landing.

Weather data indicated that carburetor ice was not the cause of the engine failure but that there was an internal malfunction of the carburetor. Knowledge of emergency procedures and traffic pattern enabled this student to land safely and avert a possible accident.

Unfortunately, such is not always the case. Often, when there is not even an emergency, accidents occur. For example, this pilot was making his first night approach. The IP had instructed him to make a no-flap landing.

He turned on final and was gliding at 90 mph indicated with no flaps. Runway Control gave him a green light, indicating that his gear had been checked and he was clear to land. After turning on his landing lights it was apparent to both the student and the instructor that they were too low and short of the runway. Both pilots applied power simultaneously which caused over-control of the throttle and the engine did not respond readily. The IP observed trees on his left and thought that if he could avoid hitting them he could land safely within the field boundary. At this point the engine responded to the application of the throttle and the aircraft started to climb. Almost immediately the right wing struck a tree which was 1200 feet from the end of the runway and 52 feet above the surface.

The aircraft rolled to the right and semi-cartwheeled in the air until the nose was almost straight down. The IP then applied full back stick and right rudder causing the plane to snaproll around to the right. The left wing and side of the aircraft struck the ground after turning approximately 210 degrees from the original heading. The main gear was sheared on impact and the plane skidded backward on its belly and stopped. Although fire broke out on impact, both pilots evacuated without injury. The primary cause of this accident was that the instructor pilot allowed the student to make a flat, low approach on his first night landing. In addition, the IP waited too long to make a correction and then applied the wrong control movements.

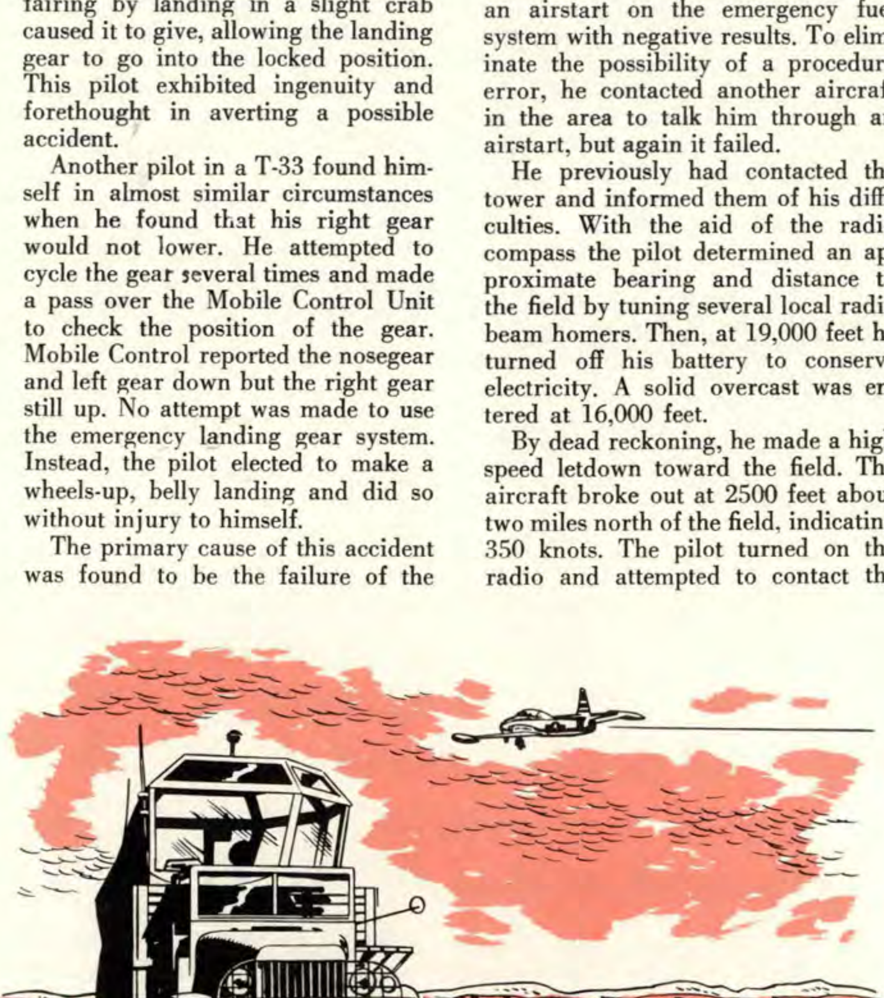
Jet Trainers, Too

Jet trainers also have their "moments of decision." The pilot of a T-33 established a low speed letdown. When the landing gear was extended, the left main indicator did not indicate in the green. The light functioned properly when push tested and hydraulic pressure was normal. The pilot had experienced previous difficulty with the landing gear microswitches and believed this to be the cause of his trouble. The letdown was continued with a GCA pickup. When the GCA was almost completed the run was broken off and a low pass was made over the tower to check the position of the gear. At first the tower reported that the gear appeared down. However, on a subsequent pass it was reported that the left main gear seemed to toe-in. With this information the pilot cycled the gear several times but could not get a down and locked indication. Side slipping and G forces were tried with no success. With fuel low, the pilot chose to drop his tiptanks and proceed with the landing. When touchdown was made he bounced the aircraft on the right gear and landed with a slight crab to the left, causing outward pressure on the left gear. This forced the gear into the locked position. The pilot executed a go-around and landed without incident.

Inspection revealed that the upper part of the left landing gear fairing door had come loose, binding on the under side of the wing and not allowing the left landing gear to extend fully. The pressure put on this fairing by landing in a slight crab caused it to give, allowing the landing gear to go into the locked position. This pilot exhibited ingenuity and forethought in averting a possible accident.

Another pilot in a T-33 found himself in almost similar circumstances when he found that his right gear would not lower. He attempted to cycle the gear several times and made a pass over the Mobile Control Unit to check the position of the gear. Mobile Control reported the nosegear and left gear down but the right gear still up. No attempt was made to use the emergency landing gear system. Instead, the pilot elected to make a wheels-up, belly landing and did so without injury to himself.

The primary cause of this accident was found to be the failure of the pilot to use emergency procedures. The emergency system was tested after the accident and was found to operate satisfactorily.



Sabre Sorties

An F-86F was on a routine flight at 35,000 feet when a severe engine surge occurred as the pilot advanced the throttle from 80 to 100 per cent. He attempted to retard the throttle from full open to preclude the possibility of an over-heat temperature condition; but was unable to prevent a tailpipe temperature rise to 850 degrees. At this instant a slight explosion occurred, followed by an immediate flameout.

The pilot stop-cocked the throttle and began a descent to 25,000 feet. There he tried an airstart on the normal fuel system and was unsuccessful. At 22,000 feet he attempted an airstart on the emergency fuel system with negative results. To eliminate the possibility of a procedure error, he contacted another aircraft in the area to talk him through an airstart, but again it failed.

He previously had contacted the tower and informed them of his difficulties. With the aid of the radio compass the pilot determined an approximate bearing and distance to the field by tuning several local radio beam homers. Then, at 19,000 feet he turned off his battery to conserve electricity. A solid overcast was entered at 16,000 feet.

By dead reckoning, he made a high speed letdown toward the field. The aircraft broke out at 2500 feet about two miles north of the field, indicating 350 knots. The pilot turned on the radio and attempted to contact the tower to give his position as well as request the surface winds. However, because of the weak battery, the radio failed to channelize. With the aid of the excess speed he set up a pattern and, as soon as possible, lowered gear and flaps. He turned on final at 1500 feet, extended speed brakes and, because of windshield frost, opened the canopy for visibility. A gear check revealed an unsafe nosegear condition and the emergency landing gear release handle was pulled. Immediately upon touchdown, the nosegear was lowered and the stick trimmed full forward to get maximum braking action. A series of rapid, hard braking actions stopped the aircraft about 500 feet from the far end of the runway.

Subsequent investigation of the aircraft showed a faulty main fuel regulator. The airstarts were not successful because of a short in the emergency ignition switch. The pilot had only about 500 total flying hours at the time of the incident.

While in a formation at 8000 feet, the pilot of another F-86F heard a roaring sound which he thought to be air. Shortly thereafter, he noticed an unsafe condition on his landing gear position indicators. He attempted to call his flight leader but found his radio inoperative. He reduced power and opened his speed brakes to slow the aircraft enough to permit cycling of the landing gear. The throttle was then retarded to the IDLE position with the aircraft responding only gradually. The rpm dropped slowly to 80 per cent and stopped momentarily. While the pilot tried to lower the gear the rpm dropped to 65 per cent. He then lowered the nose and advanced the throttle to see if he had control of the engine rpm. The engine speed picked up to 80 per cent and remained there.

Deciding to land at once, the pilot entered the initial and made a normal break for a runway using left hand traffic. He was unable to slow the aircraft below 200 knots on the final approach. A low pass was made over the runway. The control tower gave him a red light because of an aircraft parked on the approach end of the runway.

The pilot made a right hand turn at the airfield boundary following the first pass and then flew a rectangular pattern with a right turn onto base leg and final. He did not make an initial on his second pattern although his airspeed was the same as on his first approach — 200 knots. His speed brakes were in, his flaps up and his gear full up. Two pilots in Mobile Control as well as the control tower operators were of the opinion that this, too, would be a go-around, due to the clean configuration of the aircraft. This accounts for the Mobile Control Officer not firing a flare. The operators in the control tower stated that they did give the pilot another red light which was unheeded.

The pilot brought the throttle around to IDLE stop, moved it forward, and then slammed it back in an effort to stop-cock the engine. The aircraft touched down on two empty 200-gallon external fuel tanks about halfway down the runway and skipped slightly. During this skip, the pilot ejected the canopy. The aircraft touched down again about 250 feet from the end of the runway and slid to a stop some 400 feet past the end.

During the subsequent investigation, it was found that the pilot:

- Failed to recognize the need for, and made no attempt to use the generator reset procedure.
- Failed to place the throttle in the stop-cock position when landing in order to shut off the fuel.
- Failed to use emergency procedure for manual lowering of the landing gear during electrical failure.
- Permitted panic to overcome good judgment and in doing so, neglected to use any emergency procedures which could have averted this accident.

Enter The F-94

Often, emergency situations arise which serve to demonstrate superior flying ability of a particular pilot. However, some pilots seem to take the emergency along when they climb into a cockpit.

Below is the statement of one pilot who knew how to handle an emergency:

"I took off in an F-94C to make a visual check of another aircraft which had inadvertently collided with some object immediately after breaking ground. I found nothing wrong with the empennage of the other aircraft and returned to the field for landing.

"Five miles from the base at an altitude of 3000 feet and an airspeed of 300 knots, the tail section warning light, emergency fuel light and fuel pump failure light all came on. I checked the instruments which showed the tailpipe temperature surging from 700 to 1000°C., and the engine rpm increased to 104 per cent. I immediately retarded the throttle but this did not alleviate the situation so I stopcocked the throttle and set up a pattern for the nearest runway.

"The control tower was slow in turning on the lights of the chosen runway but I knew the field and the local area, and continued the flame-out, night approach. The runway was illuminated when I was two miles out on final. I lowered the gear and flaps when I saw I had the field made and touched down at 150 knots in the first thousand feet of the runway. I used the drag chute and completed the landing without further incident."

The pilot quoted above exhibited skill and calmness in completing a successful, night, deadstick landing under adverse conditions.

Yet, some pilots manage to mess up landings when nothing abnormal occurs. For example, take the pilot who returned to the base for landing after accomplishing an air defense mission with no apparent difficulty.

This F-94C was flown in a normal initial and traffic pattern to final approach. On final a combination of a flatter than normal approach attitude, too low an airspeed and a slightly gusty crosswind caused the aircraft to strike the ground approximately 150 feet short of the runway. It then bounced into the air and touched down again on the runway, nosegear first. The aircraft then began a porpoising action which resulted in the collapse of the nosegear and bending of the main gear. The aircraft then rolled about three or four thousand feet down the runway before veering sharply to the left and rolling off into the grass. This veer was caused by the left tire binding against the left strut. The pilot and radar observer escaped without injury when the aircraft came to a complete stop. There was no fire.

The investigation board concluded that the pilot displayed improper pilot technique during the landing phase of the flight and that he failed to recover properly after a short landing, a bounce and the resulting porpoising action.

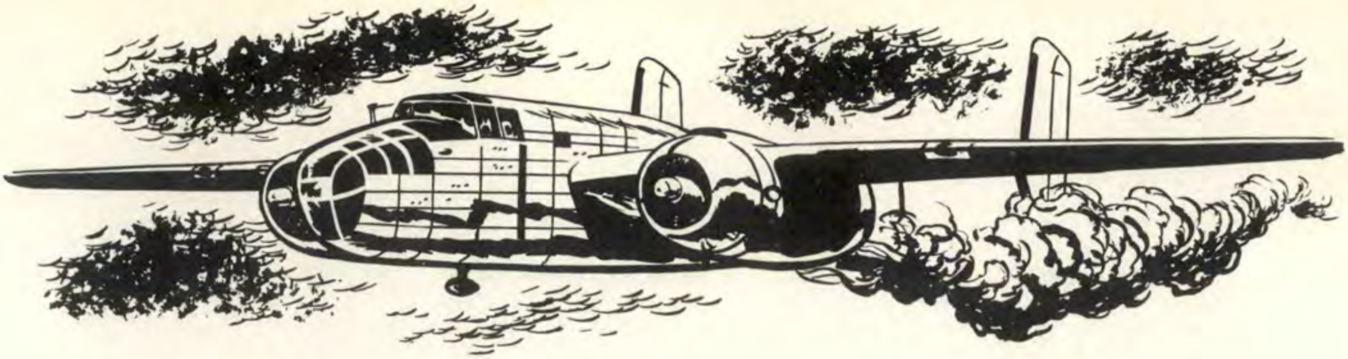
B-25 Emergencies

A B-25J was the target aircraft on a routine night radar mission. After about three hours of flight without incident while some 50 miles southwest of the base, landing lights were turned on to alert the fighter crew of an approaching flight. When the lights were turned off the left one continued to burn. The pilot toggled the light switch several times in an unsuccessful attempt to extinguish the light. It surged to extreme brightness, flickered, burned dim and then went out.

The pilot and copilot simultaneously detected burning fumes and noticed excessive grey-white smoke pouring from the left wing root. The pilot immediately turned off the battery, navigation lights and radio switches. As he was telling the copilot to turn off the generators and inverter in the upper turret compartment, a severe yaw was experienced. The left engine manifold pressure surged and there was a complete loss of power in the left engine. Single engine procedure was performed but the engine failed to feather.

At this time smoke was so thick in the pilot's compartment that neither pilot was able to breathe normally and they had difficulty keeping their eyes open. In order to read the instruments, the copilot had to hold a flashlight within six inches of the panel. All cockpit light switches, including the fluorescent lights were placed in the OFF position. The two men checked their parachutes but elected to wait a "reasonable length of time" before leaving the plane.

As the smoke began to clear from



the cockpit, more attempts were made to feather the prop but to no avail. Smoke intermittently filled the compartment during the return to the base. The pilot briefed the copilot on gear and flap lowering procedures, for all the indicators and the horn were inoperative. Hydraulic pressure was normal.

The plan was to land on active runway, if traffic permitted, or to the east of the runway on the grass should there be some obstruction. About five miles from the base, a letdown to 1500 feet indicated was made. The aircraft was then about two miles from touchdown and good visibility on the initial, base and final approaches was made possible by entering slightly below pattern altitude. Gear was lowered by the copilot and checked visually about a mile and a half from touchdown. When hydraulic pressure returned to normal, one-half flaps were lowered about three-quarters of a mile from touchdown by using the counting method. An uneventful blackout landing was made on the first third of the runway and the aircraft was turned off the runway, engine cut and brakes set. The crew abandoned the aircraft.

The investigation revealed that the left landing light relay switch had stuck, causing it to overheat. The resulting short and burning insulation burned all other wires in the junction box in the left engine and the conduit in the left wing root. The engine would not feather as the wires to the feathering motor were burned.

Unfortunately, all pilots do not recognize such emergency situations quickly enough to deal with them adequately. In the following accident the pilot, copilot and crew chief were all highly experienced personnel.

The B-25J was on a local test flight after a major inspection and number one engine change. Preflight and engine runup checks revealed no discrepancies. Takeoff was normal and the aircraft climbed to 10,000 feet. Test flight checks using the check sheet proceeded normally as the aircraft was flown in the local area until the number one engine was feathered. The prop feathered normally and was unfeathered after about a minute at which time it overspeeded to approximately 3000 rpm with the propeller control in low rpm position and the throttle retarded. Several attempts were made to feather, and to control the prop, none of which had any effect.

The engine was cut off and the prop continued to windmill at about 2300 rpm. The aircraft started losing altitude slowly while being flown back to the base. The pilot declared an emergency about two miles from the field at 7000 feet.

The aircraft was flown over the base where loss of altitude indicated the necessity to land immediately and a pattern was set up. Further loss of altitude required abbreviating the pattern and lining up with a different runway. As the turn on to final was made, the gear was started down but was retracted immediately when it was determined that the runway could not be made with the gear down. A decision was made to land on a dry lake bed one mile east of the base.

The B-25J was rolled out of the turn and held level, power was cut on the number two engine and the aircraft touched down tail first. The landing was smooth with no rebound. The right engine touched slightly ahead of the left. The aircraft slid 528 feet to a stop, rotating about 45 degrees to the right. No fire occurred and no injuries were sustained.

Of course, the primary cause of this accident was the malfunction of the prop governor on the number one engine. However, a contributing cause lies in the failure of the pilot to use proper judgment in recognizing this emergency in sufficient time to attempt a landing while he had adequate altitude over the airfield.

B-45 Complications

The B-45A was in a descent at an airspeed in excess of 400 mph when the left main gear uplock failed. Severe vibration and a violent bank to the left was accompanied by a loud noise. Immediate stability and control of the aircraft were momentarily lost. With a reduction of power control was regained. Visual inspection indicated that the left main gear had extended and had swung past the full down and locked position. All efforts to retract the gear failed. Due to broken lines, all hydraulic fluid was lost. Because of the position of the gear the navigator was unable to bail out so the decision was made to crash land.

Weather at the base was reported as 600 feet overcast — visibility one and one-quarter miles in fog. While lowering the nose and right main gear during the descent the weather had deteriorated still more and darkness had closed in. The fuel supply was diminishing because of the low altitude operation during the emergency procedures.

GCA was contacted and an approach established to land on a 9000-foot runway. The aircraft broke out of the overcast directly on the center line of the runway at about 300 feet. Touchdown was made 2000 feet down

the strip and the aircraft came to rest 4000 feet from the point of touchdown, 300 feet to the left of the runway. No flaps were used during the landing.

The board concluded that the failure of the left main gear was caused by one or a combination of the following:

- Malfunction or improper adjustment of the left gear uplock mechanism.
- Failure of the retract cylinder mounting lug casting on the left gear.
- Possible adjustment of the landing gear door uplock mechanism.

However, the ability of the aircraft commander to accomplish the crash landing under extremely adverse weather conditions resulted in a minimum amount of damage to the aircraft and no injuries to the crew.

FLYING SAFETY believes this pilot displayed outstanding flying technique. His knowledge of the aircraft combined with cool, quick thinking averted a major accident under emergency conditions compounded by bad weather.

Even The Gooney

The Gooney Bird was on a scheduled over-water navigational training flight. The crew and passengers had received overseas briefing and a refueling stop had been made without incident. Almost two hours after takeoff, the right engine started losing oil pressure. A check of other instruments revealed no increase in oil or cylinder head temperature. The pilot and copilot acknowledged the possibility of a faulty oil pressure gage, but maintained a close watch on all instruments. The pilot requested exact position and distance to destination from the navigator and the crew chief was sent for a visual inspection of the right engine.

Shortly thereafter, the right engine ran away and no corrective action seemed to help. The order was given to feather and a single engine operation was set up. Considerable difficulty was had in feathering the engine and three cycles were necessary.

A course was set up for the nearest landing strip and the details of the emergency were relayed to nearby radio stations to alert Air Sea Rescue and D/F stations. All passengers were briefed on the emergency and a check was made of all personal and survival equipment.

The weather was broken undercast at 3000 feet with occasional build-ups to 9000 feet. Moderate to severe turbulence was encountered. With 35″ and 2400 rpm setting, 95 mph could be maintained and altitude held, but the good engine heated to 250 degrees cylinder head temperature. Emergency rich mixture had to be applied to bring it down to 220 degrees. As some of the fuel burned, the airspeed picked up to 100 and then to 105.

The radio operator reported that the D/F stations had the aircraft located and a rescue plane was on its way to the position. The navigator checked and rechecked the course which later proved to be "right on the nose." When the new destination was reached, no ditching could be attempted as poor visibility kept the pilot from distinguishing water from land. All personnel were briefed and prepared for bailout in case conditions got worse.

To further complicate matters, the charts indicated a 4900-foot runway, but the tower reported the first 1100 feet under construction. Altitude of 700 feet was maintained until the aircraft was directly over the field. Everyone was strapped in tight and the letdown was begun. A perfect approach and smooth landing were made. The C-47 had flown two hours and 20 minutes after the right engine had failed.

And Then There Are These

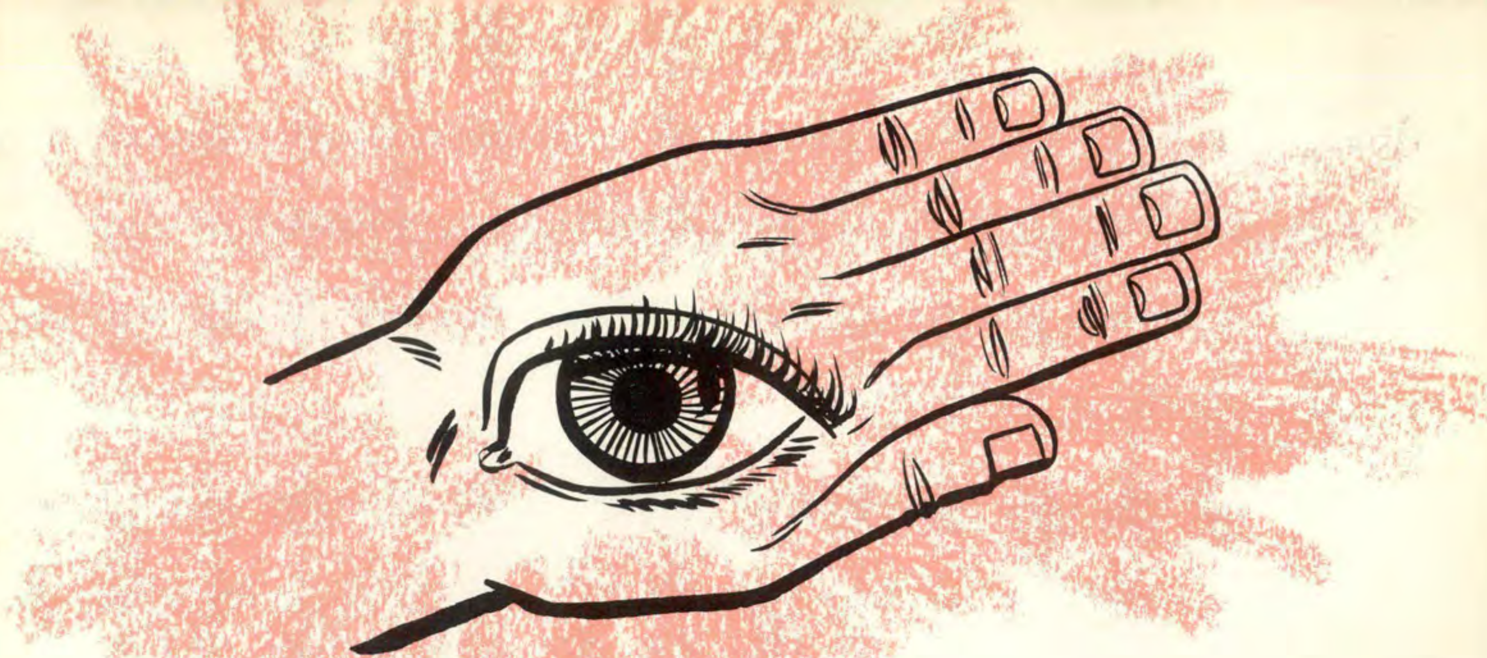
This C-47 entered the traffic pattern in a normal fashion. The checklist was used and both engines were operating satisfactorily. Approximately one half a mile from the runway at 400 feet the left engine began backfiring. Airspeed was between 100 and 105 mph and flaps were full down.

The pilot advanced the throttles and although the right engine responded, he did not believe he could make the runway. He immediately raised the gear but did not raise the flaps to an intermediate position. At this time the aircraft was slightly off to the left of the runway. The copilot and engineer thought the left engine began developing power. Both called "Let's go around." An attempt was made to go around but altitude could not be maintained. The course was altered to the left to avoid hitting a small building and a crash landing was made.

The tailwheel touched down 1500 feet down the active runway and 425 feet to the left. The aircraft stopped after the right tire blew out and the aircraft made a 90-degree turn to the right. Point of touchdown to point of stop was 600 feet.

The investigation board found that the pilot did not follow prescribed procedures for the failure of an engine in flight. He did not feather the left engine, raise the flaps to a position where they would create more lift than drag, use the proper amount of power from the right engine to maintain control and lost directional control. The pilot indicated a lack of knowledge of aircraft performance during single engine operation.

Obviously pilot error causes accidents. And just as obviously pilot effort can prevent an accident or keep one from becoming serious. Make sure yours is an effort not an error. ●



when GLARE is there...

Captain D. L. Cooper, FSO, Hq Sq 6612th AB Gp, Thule AB

THOSE who should know claim that one way to achieve fame in this highly competitive world is to build a better mousetrap, or a variation thereof. Lately, USAF pilots have been exposed to a wide variety of these mousetraps in the form of new eye shields and hoods for instrument practice. Some of them were simple, some complex; all of them had many good points. But the pilots at Thule Air Base believe they have been given one of the better mousetraps.

Any pilot who has ever flown into the sun has at one time or another placed his hand before his eyes. With a slight adjustment of his hand, this squinting pilot probably picked up a few minutes of instruments without using a shield or hood. It stands to reason that if one hand can cut down outside glare, something a little larger could restrict vision to the inside of the cockpit, provided that this something is close enough to the eyes.

Up here in the land of the midnight sun and arctic glare, Capt. Vernon W. Fisher, formerly of the 6612th Air Base Squadron, became tired of flying with one hand. He was aware of the problems that the present shields and goggles presented; of their bulkiness and weight, and the steam and fog they generate when a pilot is sweating it out. He decided to find out just how small and light an effective instrument shield could be. And up here he had 24 hours of sunlight everyday to further his quest for suitable materials.

His search took him to the base hospital. There he noticed that the operator of the X-ray machine occasionally over-exposed the film when things got busy. This ruined film was both light and dark; lightweight and dark colored, that is. Proper size and shape were taken care of with a pair of scissors.

Captain Fisher's next problem was how to mount the shield. In the Arctic, where the continuous sunlight on the snow during the summer months produces a terrific glare, dark glasses are a must. Fisher mounted his first shield on the arctic glasses issued each pilot. He then designed a second shield which can be used when there is no glare and conditions are normal. This shield is mounted on a lensless set of frames or over your regular glasses, if you use cheaters to tool around the countryside.

Captain Fisher passed some of his better mousetraps around among the pilots at Thule to get their reactions to the shield's weight and air circulation. The boys bought the idea completely; the whole contraption weighs only four ounces and is no more uncomfortable than any other pair of glasses. Air circulation is free and complete since the shield is worn in the same way as are any pair of glasses. It can be worn with a headset, crash helmet or a ball cap for long periods without the feeling of weight so common to the larger shields.

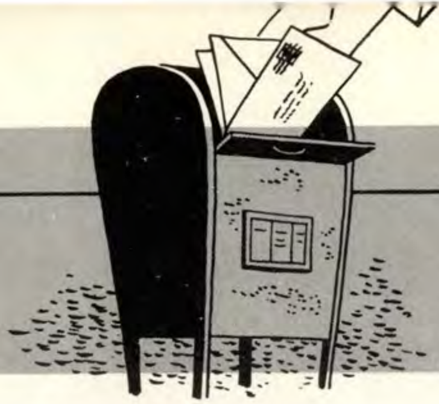
Frames and X-ray film make ideal glare shield.

The shield, as illustrated in the story, is particularly adapted to instrument flying in a B-25, C-47, C-54 or a T-29. For use in a B-29, B-50, C-46 or B-36, it may have to be modified to compensate for the lower windows in the sides of those aircraft.

Directions for making a shield for your use are as follows:

- Take a piece of over-exposed X-ray film and cut and bend it to the desired size and shape.
- Cut two slits on either side and insert the earpieces of your glasses or empty frames.
- Get in an iron bird, with someone to safe-observe you, and take off on one each instrument flight.

We here at the top of the world think we have found a better instrument shield. So, some evening, "when the dogs are fed and the stars overhead are dancing heel and toe," why not give it a try? We did, and can guarantee it works. ●



CROSS FEED

LETTERS TO THE EDITOR

GCA Capabilities

In your February issue a very interesting article was published under "Keep Current" and credited to AACS, discussing the merits of GCA. This article stated in part, "GCA is capable of controlling any type aircraft to touchdown dependent only on the proficiency of the pilot and radar operator." The USAF Instrument Pilot Instructor School is of the opinion that we are building false security in the minds of inexperienced pilots charged with operating first line aircraft. Our opinion is based on several facts derived from active participation in over 1000 GCA runs per month at Moody AFB.

1. Some jet aircraft are easily lost on both search and precision radar scopes during moderate to heavy precipitation.

2. Considering a time lag of five seconds between an accurate observation by a controller and subsequent correction applied by a competent pilot, an aircraft at average approach speed will travel approximately 800 feet forward and 50 feet down. This is sufficient vertical and horizontal velocity to make quite a dent in the sod.

3. No mention is made of the probability of stopping the aircraft safely after touchdown.

We have utmost respect for AACS and GCA but we also have respect and an obligation to the people responsible for writing our regulations. The implication that a pilot may merely call GCA and then safely land the aircraft under any weather conditions is erroneous. A pilot and controller combination possessing the skill and judgment necessary for a weather approach and touchdown would be an extreme rarity. Are we facing facts?

Although we are progressing toward our goal of an all-weather Air Force, we are still somewhat removed from the era of "approaches to touchdown" whether it be automatic or pilot controlled. We recommend using available facilities to the full extent of their capabilities, but let's not gamble with government money. Aircrews and aircraft are expensive.

Col. Dean Davenport
Commander, 3550th FTG
Moody AFB, Ga.

Colonel Davenport's point is well taken. FLYING SAFETY did not mean to imply that a pilot could land safely under any weather conditions merely by calling for a GCA run. We wished to show that a pilot can make practice runs below minimums, and, under emergency conditions, should utilize GCA capabilities to the fullest extent of his ability to fly instruments safely.

★ ★ ★

Request from Canada

We have read with considerable interest the article "Foul Winds at Fairweather" that appeared in the January 1954 issue of *Flying Safety*.

This article would be of considerable interest to our forecasters, especially those serving flights in the West Coast area, as well as to Canadian Pacific Lines and the RCAF in their West Coast operations.

I would be grateful if you would advise whether it would be in order for us to reproduce copies of this article for distribution to our forecast offices, Canadian Pacific Air Lines, and the Royal Canadian Air Force. Full acknowledgment of source and permission would, of course, be given on the reprint.

Andrew Thomson, Controller
Air Services Meteorological Div
Department of Transport
Toronto, Ontario, Canada

Good idea. Let's spread the word.

★ ★ ★

Ground Safety Device

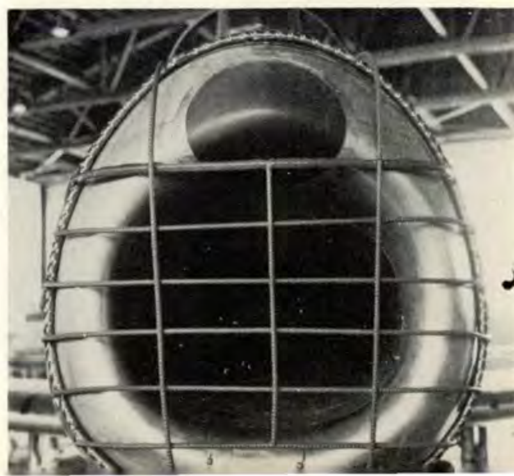
This unit of the Washington ANG has maintained a perfect ground safety record since reorganization from active duty, 1 May 1952.

Here is a picture of an F-86A nose cover, built and used by this outfit for high speed ground operation of jet engines. We are sending this to you in the hope that you can use it in FLYING SAFETY and help other units with a similar problem.

Capt. Charles L. Nelson, Jr
CO, 116th Ftr-Int Sqdn
Washington ANG, Geiger Fld, Wn.

Lt. Colonel William Benedict made a successful take-off and landing in this ski-equipped F-80. The '80, which crashed in Alaska, was repaired but could only be flown out on skis, using jato.

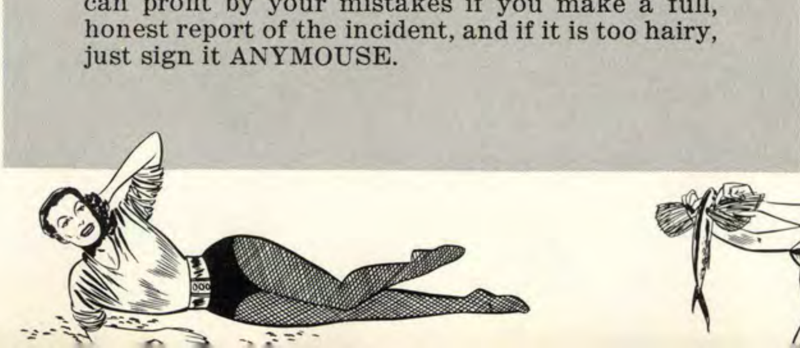
This F-86 nose guard was designed by a unit for use during high speed ground operation.



Any Mouse Will Do....

In the spring a young man's fancy wanders through strange and wondrous channels. This month, **FLYING SAFETY** comes to the male animal's assistance with a bevy of beauties a la Steve Hotch.

In a more serious vein, the Anymouse program as outlined on page 19 deserves serious consideration from all commanders and flying safety officers. As a part of an accident prevention program, incident reports, either signed or anonymous, have a tremendous educational value. Other pilots can profit by your mistakes if you make a full, honest report of the incident, and if it is too hairy, just sign it ANYMOUSE.



Mal Function

Mal has cold, treats himself
Lots of medicine from the shelf.

Sick call line is just for dopes,
Mal's not grounded, he knows ropes.

At 35,000, pills work magic
End result will be quite tragic.

Mal comes down, but things seem hazy,
Eardrums pop, plane acts crazy.

No more flying for this lad,
Wings not issued by old Dad.

★ U. S. GOVERNMENT PRINTING OFFICE . . . 271142