UNITED STATES AIR FORCE • MARCH 1968

Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

THE MAGNIFICENT DOZEN

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March 1968 AFRP 62-1 — Volume 24 — Number 3

SPECIAL FEATURES

REGULAR FEATURES

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PREFLIGHT

THERE'S SOMETHING for just about everybody in this issue of Aerospace Safety. *The Magnificent Dozen,* a first person account by an F-105 pilot shot down in North Vietnam, is a terse, dramatic description of the pilot's rescue by men who fly the Sandies and the Jolly Greens.

On page 4 there's some good info on parachute harness fitting, particularly important for crews of certain aircraft. Then, there are a couple of semi-technical articles that are recommended for pilots: One of them, *The Flight Director,* is the second of a three-part series by the people at IPIS. The other, *Eyeballing Storms,* tells how to get the most out of your airborne radar.

Have you ever wondered what you'd do if suddenly you were told, "You're the new Flying Safety Officer?" Grover Tate, a frequent contributor, points out that the outlook might be rosier than you think, if you think positively, in *Flying Safety IS Fun.*

Whether to make a forced landing or eject has bugged many a pilot with a sick airplane on his hands. *Ejection versus Forced Landing* may help answer the question of what to do. ★

TO THE PILOT DOWN IN NORTH VIETNAM, THE 12 MEN IN THE SANDIES AND JOLLY GREENS WERE . . .

THE MAGNIFICENT DOZEN

This is the story of Captain Robert Cooley, F-105 pilot, whose aircraft was crippled during an airstrike over North Vietnam, forcing him to eject. It's an exciting first-hand account of his evasion and rescue, but our real reason for presenting it here is education for other crews who may find themselves in the same predicament.—ED.

AFTER I got out of the airplane I tumbled violently, but the chute opened as advertised. I didn't have my zero delay lanyard hooked up. The ejection seemed to be normal in all respects. I kept my helmet—I had the visor down, the mask tight and the chin strap tightly fastened. A lot of G! I believe I ejected at a quite high airspeed. All my personal equipment stayed with me just fine. As I was coming down I lifted my visor and looked up and checked my chute. There was one hole, I'd say two feet by two feet at the top of the canopy; I was amazed that the thing had even hung together. Then I took my radio out as you know, with the beeper going and checked it and tried to talk, but I couldn't, so I just stowed the radio back again.

I saw I was coming down in a small village. I have had previous jump training—I did it in college as a sport—so I was able, quite handily, to slip the chute to the top of a ridge. I am very proud of that, actually; I hit just about where I wanted to and came down into about 100-125 foot trees. The landing was very gentle, very easy. Before I hit in the trees I got in a good position, put the mask on and the visor down, had the gloves on by this time, got my legs together and made a tree landing, just like the book says. I don't believe this hurt me a bit. It was the softest parachute landing fall I've ever made; I didn't even touch the ground. I was hung up about 75 feet and I could look down and see the ground. I was on the side of a very steep slope, I'd say about 45 degrees.

I took off my helmet at this time and tried to catch it in the crook of a tree but it fell off, hit the ground and rolled away. This was the only thing I was sorry I had lost, but as it turned out I didn't need it anyway. I carry my tree escape device right in front of me, right where your belt buckle is. To my mind this is the only place to carry it. I know some of them are carried in the back cushion of the parachute. I don't know how in the hell you'd ever get them out, for I was really strung up there. I got out my tree penetrator and clipped it onto the chute after jumping a couple of times to make sure the chute was snagged firm. I ran it up through my loop by the chest strap and then unhooked from the chute and with finger pressure just boop, boop, boop right on down to the ground. There was no problem at all. I'm sorry I couldn't get the penetrator back. I tugged at it but it was caught up in the trees.

I got my MD-1 kit; there is a radio in there which I took out. I decided to head for the top of the hill, as I could hear quite a bit of rifle fire in the valley. I headed up the hill for about 100 to 150 yards. This took me almost 15 minutes as there was very heavy underbrush, a lot of vines, snagging me. I had hurt myself but at the time I really wasn't thinking much about that.

I carry two radios on my person and one in my kit giving me a total

of three. Incidentally, before I left the parachute down by the tree, I jerked the aerial out of it and bashed the beeper real good, after checking to make sure that my one radio worked. Then I headed up the hill. Incidentally those are the only pieces of personal equipment I left behind—the chute, the tree penetrator, my helmet and the life raft which was inflated and hanging in the tree. After I got to the top of the hill, I drank some personal water I carry, spread out my survival gear and sat down and tried to collect myself. I didn't think I was hurt very badly but I was bleeding in a couple of places from scratches and bruises. Then I heard a reciprocating engine and I knew this would be the Sandies (A-1s).

I pulled out by radio and said, "This is Fosdick 3 calling Sandie; how do you read?" He came right back with, "Five by, how are you buddy?" I said, "Fine." He said, "Can you see or hear me?" I said, "I can hear you. Keep coming. It sounds like you are south, turn north." He said, "O.K. Tell me when you can see me."

Then I did see him through the top of the trees, and I said, "You are over me right now." He said, "Rog, I've got your hill," and then, "I'm going to see if I can come right over the top of you."

I could see him going by one hole and then I'd pick him up through another hole in the canopy and I just vectored him in. I told him when he went right over the top of me. I asked him if he wanted a flare. He said, "Negative flare, don't fire anything 'til we tell you." Later on I found out why he said that.

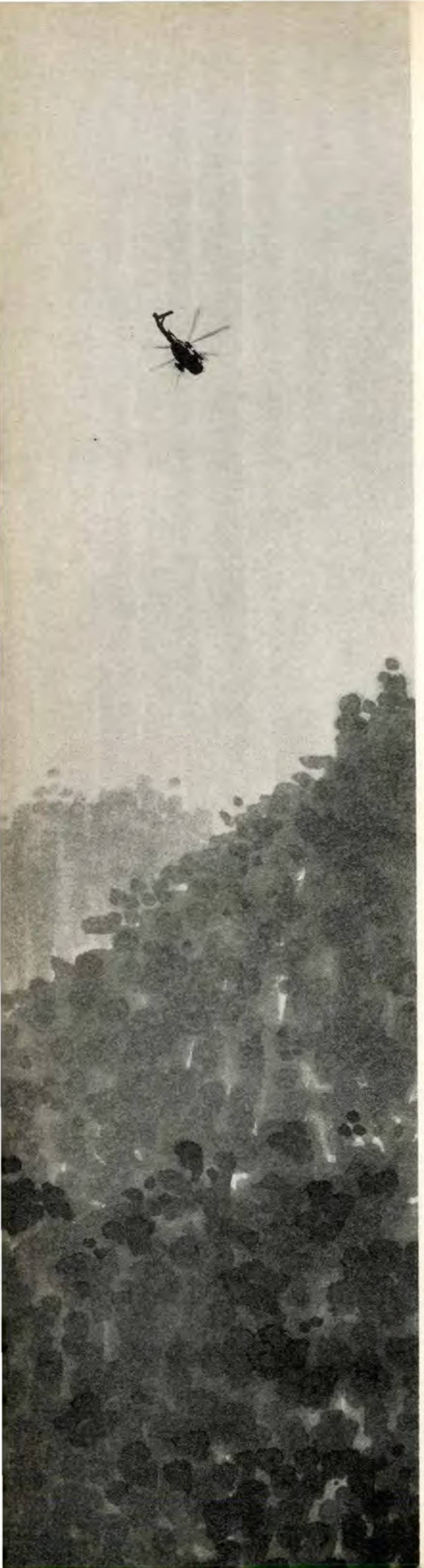
I had my gear laid out, all three radios; they all three seemed to be working properly. I checked them all. The way I was doing this was with each transmission with the Sandie I was picking up one radio as I put down the other, just to see that it was working. Then as the Sandie came around and called up, he said, "Can you hear any rifle fire?" I told him, yes, but I couldn't see anybody.

There were four Sandie type aircraft in all. He told me, "We are going to start strafing around you now." I asked, "Do you see anybody?" He said, "Yeah." And I said, "Uh-o. When is the chopper going to get here?" and he said, "About 40 minutes." I recall I told him at that time, "Don't bother, man, they'll be here by then." He said, "Don't worry, buddy, we'll stick with you." He was quite reassuring.

Then around me for the next 30-35 minutes was the most magnificent air show I've ever seen. The Sandies were delivering rockets, all types of ordnance, strafing, bombing all around the area. At one time the Sandie called up and said, "Fosdick 3, I'm going to lay a load of rockets in on the ledge right below, but I know right where you are so don't sweat it." It really hit the ledge below real hard. All the birds left and the dust and everything. I asked him if they were that close and he told me there were a couple but "don't sweat them."

This strafing and rocketing and what they were doing—the four of them were going around my hill, just like a merry-go-round. Much of the time they were delivering their ordnance below my position. They were quite low and they were really sticking with me; it was quite reassuring.

A year later, it seemed to me, the chopper finally said he was five out and the Sandie called and said, "O.K. I need your position exactly; fire a pengun flare." I said, "Rog," and I did, up through the canopy. It functioned perfectly. He said, "Rog, we have you exactly." Now I see



why he didn't say to mark my position before, because then the shooting really started. Bullets began hitting the tops of the trees that I was under. As I recall there wasn't a slug that came within a hundred feet of me at any time, but I could hear the bullets tearing through the tops of the trees. I had never heard bullets in trees before but I knew that is what they were.

Then the chopper came in. The Sandie was very explicit all the time, telling me what to do, "Take out two orange flares, orange day smoke for the chopper, and light them when the chopper tells you to." When the chopper told me to light up my orange day smoke, I did, but it took a few seconds for it to get up through the tree canopy. Finally the chopper guy said, "Rog, we have it; we are moving in."

Looking directly up I could see a little bit of sky and the chopper moving over. He said, "We have you in sight." At this time I threw down that flare and lighted my other one to give them a fresh position. Looking down through the trees they saw me. This is what I thought was above and beyond the call because by now there was all kind of shooting.

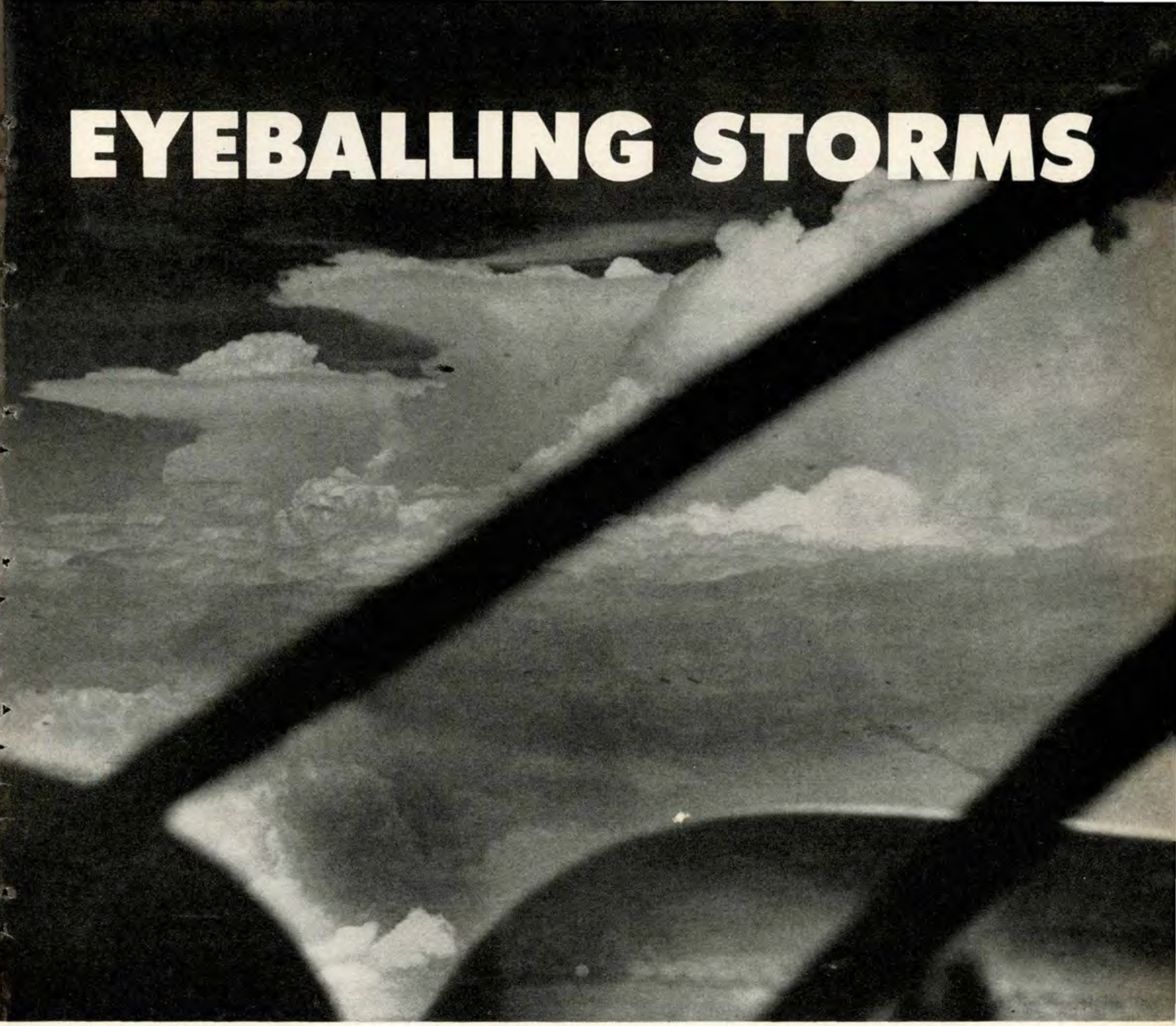
By this time two F-105s had also shown up and they were strafing with the Gatling gun, along with the four Sandies who were delivering ordnance all around the place, along with another chopper who stayed high while the low Jolly Green came in to get me. There was all kind of shooting and all kind of noise and this fellow came over my position and just stopped.

He stayed still for two or three minutes while his hoist master worked the tree penetrator down through the trees. He'd take it down a minute and then stop it and the chopper would move over a couple of feet, then he'd move it down a couple of more feet, then they'd move over. It would hang up a little on a limb and he'd jerk it and then it would come down. He missed me with the tree penetrator—he got it six inches from me. I thought that was amazing. I could have had two broken legs and still got hold of it.

I had been through survival school and knew just what they looked like. I had been hoisted on one before and knew how it felt, so I unzipped it, put the cord around me, got in the seat and gave him the up signal that means you are ready to go. Believe me, we went. He started heading for Channel 31 right then. As I got up to the top of the trees we were moving off. They just towed me up and put me on the floor of the chopper. They had their weapons out and we started to clear the area.

As we came up through the trees I saw the spot I had been in. There was shooting all around the place. They were picking up automatic fire off the ridge by this time and getting all kinds of rifle and small automatic weapons fire from down in the valley. We came out and there was just no problem. The people in the chopper took beautiful care of me. They gave me a "prescription" bottle of stuff for my recent harrowing experience, a cigarette, wrapped me up in a blanket and laid me down on a stretcher. I can just say they were magnificent. Incidentally, there were four pilots in the Sandies plus four people in each chopper, a total of 12 people, which I have submitted for decorations through our wing. I thought it was an amazing show. These guys are just something else again. Anybody who will drive an airplane in over a position and hold it still for two or three minutes — why they weren't shot down I just can't understand! ★

EYEBALLING STORMS



Hq Air Weather Service, MAC, Scott AFB, Illinois 62225

A C-141 was damaged by hail during departure climb at 25,000 feet. All leading edges were dented and radome disintegrated. Cost of repair was $118,615.

A B-52 received major damage to all leading edges during a one minute encounter with hail at 31,000 feet. Repair cost was $244,143.

A B-58 was cruising at 26,000 feet in an area of observed thunderstorms. Airborne radar was operating and an echo was observed ahead of the aircraft. The pilot was in a turn to avoid the radar echo when he entered heavy cirrus and hail. Hail shattered the windshields and subsequent emergencies required crew ejection.

Hail is just one of the hazards in severe storms. Turbulence may be violent enough to seriously damage an aircraft or cause it to go out of control and crash.

This article, prepared by Air Weather Service, MAC, gives pointers on the use of airborne radar in detecting and avoiding severe storms. It is recommended for pilots and navigators of aircraft equipped with radar.

A growing amount of evidence indicates that squall-line thunderstorms and severe isolated storms are basically different from the normal air mass thunderstorm. Several new theories have been presented which attempt to explain the dynamics of severe storms and their associated hazards to aircraft. Two of the prominent ones were put forth in recent issues of flying magazines

Fig 1

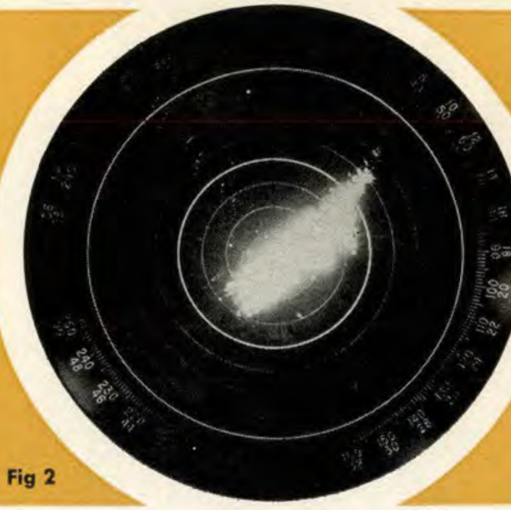


Fig 2

by Dr Bates of St Louis University and Dr Fujita of the University of Chicago.

Dr Bates feels that tornadoes form in the sloping clouds that frequently grow on the upwind sides of major thunderstorms. He further hypothesizes that the tornado funnels are connected to, and evacuated by, the updraft of the parent thunderstorm through vortex tubes ("Inside the Tempest," June, 1967, *Interceptor).* Dr Fujita theorizes that wind-shift lines below and ahead of squall lines are much more intense than those beneath isolated thunderstorms. He believes that these wind-shift lines are violent enough to destroy an aircraft ("Deadly Surf in the Sky," July 1967, *MAC Flyer).*

Sufficient evidence has not yet been collected to justify complete acceptance of these theories as a basis for altering current operational flight procedures. However, the ideas have been carefully considered in determining the recommendations which follow. Dr Bates has definitely pointed out a region of the thunderstorm which could be hazardous to aircraft. Tornadoes do tend to occur on the upwind side of storms, and their funnels are invisible to radar. Airplanes flying in this region of the storm could fly into a tornado funnel which extends up into the cloud without the crew ever seeing it on radar. Dr Fujita's theory that the wind-shift line beneath squall lines is violent enough to destroy an airplane requires further substantiation before changes in current flight procedures are dictated.

Avoidance rather than penetration of thunderstorms is still the best procedure, and the most effective tool for severe-storm avoidance is airborne radar. Radar, when in satisfactory condition and properly used, can provide safe navigation of severe-storm regions if it has the weather-mode capability. An ordinary pencil-beam radar provides much information which can be interpreted for avoiding hail, turbulence and tornadoes. A pencil-beam radar which has the added feature of iso-echo can provide even more information.

The fan-beam radar, however, should be used with caution as it provides neither sufficient nor accurate information for storm avoidance. The reason the fan-beam radar is a poor weather tool is that the width of the beam in the vertical produces a return which is not indicative of the actual conditions at flight level. A small intense storm could appear the same as a large weak storm, depending on the volume of the storm intersected by the beam. The pencil-beam radar, on the other hand, is quite good in determining the severity of a storm because it radiates in a thin slice through a storm.

This article will provide recommendations for the proper use of airborne radar in its various modes to detect and avoid severe storms.

RADAR OPERATION

One of the keys to successful use of radar is the adjustment of the gain control. The following procedure is suggested:

1. Tilt the antenna up to eliminate ground clutter.
2. Turn the gain-control knob clockwise until the scope is covered with a heavy, salt-like noise return (Figure 1).
3. Turn the knob slowly counter clockwise until the noise return just disappears or, to be reasonably certain it has not been turned too low, until a very faint trace of noise return still remains (Figure 2). A bare trace of noise return will allow the set to "see" all targets without objectionable interference and, more important, will permit the operator to view storms year in and year out with the same receiver sensitivity. As the tubes deteriorate, the proper gain setting will be farther clockwise.
4. ALWAYS USE THIS MAXIMUM GAIN SETTING. Other adjustments should be made per operating instructions for the set concerned, but the standard maximum gain should never be adjusted during flight once it has been set. When range settings are changed, it may

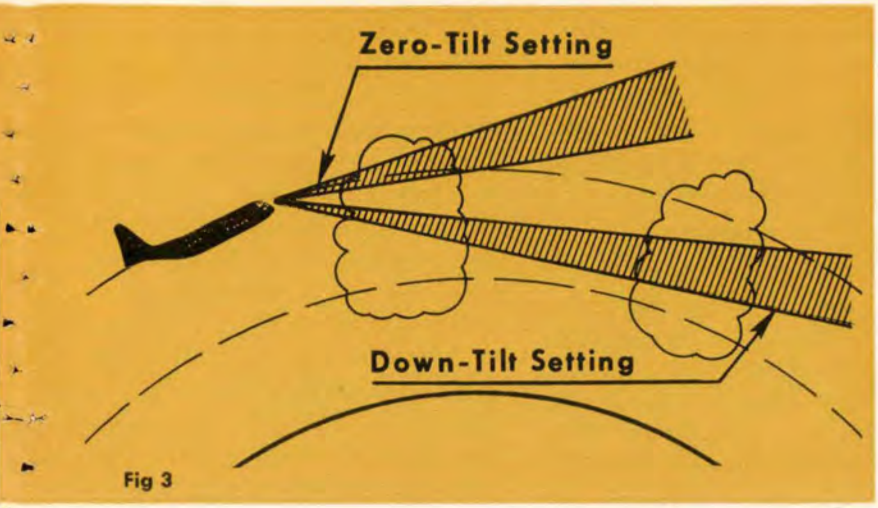


Fig 3


Fig 4. Tilt too low.

be necessary to adjust brightness BUT NOT GAIN.

Antenna-tilt setting, too, is important for weather interpretation. There is no good rule-of-thumb guide for proper tilt setting because it will vary with the aircraft altitude and radar range setting used. Think of your radar as a flashlight; you must direct the beam at the object you wish to see. At close ranges a zero-tilt setting should normally insure good coverage. Adjust the tilt up or down to "see" important features at different levels in nearby storms. At longer ranges and at high flight levels a zero-tilt setting could be too high due to the curvature of the earth's surface. Adjust the tilt down to account for this factor. See Figure 3 for the configuration of the radar beam.

There are a few "tricks of the trade." One very useful item for setting proper tilt is ground clutter. For example, if you are scanning with a long-range setting, the tilt can be adjusted until ground targets just begin to appear at the distance desired. You can now be certain that the bottom portion of the beam has touched the ground and its natural spread upward should take care of any storm in the vicinity. Storms located in the midst of mountain peaks are best observed by permitting just a few of the higher peaks to remain on the scope (see Figures 4, 5 and 6). This again assures you that you are not looking too high and observing only the weaker portion of the storm or, more specifically, the ice-crystal portion in which case the storm may appear more innocent than it really is. A few "dry runs" on days when there are no cloud echoes will prove invaluable in learning about proper tilt setting.

Occasionally, when flying near thunderstorms, it may be desirable to run the tilt up momentarily to obtain an estimate of what is going on at higher altitudes. At high flight levels it may be desirable to tilt the antenna down somewhat to observe the lower portions of storms. This helps to determine their strength.


Fig 5. Tilt could be too high.

ECHO INTERPRETATION

Your radar can only indicate where moisture concentrations (in liquid or solid form) are located. These moisture concentrations are created in the areas of the storm which are the most violent. Liquid droplets are much better reflectors of radar waves than are ice crystals of equal size. Consequently, if the moisture concentrations happen to be in crystalline form (ice), the radar may not give the whole picture. That is why there should be different avoidance distances when operating at higher flight levels, where the cloud particles are more likely to consist of ice crystals. It is


Fig 6. Proper tilt.

Fig 7
Without Iso-Echo

Fig 8
With Iso-Echo

by studying these moisture concentrations to determine their gradients, shapes, and intensities, and then assigning the proper avoidance distance that encounters with severe weather can be minimized.

TURBULENCE

Because of the tremendous energy released through the condensation of water vapor in the thunderstorm updraft, an aircraft penetrating any thunderstorm echo is likely to encounter strong drafts and turbulence. Turbulent conditions exist throughout the storm and particularly at the boundary between the major updrafts and downdrafts of thunderstorm cells. To a degree, the pilot has some control over turbulence by configuring the aircraft for storm penetration. With a radar-equipped airplane, this slight control is not as effective as assigning a proper avoidance distance and circumnavigating the area entirely.

Attempts have been made by the National Severe Storms Laboratory (NSSL) for several years to find a correlation between turbulence and echo intensity. Personnel of NSSL fly planes through thunderstorms to measure the turbulence and then compare the turbulence encountered with radar features. The latest findings show that there is some correlation with the gradient of echo intensity and better correlation with the maximum echo intensity. However, neither feature exhibits sufficient correlation that it can be depended upon for unique determination of storm turbulence. Until more satisfactory indicators of storm turbulence are found, the employment of the echo shape, the echo intensity, and the gradient of echo intensity, in combination, must be depended upon for identification of turbulent regions.

If your set is equipped with contour circuitry (iso-echo), you can choose a flight path through areas with a gradual gradient of intensity. These areas appear as wide bands when the radar is in the iso-echo mode and do not normally contain severe turbulence. Radar echoes shown on the scope without iso-echo depict water content which can be pictured as in Figure 7. Iso-echo blanks out returns above a fixed degree of intensity. With this feature the storm echoes would appear as shown in Figure 8.

Frequently two storms that appear approximately equal in size and intensity without iso-echo are found to be of considerably different strength when viewed with iso-echo. In Figure 8 you can see that storm B has a sharp gradient of intensity because of the narrow band between the no-echo region outside the storm and the hole in the center. It, therefore, has a greater chance of severe turbulence and should be avoided by a safe distance. Storms with sharp edges likewise indicate a possibility of severe turbulence and should be avoided.

If your set is not equipped with iso-echo, then intense and/or sharp-edged echoes are the best clues to turbulence.

HAIL

The procedure for radar identification of hail is to watch for, identify, and avoid echo patterns which have hooks, fingers, or scalloped edges. Hail shafts form quickly in active thunderstorms, and constant scope monitoring is mandatory during flights near such storms. Anytime a storm is changing shape fairly rapidly, chances of hail shafts are enhanced, and severe turbulence is almost assured.

Figures 9, 10, and 11 show ground-based radar presentations of hooks, fingers, and scalloped edges, all typical of hail-producing thunderstorms. The airborne radar presentation would appear practically the same with the exception of the ground clutter near the center. Shafts of hail characteristically fall from the fringes of such thunderstorms rather than from the inner heavy-rain core. Winds often carry these hail shafts well out into clear areas adjacent to the storm. Hence, echoes with those patterns should be given a wide berth.

TORNADOES

Radar identification of tornadoes is difficult due to the small size of the funnel. Tornadoes are generally associated with storms which are larger than average and have unusually high radar intensities. Although tornado vortices are not visible on radar, a hook echo is frequently seen on the edge of the main echo in tornadic situations (see Figure 9). Tornadoes are most likely to occur on the upwind (usually south or southwest) side of the main echo. Unquestionably, the tornado funnels observed beneath a cloud deck must extend upward some distance into the cloud itself, but no data are yet available as to the size, location and intensity of such a vortex within the cloud mass. It is entirely possible that vortices can exist within the cloud mass, at least for short periods, without an accompanying visible funnel beneath the cloud base. Consequently, it could be hazardous to attempt a radar-controlled penetration through cloud masses on the upwind side of severe storms.

AVOIDANCE TECHNIQUES

United Airlines has developed procedures to avoid hail and heavy turbulence at all flight levels which have permitted them to attain a record of no hail encounters for a period approaching 12 years. Although these procedures are based on C-band (5.5cm) radar rather than the more sensitive X-band (3.2cm) radar used in military aircraft, they are considered to be applicable to military radar.

Remember, radar is the pilot's best "eye" for navigating severe storms and the use of sound procedures will permit safe avoidance of hazardous conditions. ★

Fig 9

The photos on this page show hooks, fingers and scallops typical of hail producing storms.

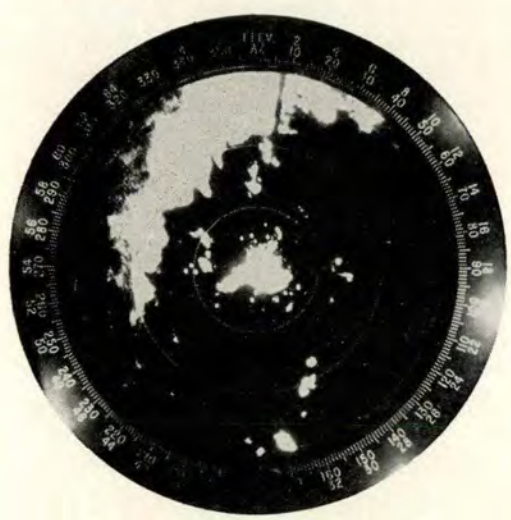


Fig 10

Fig 11

the I.P.I.S. approach

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

The Flight Director

Part II of Three-Part Series

THE previous IPIS Approach article discussed use of the manual heading mode feature of flight director systems. The two remaining modes are used for flying an ILS approach. The INTERCEPT mode is used to intercept the localizer course and the FINAL APPROACH mode is used to maintain the localizer course and/or glide slope. This month IPIS discusses the INTERCEPT mode.

The inputs used by the computer in the INTERCEPT mode are (1) localizer error, (2) course error, and (3) bank angle input from the attitude gyro platform. The strength and direction of these three inputs provide the computer with the information needed to position the bank steering bar.

Localizer error is a function of that part of the localizer beam (90 cycle or 150 cycle) being received. When the aircraft is on the centerline, localizer error input is zero. As the aircraft moves laterally from the centerline, localizer error increases as a function of degrees off course. The lateral distance from the localizer centerline beyond which the computer commands a maximum intercept angle will increase with distance from the localizer transmitter. The magnitude of localizer error signal will cause the computer to command a given bank angle/heading change.

Course error is obtained from the Horizontal Situation Indicator (HSI) in much the same manner as heading error. Course error is the angular difference between the upper lubber line (aircraft heading) and the head of the course arrow (selected course). The correct course error information is supplied to the computer only when the front course is set in the course selector window.

Bank angle input from the attitude gyro platform functions the same as in manual heading mode and is used to center the bank steering bar when the correct bank angle is obtained. The maximum bank angle commanded in the INTERCEPT mode will be the same as for the manual heading mode, usually 25 to 35 degrees of bank, depending upon type computer and/or computer setting.

Figure 1, position 1, depicts the aircraft in the area of maximum localizer error signal. The pilot must start following the bank steering bar command from a position which will ensure localizer interception prior to the final approach fix (glide slope intercept point). Maximum pre-set bank angle will be required to center the bank steering bar. As the left bank is established, aircraft heading changes and course error increases. When course error approaches the pre-set limit, the bank steering bar will command a decreasing bank angle until the aircraft is established on the maximum intercept heading (position 2).

The aircraft continuing on this heading will cause localizer error to decrease below the pre-set maximum value. Now the amount of course error commanded will be proportional to the localizer error being received. The pilot will see the result of this decreasing localizer error vs. course error as a bank steering bar command to turn right toward final approach heading. As the aircraft turns, course error signal decreases as a result of heading change. Localizer error continually decreases as the aircraft approaches the localizer centerline. The decreasing localizer error causes the bank steering bar to continue a right bank angle command toward the final approach heading until course error equals localizer error. These commands result in an ever decreasing angle of interception to the localizer (position 3).

With early model computers you may never quite get to the localizer centerline under strong crosswind conditions. If you continue to keep the bank steering bar centered, the aircraft may remain to the downwind side of the localizer centerline. This is called localizer "stand off" and the amount will be proportional to the crosswind component. Later computers, e.g., CPU/27, CPU/65, have wind drift compensation in the INTERCEPT mode.

The pilot is not required to have an exact technical knowledge of the flight director system, and the preceding paragraphs are intended to give only a general description of equipment operation. If the pilot has this knowledge of flight director capabilities and limitations, he will understand the following rules which govern INTERCEPT mode operation:

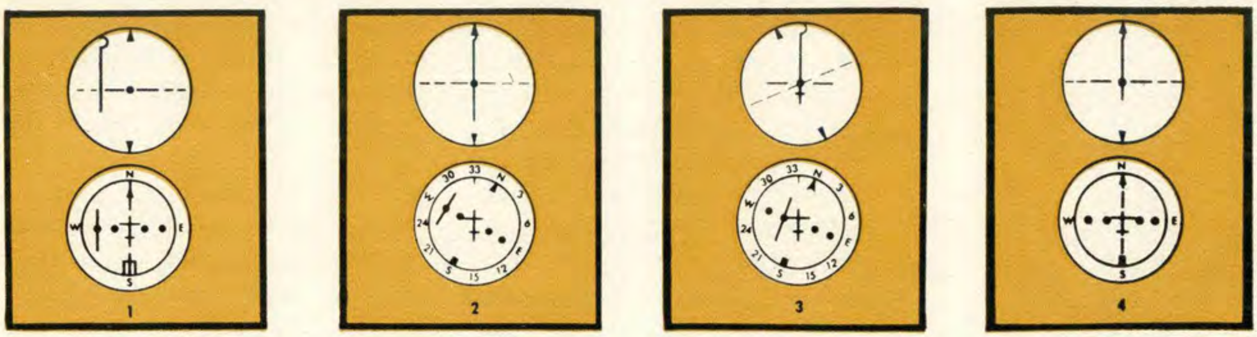
1. The front course must be set in the course selector window.

2. Bank steering bar commands are not usable unless the aircraft heading is within approximately 90 degrees of the front course.

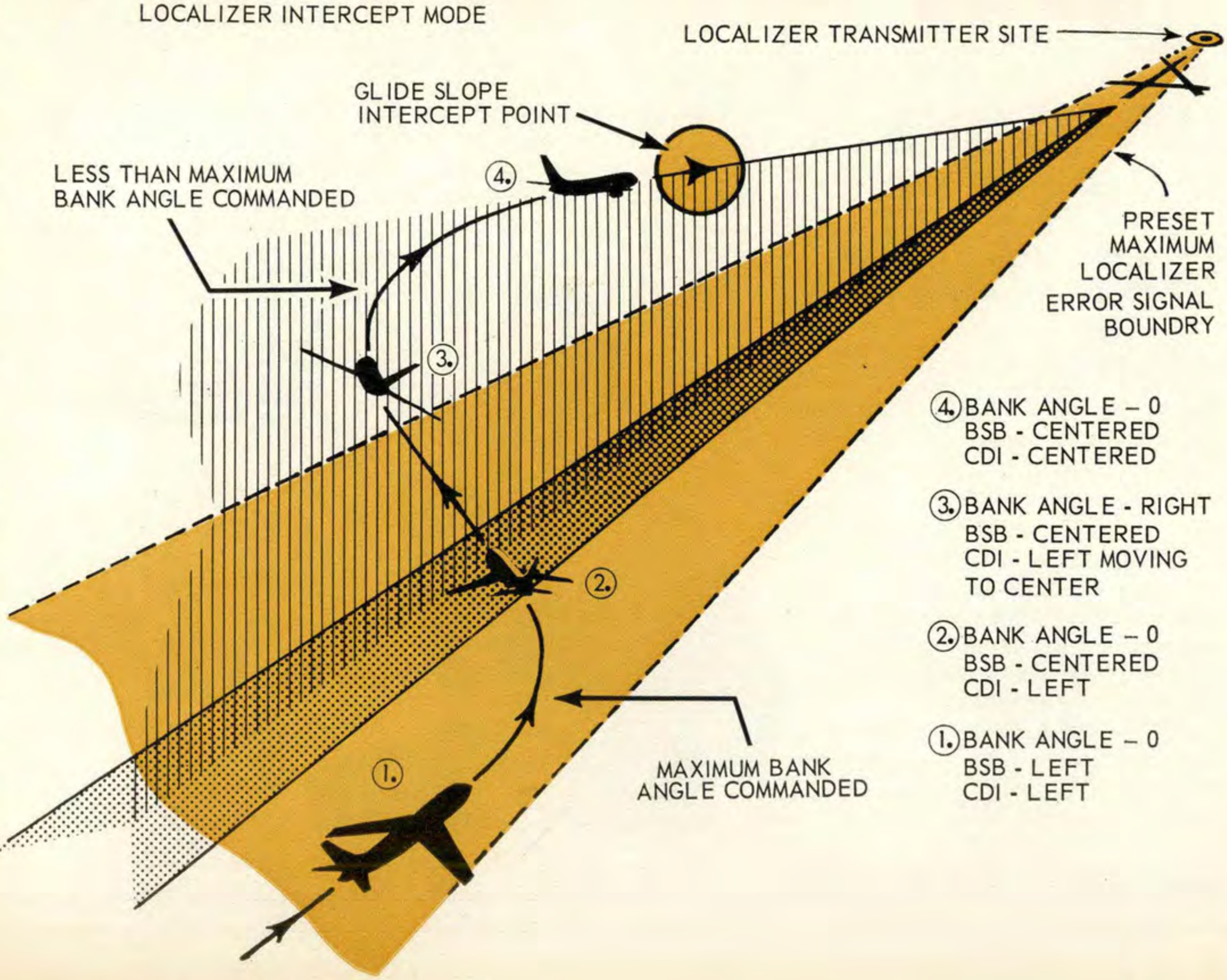
3. Before following bank steering bar commands, the pilot must assure that the command intercept heading will result in localizer interception prior to the final approach fix.

4. Older computers, e.g., CPU-4, do not compensate for wind drift in the INTERCEPT mode.★

Next month's article will discuss operation and use of the FINAL APPROACH mode.



LOCALIZER INTERCEPT MODE



IT'S THE FIT THAT COUNTS

Herman Engel, Jr.,
Aeronautical Systems Div., AFSC

THE Air Force integrated harness PCU-3/P, used in the F-4, OV-10 and A-1 aircraft is an adaptation of the Class IV harness described in T.O. 14D1-2-1, and should be fitted in accordance with the instructions of paragraph 3-12. Failure to follow these procedures may result in unnecessary discomfort and possible injury during parachute opening, and also compromise upper torso restraint. Improper fitting can reduce the capability of the harness to restrain the upper torso during ejection and in flight conditions where high accelerations and buffeting occur.

The PCU-3/P harness, like an aircraft, has had equipment added to improve the airman's capability (the aircraft gets a bigger punch, the airman gets a bigger pouch with survival goodies). The parachute harness (now the secondary function) carries a full line of survival equipment; i.e., the survival kit, a personnel lowering device (tree), strobe light, CRU-60/P, and URT-27 or -33 beacon, Fig. 1.

All equipment added to the harness has been located in such a manner as not to interfere with proper fitting and adjustment or functioning. Operating instructions are now being published to re-identify and re-emphasize the need for proper adjustment and fitting of the parachute harness.

In order to put the operational types one step ahead of the game, here are some pointers on the proper adjustment and fitting of the harness:

a. Prefit the harness as with any harness. This primarily means to set the mainsling length to match your torso. If the harness is not personally issued to you, the previous wearer may have been a basketball center and you as a shorty can pull on legstraps all day long and the harness will never tighten to your body. Prefitting instructions for the PCU-3/P should coincide with those provided in Paragraph 3-4B, Sec. III, T.O. 14D1-2-1, for the Class IV harness.

b. Don't be so eager to thrust a loose mainsling so far under (and past) the buttock that when you seat yourself in the cockpit the hinging of the body causes a proportionate loosening of the sling and a loss of firmness to the body. This reduces the restraint capability of the PCU-3/P since its integral function as a restraint device is enhanced by the sling remaining firm on the torso.

c. On the chance that pertinent instructions on the PCU-3/P have not reached you as yet, we are paraphrasing those sections of T.O. 14D1-2-1, dealing with prefit and adjustment of the Class IV harness. Take particular note of Fig. 2, this article, depicting a loose sling in position for adjustment and Fig. 3, this article, depicting a sling after adjustment. Figures 2 and 3 of this article are similar to Figures 3-7 and 3-8 of T.O. 14D1-2-1:

(1) To prefit the Class IV har-

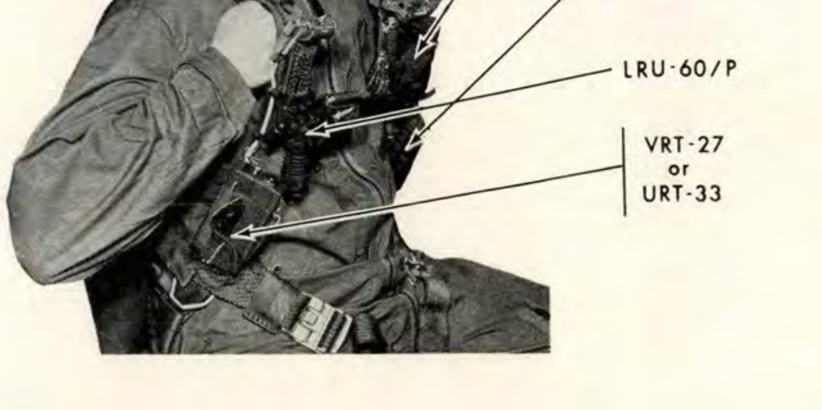


FIGURE 1.

FIG. 2

FIG. 2a

FIG. 3a

FIG. 3

ness proceed as follows: Don the harness temporarily with only the chest strap hooked. Note the canopy releases are prefixed to the fabric vest and they position themselves to a good average level on the shoulders, regardless of your stature. Also, the sling on the Class IV harness, is sectional and its length is adjusted from the hips down without changing the canopy release positioning. Adjust the lower sling, as later described, so it crosses slightly above midway across the buttocks, (reference Fig. 3-8) and take note of your index number.

(2) Adjusting the Class IV harness. There are three quick adjustment points. The following steps will aid an individual in adjusting a Class IV harness to the torso for the first time:

(a) As in prefitting, let the mainsling adjustment webbing out to approximately a No. 1 setting at each diagonal back strap adjuster bar.

(b) Slip the harness over the shoulders and assume a forward leaning stance, similar to that indicated in Fig. 3-7.

(c) Take up on the sling adjustment webbing uniformly on each side until the seat sling is snug against the buttocks. (See Fig. 3-8.)

(d) Check the mainsling, leg straps, and hardware for twists or malpositioning, and attach the adjustable V-rings of the leg straps to the snaps located at the hip area.

(e) Tightening of the leg straps will generally serve to pull the sling into a suitable position on the buttocks, unless bulky clothing is being worn. In the case of bulky clothing, some extra guidance with the hands may be necessary.

NOTE

Restudy Fig. 3-7 and Fig. 3-8. If you are quite tall or of large stature and wearing bulky flight gear, the mainsling may cross somewhat above the adjusted position shown in Fig. 3-8, even with the mainsling fully let out. You may then be unable to pull the sling fully under the buttocks. This does not mean that the harness strength is compromised, or that there is any danger of falling out of the harness if you jump. The harness is designed to withstand maximum stresses, whether the sling is under the buttocks or not, the percentage of total opening force exerted in the legstraps will often equal that exerted in the lower sling due to the straightening of the body by opening forces.

(f) Attach the chest snap and adjust. The level of the chest strap will vary with torso size, since it is permanently fixed to an average location.

(g) Stow all excess webbing ends into elastic keepers provided for that purpose. ★

REX RILEY'S CROSS COUNTRY NOTES

IT IS AWFUL EASY for the man up in the tree to tell the man on the ground how to fight the bear. But what happens when the guy up in the tree HELPS the bear? This is how the ground crew felt about the Ground Controller in the tower who instructed the crew of a C-141 to ignore directions given by them.

The C-141 had aborted a takeoff and taxied back to a hard stand for repairs. When the aircraft was ready to go again, the Ground Controller told the crew to taxi onto the hard stand and turn around. The Controller also told the crew that they should ignore the marshaller's signals as he might think the aircraft was being taxied back to the parking ramp. The outcome of this was a lot of frantic running around by the ground crew trying to guide and wing-walk the aircraft, two men hiding behind a power unit to keep from being blown away, another man almost getting run down by the aircraft, and the marshaller being bowled over by the jet blast. There were no injuries and no damage, but it did make the units concerned take a long, hard look at their communications and control procedures. This brings up a question concerning control of transient aircraft.

The things that make handling of transient aircraft unique are generally found in the aircraft itself. If an aircraft is carrying cargo it is parked at the freight terminal; if it is carrying passengers, their convenience must be taken into consideration; DVs go close to Base Operations, and so it goes, with each aircraft.

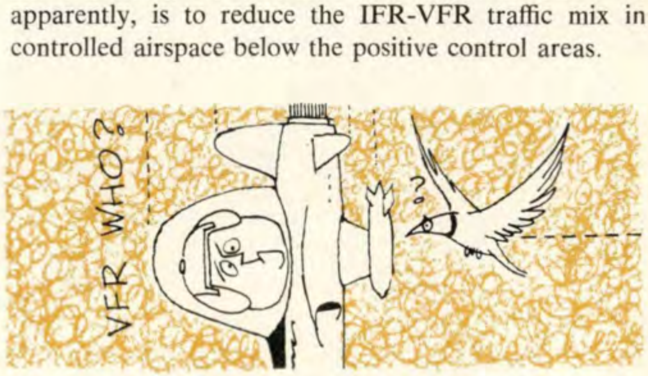
But who decides where the aircraft will be parked? The pilot's first contact is with Ground Control in the tower, and he must follow the controller's directions to the parking area. Then what? Most bases have a transient monitor in Maintenance Control who works from a parking plan display board, but he can't see what's going on out on the ramp. Then Base Operations enters into the picture. And finally it comes down to the Transient Maintenance supervisor. Each of these agencies has its own ideas and plans for the aircraft. Maintenance Control may be worrying about the convenience of parking for cargo loading. Or, Base Ops may be concerned with the DV on board, or keeping a certain area for other traffic. The Transient Supervisor has his problems: he has to figure how to get the aircraft in and out, the effects of jet or prop blast on other aircraft, and his other traffic.

So what is the solution? Each aircraft must be treated as an individual case and each must be coordinated, planned for and supervised.

PROPOSED REDUCTION OF VFR FLYING. From time to time we receive FAA Information releases. When they would be of interest to aircrews we'll pass them on. Here's the most recent one.

FAA has proposd a new rule that would require all jets and aircraft weighing more than 12,500 pounds to operate IFR when in controlled airspace within the contiguous 48 states. Deadline for comments was March 1.

In the announcement FAA took note of the rapid growth of flight operations and the need for improving and expanding the air traffic control system. The idea, apparently, is to reduce the IFR-VFR traffic mix in controlled airspace below the positive control areas.



YOU JUST NEVER know what you might meet on the runway. Birds are common, but a deer? If it hadn't been for a sharp bit of piloting this story might have turned out differently. Just after the T-33 nosewheel touched down a small deer dashed into the path of the aircraft. The animal collided with the nosegear and

speedboards. Somehow, the pilot managed to keep the T-bird going straight for about 2500 feet with the nosegear partially retracted because of a broken lower drag link. Finally the bird went off the side, but damage was minor to the aircraft. The condition of the deer is another story.

Hz. While it's not particularly significant, you may have seen the term Hz and wondered what it means. It stands for Hertz and one Hertz is equal to one cycle per second. So a frequency may be expressed as 336.5Hz.

This terminology is in recognition of Heinrich Hertz, a German physicist whose discoveries in electro magnetic radiation led to radio. It is being widely adopted so expect to see it used more frequently in the future.

TUMBLE? . . . SPIN? This happened to a couple of our Canadian friends flying a CF-104D. Their flying safety mag, FLIGHT COMMENT, carried it and we thought our own fighter jocks would be interested.

"Entry (into the loop) was at 11,000 ft, 550 kts and four G was applied as the IAS passed through 470 knots. The student thought he had time to crosscheck other instruments before selecting (takeoff) flaps. At a much lower speed (about 400-390) the flaps were lowered, however they went right through to 'land' and were then selected all the way up (through the loop somehow), then reselected back to takeoff position. I suppose that they did not get down till around 300 kts or less. During this time back pressure had been almost completely relaxed and the aircraft had stopped looping. I took control and first realized that we were completely vertical with no IAS. I put the stick hard left with absolutely no response. I remember seeing 22,000 ft on the altimeter some time before this. We sat in this vertical attitude for, I would think, 20 to 30 seconds (a hell of a long time, anyway) then the stick began to shake and very slowly the aircraft fell over to the left and in a form of gentle hammerhead stall, fell faster and faster to about 60 degrees below the horizon when it flicked to the left quite fast. Then the nose fell further to the vertical (like straight down) position and it began to flick into a spin to the right (I distinctly remember still no IAS registering). I think it did 2½ revolutions to the right and then speed began to increase fairly rapidly (throttle still in military) and the shuddering and buffeting slowed down and the aircraft was eased out of the vertical dive at 13,000 ft, IAS 450.

"After the first flick to the left the student was told that a bailout was a definite possibility and the dragchute would have been pulled very soon had the spin not ceased. The controls on recovery were stick forward and full opposite rudder."

As any F-104 jock knows, these lads did right well in recovering from this situation. It is quite obvious that the "light touch" on the controls aided the recovery of this bird.

From time to time we receive news releases from MAC's 61st Military Airlift Wing on their current record of accident-free flying. And we continue to marvel at the record this Hickam AFB Headquarters Wing is setting. Early in January the Wing completed 750,000 hours without a major accident.

The 61st Wing has three squadrons flying C-124s in an area that stretches from Antarctica to Japan and from Hawaii to Pakistan. Crews take their aircraft into all kinds of landing fields, from remote strips without navigation aids to some of the world's busiest airports. Their last accident was in 1956 — 11 years ago. Good Work! ★

FORCED LANDING VERSUS EJECTION

Maj Michael G. Filliman, Directorate of Aerospace Safety

A recent accident renewed interest in one of the old controversies in the flying game: which is the best advice for the single engine jet jock with a flameout or partial power situation, eject or attempt a forced landing? A study, therefore, seemed to be in order to see if there could be some new light shed on the subject.

It should be realized that studies on this subject have been done before and will probably be done again. The idea here was to take an unbiased look at history and see if some reason could be inserted into the discussion. The study was conducted by the Directorate of Aerospace Safety to determine the wisdom, from a pilot survivability viewpoint, of attempting forced landings in lieu of ejecting. It covered the period 1 January 1963 through 15 October 1967 and included the F-84, F-86, T-33, F-100, F-102, F-104, F-105, and F-106 aircraft. The start date, 1963, was used since it was during the first part of this year that a significant policy change in simulated flameout practice was made by a large major command. It should be noted, however, that expansion of the study to include previous years, for example, 1960-1962, still does not affect the conclusions and recommendations of the study.

The first objective was to determine the number of aircraft saved through use of a flameout pattern compared to the number of aircraft lost in actual attempts or practice simulated flameouts. In determining saves, some value judgments were necessary, especially where a complete power loss did not occur. In these partial power cases, a save was not credited unless it was obvious that level flight could not have been sustained and a normal landing pattern could not have been made. A second objective was to determine the number of pilot fatalities that resulted from actual or practice flameout landings.

The study revealed 70 instances in this time period where a flameout-type pattern was necessary due to engine malfunctions. Out of the 70 cases, 62 aircraft were saved, 8 were lost, and there were 9 pilot fatalities. During the same time period, 6 aircraft were lost in practice simulated flameouts resulting in 3 pilot fatalities. The total number of practice simulated flameout attempts, however, could not be determined. Looking at these numbers, you might want to draw the conclusion that the present guidance is okay—try to land it if you wish, or eject, your choice; but wait—let's look at the data from a different angle, let's look at it aircraft by aircraft.

The real purpose is to establish a comparative ratio between aircraft saved and pilot losses for each particular aircraft, in order to identify those aircraft for which a favorable ratio has been demonstrated and where a reasonable chance of success could be projected for the future, provided the many variables in

Fig. 1 — Aircraft Saves vs Pilot Fatalities
1 Jan 1963 - 15 Oct 1967

Aircraft		Pilots	
F-100			
Flameout Saves	7 (10)	Flameout Fatalities	3
Lost In Practice	1	Practice Fataliites	2
Net Saves	6	Total Fatalities	5
F-102			
Flameout Saves	16 (18)	Flameout Fatalities	1
Lost In Practice	0	Practice Fatalities	0
Net Saves	16	Total Fatalities	1
F-104			
Flameout Saves	1 (2)	Flameout Fatalities	2
Lost In Practice	0	Practice Fatalities	0
Net Saves	1	Total Fatalities	2
F-105			
Flameout Saves	2 (3)	Flameout Fatalities	1
Lost In Practice	2	Practice Fatalities	1
Net Saves	0	Total Fatalities	2
F-106			
Flameout Saves	2 (2)	Flameout Fatalities	0
Lost In Practice	0	Practice Fatalities	0
Net Saves	2	Total Fatalities	0
T-33			
Flameout Saves	22 (23)	Flameout Fatalities	2
Lost In Practice	3	Practice Fatalities	0
Net Saves	19	Total Fatalities	2
F-84			
Flameout Saves	6 (6)	Flameout Fatalities	0
Lost In Practice	0	Practice Fatalities	0
Net Saves	6	Total Fatalities	0
F-86			
Flameout Saves	6 (6)	Flameout Fatalities	0
Lost In Practice	0	Practice Fatalities	0
Net Saves	6	Total Fatalities	0

NOTE: Figures in parentheses reflect the number of attempts.

the problem did not change (pilot proficiency, operating environment, etc.). There was no attempt to compare one aircraft with another in terms of success, since a fair comparison is not possible due to different operating environments and circumstances.

An analysis of the data (Chart 1) reveals vast differences in the ratios between different types of aircraft. It appears that the pre-century series aircraft (F-84, F-86, and T-33) have ratios favorable enough to encourage flameout landing as an operational policy, while most century series aircraft do not. This is undoubtedly accounted for by the differences in glide ratios, handling characteristics, and approach speeds.

The F-102, however, is an exception in the century series category. The favorable ratio for this aircraft could be partially accounted for by the operational environment, since the typical F-102 power loss/flameout occurred at high altitude, which placed the pilots in a favorable position for flameout pattern entries. The F-106 data shows a similar trend; however, the numbers here are rather small for valid judgments.

The conclusions drawn are that flameout/partial power landings are reasonable in some single engine jet aircraft, specifically the T-33, F-84, F-86, F-102, and possibly the F-106 (Chart 2). These conclusions are further strengthened when it is realized that not all ejections are successful and fatalities do occur. An overall policy of "eject rather than attempt a flameout/partial power landing" would have resulted in some pilot ejection fatalities. Had this been the policy in the time period covered by this study, the pilot loss in these aircraft could well have been the same, or even higher, while 52 aircraft that would have been lost were saved.

As a result of the study, the Directorate of Aerospace Safety recommended that the flight handbooks for the F-84, F-86, T-33, F-102, and possibly the F-106 continue to reflect consideration of attempting flameout/partial power landings at the pilot's discretion under ideal conditions. A key point here is that the pilot's proficiency is a very important factor and continued practice of the simulated flameout is a must. It must be stressed, however, that practice cannot always simulate the real problems encountered in a flameout landing, since aircraft control and systems operation may be considerably different in actual attempts.

For the other single-engine jets, past history (Chart 2) clearly indicates an unfavorable ratio between aircraft saved and pilot fatalities. It was strongly recommended, therefore, that the flight handbooks require ejection rather than an attempt at a flameout landing pattern. The pattern should not be practiced and a discussion of "forced landings versus ejection" should not be included in the flight handbooks. The procedures, however, could remain in the handbook for informational purposes.

It was further suggested that follow-on single engine jet aircraft be reviewed for similarities in flight characteristics and operational environment with one of the two categories of aircraft in this study. A reasonable policy on "ejection versus forced landing" could, therefore, be adopted at the outset with a possible saving of aircraft and pilots.

Regardless of the final actions taken on the recommendations of this study, it is suggested each airplane driver of a type reviewed here take note of his bird's record. A knowledge of its history may aid in making future decisions. ★

Fig. 2 — Flameout Pattern Effectiveness

1 Jan 1963 - 15 Oct 1967

All Aircraft		
*Attempts	70	
Aircraft Saved	62	
Aircraft Lost	8	(+6 Practice)
Fatalities	12	
T-33/F-84/F-86/F-102/F-106		
*Attempts	55	
Aircraft Saved	52	
Aircraft Lost	3	(+3 Practice)
Fatalities	3	
F-100/F-104/F-105		
*Attempts	15	
Aircraft Saved	10	
Aircraft Lost	3	(+3 Practice)
Fatalities	9	

*Includes only those accidents/incidents involving an engine problem which required execution of a flameout type pattern.

FLYING SAFETY *is FUN!*

Grover C. Tate, General Dynamics, Ft Worth Div, Edwards, California 93523

"YOU, Major Friend, are appointed Base Flying Safety Officer; orders are cut and you will assume that duty as of now," the Commander announced.

BOOM!

That order hit me as if it had just been announced over the base PA system that I had written latex checks at the O Club. What had I done to deserve such an obviously punitive assignment? I had a clean record, a few incidents maybe, no accidents, nothing serious. I had been good to my wife and kids, provided them with all of the necessities of life such as color TV, skateboards, and the fruit flavored chewy kind of vitamins. I contributed to Air Force Aid, United Fund, Squadron Fund and supported the Officers' Wives Club. I kept my shots current, carried my Geneva Convention Card, kept my Dash-One and checklist up to date, and had successfully endured the indignities of a current flight physical.

Maybe it was because of that picture on the inside of my locker door or the roaring black panther's head painted on my helmet. Maybe they "bugged" the autovon and heard that "official" call I made to Ken at Barksdale, or maybe they just didn't like me. I searched my soul for sins of the past and, although I found a few, there were none that justified such a crucifixion as I imagined this new assignment.

Next, I started looking for an escape. Volunteering for SEA or permanent alert duty didn't work. Requests for compassionate retirement was denied, fear of responsibility didn't impress the medics, a plea of temporary insanity went unheeded and swearing that I drove my roaring MG around without my safety belt fastened didn't disqualify me.

No matter what approach I took to the problem, it still remained a problem. I couldn't sleep for worrying about my new responsibilities. My appetite faded and I became haggard and weak. You remember the picture of that toothless old man in the hard hat, with the caption "flying is fun"—well, I looked just like him, perhaps a bit worse. This wasn't a planned approach to the problem but it sure looked like the answer.

After a sleepless night of trying to think of appropriate flying safety programs, of soaring accident rates and of stuttering introductions of programs before the assembled heads of state of the base, I looked like a reject from both ends of a before-and-after ad. In this emaciated state, I limped into headquarters, took out my partial bridge for added emphasis and hoped that the commander types would note the horrible condition to which I had been reduced. Note it they did. They were happy to see that I was taking my new job seriously, glad to see that I was showing concern, and sure that they had made a wise choice for the job.

The next step in my self pity program developed some pronounced suicidal tendencies, but the fine print in my insurance policy and other pertinent details made this somewhat distasteful. So—I squared the bare bones that were left and faced the problem.

Now, I had accepted this thing, but what to do about it? First, I had to learn just what *flying safety* was all about and what was expected of me. I read the regulations, looked at the publications in the Tech Library, read the job description, sought the advice of former FSO types, looked for an immediate entry date into FSO school and looked in all directions, including up, for guidance.

Deeply distressed and steeped in woe, I watched the young tigers troop in and out of Ops going to and from their magnificent flying machines. Man, how I wished I could join them—just pure flying duties, none of this extra curricular FSO bit. I almost shouted to them that I wished that each of them was an FSO—Yeah, every man an FSO.

POW!!

All of the powers of my "average but acceptable for cadet training" IQ mustered forces, conferred, considered, approved, and announced an idea. *Make every man an FSO* —then we could all have fun playing flying games. The idea was good, but it had a vaguely familiar ring to it. Someone must have pursued that idea before, although I couldn't recall anything about it so I continued with my pursuit.

If I could get a program going to make every one really flight safety conscious, it would make my job a breeze and contribute something real and tangible to the safety program. It might even bring the accident rates down, it might have worldwide impact, it might—the idea was filled with possibilities. Resentment toward my assignment ebbed and a flood of enthusiasm replaced it.

Then I needed a starting point—sort of a checklist for the FSO. I thought of all of the aggravating and unsafe situations I had tolerated because I felt there was nothing I could do to change them, of all of the safety violations I had noticed and of those I had committed—and had done nothing to keep others from repeating those actions.

"Who put that handle over there where it takes an ambidextrous orangutan to reach it?" I remembered looking at that handle the next time I flew, of silently agreeing with the voiced opinion and then of promptly forgetting about it.

I recalled a navigator pointing out

an impossible procedure in an emergency checklist and of doing nothing about it beyond agreeing with him.

The memory of an officer in weather briefing that was much less informative than the local newspaper forecast came to mind. All I did to help this situation was to try to avoid him at future briefings.

Then there was the IP who always numbered the engines from right to left rather than the more commonly accepted method. Him, we not only did nothing about, we mimicked his methods during bar flying sessions. Like when the scanner called "fire on #4," the IP feathered #1 and the story degenerated into a regular "Who's on first" fiasco.

Ops Hazard Reports made ideal scratch pads to jot down base transport, O Club and other more highly selective phone numbers. They were often mentioned at flight Safety meetings and route briefings, but I had never actually used one.

If I had been an FSO during any one of these events I would have done something about each incident and maybe saved a life or a multimillion dollar aircraft. Now I was in a position to help others do something about such things.

There are so many things that contribute to Flight Safety that it's difficult to start a checklist. First, I had no ideas, now a rag bag filled with ideas to be sorted and catalogued. I didn't know how to organize this valiant effort so I started taking notes on how to advise others about flying safely.

1. Take care of YOU, the man. No matter how perfect the equipment if you are not in shape to handle it, you can induce malfunction. If you have the sniffles, don't take violent evasive action each time the flight surgeon wanders into view. Believe it as you will, but the flight surgeon is really your friend and is there to help you. Pretend that each flight is a maximum altitude flight that will terminate in an explosive decompression resulting in a 24G bailout into sub-zero, enemy infested terrain. If you are in condition to survive in this circumstance, you are in shape to fly that parts run to the boondocks.

2. Make like Rex Riley while you flight plan and prepare to fly. Evaluate everything around you—accuracies of briefings, availability of needed equipment, currency of required information. Check the food service. Maybe Rex recommended the place but there are lots of restaurants that serve lousy food after they win the Golden Pitchfork award.

3. Preflight your bird as through your life depends upon it—like it really does. Check the support equipment and the area around the aircraft. Assume an additional duty as FOD officer—whether it's a rock that might be injested in a whistling jet or a nail just waiting for an old shaky tire—pick it up and put it in an appropriate receptacle.

(Now you're FSO and FOD—surely someone can make something out of that.)

4. Make sure that you have all of your personal equipment with you and that it is in operating condition. Go back to item one and augment your own good health with the necessary equipment to survive under the same conditions.

5. Be a human factors type all of the time. If you're 5′7″ and they made the rudder pedals for a 9′ giant, get it corrected and return those seven pillows to the BOQ. (I'm only 5′6″ and have nine to return.) If you continually confuse one lever or knob or switch with another, make an issue of it and get the confusion factor eliminated. If you find the bird uncomfortable regardless of how many times you twist and turn, let the troops in the Big House know about it.

6. Specifications and Tech Orders aren't holy. If you encounter an impossible spec or an instruction in error, pursue it until you get it cor-

rected. Tech Order changes are still being issued on the old and faithful Gooney. Somebody causes these changes and so can you.

7. Copy your clearance correctly and make sure the departure given you is compatible with the performance of your bird. Don't accept a clearance which is impractical or one that you don't thoroughly understand.

8. Taxi within the prescribed areas and speed limits of the base or your aircraft—whichever is less. Be alert for other aircraft or vehicles or pedestrians or birds or coyotes or water buffalo or what have you.

9. Do not take the active until you are sure you have been cleared —and then make a quick visual check for traffic just to be sure. (I had a radio transmitter out one day and while the tower was giving me a green light they were clearing another guy into #1 position. That was one of those minor incidents mentioned earlier.)

10. Make a thorough power check before starting to roll—it's your last free look at things. Believe and follow the go-no-go check—it's telling you something and all you have to do is listen.

11. Use your checklist as it is intended. Don't just recite it like when you played one of the three wise men in the Christmas play at church, but treat each item as though it was the most important thing ever written. There must be millions of things about checklists that could be used as examples—control locks left on, lights not checked until darkness (after airborne in bright daylight), switches in wrong positions, etc. Gear warning horns must have been invented for guys who failed to use checklists.

12. Read and profit from Flying Safety publications. There is a lot of good poop in these magazines and . . .

I could make an entire safety program on each of these subjects, at each meeting stress a particular subject and, after a year, give certificates to those who attend all twelve programs.

This is going to be great. With some reorganizing I can really cram the meetings with good material. Get experts in each field as guest speakers, guys who really get the message across. I might make this the safest and most efficient outfit in the business.

Could be that I could earn a promotion and could stop telling the story about the chimp that make Lt Colonel before I did.

My reverie was brutally shattered and I again became the oldest Major in the Air Force when some unfriendly advised me (in terms usually reserved for Navy use) to answer the phone.

"Flying Safety Office, Major Friend speaking" (I whispered in deep professional-like professor tones).

'Sir, this is Sgt Bleaker in Personnel. We just got word that you are to go to USC for the FSO course starting the first of next month. Captain Fragile will continue here as FSO until you complete the course and . . . ."

I heard no more—all that sweat, those tears, beautiful evasive plots, total physical and moral deterioration—and now I was going to school.

All of my magnificent plans before me were for naught. Not necessarily, I left them for Fragile—it would make his task easier and his life happier. I would be in school, really learning the FSO business and would be happy.

Already my profound theory had started to work—Flying Safety IS Fun! ★

WHAT IS CORROSION?

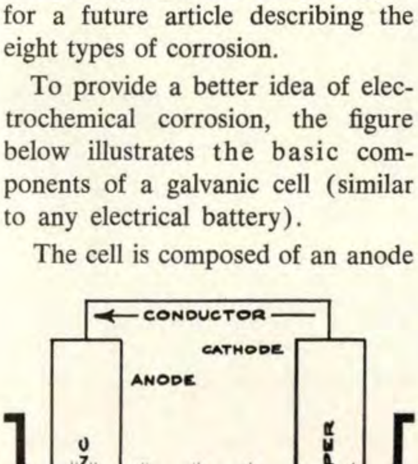
Capt Walter S. Yager, Directorate of Aerospace Safety

TO the average technician, corrosion control is that dirty clean-up chore his supervisor tells him he must do at the completion of each job. Why is this clean-up so important? Why must this technician's valuable time be "wasted" in a clean-up exercise? What is corrosion, and how does it affect Air Force weapon systems?

Technically, corrosion is defined as "The undesirable reaction between a metal/nonmetal and its environment, either chemical or electrochemical." Chemical corrosion (oxidation) is typified by the reaction of oxygen with iron to form rust. Electrochemical corrosion is similar to the type of reaction that occurs in an automobile battery. A difference of electrical potential exists, which in turn causes electron flow inducing corrosion. This electrical potential can be created in several ways, and will be the subject for a future article describing the eight types of corrosion.

To provide a better idea of electrochemical corrosion, the figure below illustrates the basic components of a galvanic cell (similar to any electrical battery).

The cell is composed of an anode



(zinc), a cathode (copper), and electrolyte (solution), and a conductor between the anode and cathode. A potential difference exists between the zinc and copper because they are dissimilar metals. A complete electrical path is provided by the electrolyte and the conductor. Zinc, the more active metal, will give up electrons. These electrons travel through the electrolyte to the surface of the copper. The circuit is completed by the flow of electrons from the copper through the conductor to the zinc. The loss of electrons by the zinc (anode) results in corrosion.

This particular galvanic cell does not occur in real life in a missile silo. However, picture a stainless steel hose with an aluminum fitting attached lying in a pool of water. All the components are available; dissimilar metals, conductor, and electrolyte. Consequently, corrosion occurs.

Corrosion cannot be eliminated, but it can be reduced by proper preventive measures. The standard question now is: "But why worry? That little spot of rust won't hurt anything." It does hurt, and it hurts big! Combating the effects of corrosion costs the United States approximately eight to 10 billion dollars annually. The magnitude of the problem may seem to make an individual's efforts insignificant. Not so! That small amount of hydraulic fluid that was spilled might be the catalyst required to cause the failure that results in the loss of a multimillion dollar aircraft or missile. A small amount of water, oil, or any other contaminant may complete the circuit (like an auto ignition key) to start an electrochemical reaction.

The best means of combating corrosion is good housekeeping. By keeping the area clean and dry by wiping up those spilled fluids, corrosion may be prevented and valuable Air Force resources saved for future use. ★

Engine failure in a single engine aircraft often makes for a story with a sad ending. This story is different because the pilot was alert and spotted the trouble before the situation got out of hand. Recommended reading for all pilots.

aero club MAY DAY!

1st Lt Gary A. Michels
Roswell, New Mexico 88201

IT was a clear, cold winter morning when we departed Walker AFB for Albuquerque, where I was taking my wife and child to make airline connections.

The aero club T-34 had reacted normally during warm up with a good mag and prop check. Takeoff was routine and the aircraft climbed faster than normal, giving me 400 feet per minute with power settings of 2350 rpm and 2100 manifold pressure. Ten minutes after takeoff, with all instruments in the green, I noticed a slight oil pressure fluctuation with a gradual drop in oil pressure and no change in oil temperature. At takeoff plus 15 minutes, I noted a rapid rise in oil temperature and a 15 pound decrease in oil pressure putting the needle at the bottom of the green.

I initiated a 180-degree turn toward Roswell Municipal, reduced both throttle and RPM, and started a 100 foot per minute descent maintaining 100 knots indicated airspeed. After the power reduction, I noted a five pound increase in oil pressure and a decrease in oil temperature. At this time, the engine started excessive vibrations. I smelled smoke and shut the engine down, turning off all electrical and fuel switches except the battery, which gave me power for the radio and landing gear lowering system.

I made two distress calls to Roswell Tower stating engine failure and position. A point to be noted: for position I called 15 minutes out of Roswell on the 308 radial. The tower was unable to tell whether I had said miles or minutes, which hampered search operations somewhat. On engine failure I put the prop to a full-cruise position and established a 90-knot glide. I made a circling approach to a dirt road with power lines paralleling the road. During the descent oil spattered back to the windshield completely restricting visibility. I opened the canopy, obtaining visibility by leaning out the side of the aircraft. Seeing I was short of my desired touchdown point, I lowered the nose to increase my airspeed taking the aircraft to 10 feet above the terrain. The increased airspeed lengthened my glide and enabled me to reach my desired touchdown point. About the time I reached 10 feet above the terrain, I noticed two black flashes overhead. I later walked back to this point finding a set of power lines crossing my flight path. They had gone unobserved due to the poor visibility. Touchdown was smooth. The road was about 35 feet wide and recently graded.

I never received confirmation of my distress calls and, therefore, expected at least one and a half hours of ground time before a search would be initiated. The temperature was between 15 and 20 degrees but we were able to keep warm with the extra clothing in my wife's luggage. The first signs of air search came approximately one and a quarter hours after touchdown. Contact was made by radio with one of the search aircraft and we were assured assistance was on the way. The first cars arrived approximately one and a half hours after touchdown.

The aircraft sustained no damage on landing and was returned to Walker AFB by low-boy trailer the same day. No one on board the aircraft was injured in any way.

Although it is an experience we don't wish to repeat, we have previously flown over 50 hours together in the T-34 including a trip from Los Angeles to Nassau, Bahamas.

In retrospect, we feel that those who are non-smokers should carry matches with them on their flights. A fire would have been both helpful in the search operation and a welcome warmth while we were waiting. ★

ED. NOTE—The author, an amateur pilot, did a fine job in our estimation. However, sharp-eyed readers will have caught one discrepancy — where he lowered the nose to increase airspeed, which he says enabled him to lengthen his glide. Many a pilot has fallen into this trap with catastrophic results. This might be a good subject for safety officers at the next aero club meeting.

The Anatomy

# of an Accident

THE barracks felt cold and damp as Swazak awoke to the alarm. He lay there for a while and tried to clear his mind before getting up. He could hear rain beating outside, and wind rustling the trees near his window. Another miserable day, he thought, and that two-hour drive out to the missile site in this lousy weather. He thought back to what had been a good intention a few hours before—"A few lines of bowling, and early in the pad." But he'd gone along when his boss, Art Gage, had suggested going into town for "just one beer." He should have known better; there never was "just one beer" in Art's life. He looked at the clock — only three hours of sleep! It was a rotten way to start the day.

There was a driving rain as he ran from the barracks. No raincoat —he'd forgotten it at the bowling alley. By the time he reached the car, his fatigues were soaked. "What a rotten way to start the day," he murmured to himself for the second time. It was one of those days—nothing would go right. The engine turned over on the first try — maybe things would change — but the slow drive through the rain and runoff covering the road, with the wind hitting broadside, gave promise of what to expect on the way to the site.

Another run through the rain from the parking lot to the missile maintenance building left "Swak" feeling and looking like a wet rat. It didn't help any when Art (TSgt Gage, the section NCOIC) told him he'd have to get out to the site on the double. The standby battery unit was inoperative and a TCTO on it was due. Art was usually a good guy, but when he said, "No stops for coffee," he meant just that. Of all days, Swak needed as much hot coffee as he could get. Damning the rain, missiles, Art, and the world in general, he picked up the work order, his tool box, a volume of Tech Orders, and his helper, in that order, and headed for his maintenance vehicle.

Swak and Art had been buddies ever since his OJT days as an electrician. As Swak drove out of the squadron area, it crossed his mind, "Not much briefing about the job. Art must be pushed—but then he knows I know my business!!" Battling the wind and rain and the clammy feeling of his wet fatigues removed from his mind any further thoughts about Art or the job.

TSgt Art Gage had been NCOIC of the electrical shop for over two years. He knew his job pretty well, but it wasn't easy doing it any more. There weren't enough good electricians left to do the work. That made doubts and Art didn't like doubts.

Lt Col Kearn H. Hinchman,
Directorate of Aerospace Safety

Swak was a pretty good troop — good bowler and all, but after he'd gone, Art had a few doubts about not having given him a briefing. "Shouldn't have pushed him so much, even if Job Control did say it was a rush. Well, it will be all right." Art was pretty sure Swak had done the job before. "I should have let Swak hit the snack bar before going; I'm tired and Swak is too." There never seemed to be time to do things right any more!

The young airman sitting next to Swak was new in the outfit. He had known him to say, "Hello," but this would be the first time Swak was to use him as a helper. The driving was slow and tedious—it seemed to be raining even harder now, if that were possible, and the lack of sleep didn't make Swak very talkative.

They arrived at the site soon after the maintenance officer. Lt Avis knew that there had been a problem with the battery charger unit, so he gave them a short and general briefing. It looked as though information about the work would have to come from the Form 210 and the Tech Data. The discrepancy was listed as "Battery Unit Inoperative," which was as general as you could get. Lt Avis asked Swak if he had his tools and the right Tech Data, gave him a copy of the TCTO and the modification kit, and cleared him to the electrical equipment area of the missile bay.

In the electrical equipment area, Swak took off his shirt and draped it over a cabinet to dry. He was wet and chilled, but he wasn't sure whether it was from his clothing or if he was catching cold. He read the TCTO for familiarization, and decided to do it first. He wanted to get the job over quickly.

They laid out the TCTO kit for inventory. Everything was there. This shouldn't take too long, Swak thought hopefully. Step number one in the TCTO was, "Turn off all power to the 28-volt d.c. Standby Battery Power Unit." It gave no cross reference to this, but Swak knew that the Tech Data he had brought with him from the electrical shop contained more specific instructions. They opened the backup Tech Data and, with the helper reading, Swak went through the steps necessary to remove 28-volt a.c. power.

The next step in the TCTO was, "Remove four hex nuts, two lock washers, four flat washers, and two bolts from terminal bus bar and discard hardware." Swak checked the nuts and then looked through his tool box for a wrench large enough to remove them. He couldn't find one. A check among his tools by the helper failed to turn one up. By this time, Swak was in no mood for delays, like returning to the complex tool supply to borrow a wrench, so he selected a cable stripper which he thought would do the job. The first nut was on tighter than he thought. More pressure — a firmer grip — another try! The cable stripper slipped.

Swak was not too worried by the sparks produced when the tool contacted another terminal and the battery unit case simultaneously. He was more concerned with skinned knuckles. However, a loud explosion from the missile bay, followed by the almost simultaneous sight of smoke and sound of the emergency alarm, brought mind and reflexes into focus for *survival.*

The foregoing narrative is based upon a true incident. It is presented to show the cumulative effect of factors until an irreversible sequence is achieved and an accident occurs. The one factor not mentioned, but having an equal bearing on the outcome, together with Swak's state of mind, discomfort, fatigue and selection of a wrong tool, was the presence of power in the battery unit. The factor which Swak did not consider in "removing all power to the battery power supply" was the 28-volt d.c. power from another source (the readiness rectifier). Swak knew this. It was contained in Tech Data and was a part of his job knowledge; but, because of the personal factors already influencing him, he had forgotten it. It was this power, shorted to the battery case when the cable stripper slipped, which provided a path through facility ground to the missile, causing the explosion.

The history of accidents is a history of many causes coming into play to produce a catastrophic result. Therefore, as this incident proves, every factor which can lead to the development of an accident must be prevented. Primarily, this is the responsibility of each individual whether supervisor or technician. The mental and physical condition of each person doing a job is generally the most important consideration in preventing an accident. In this regard, therefore, each of us must not only be our own, but our brother's keeper as well. ★

FAA RESPONSIBILITIES DURING TRAFFIC ADVISORIES — An OHR near miss report was submitted at another base recently which indicated that some pilots are unaware of FAA responsibilities in vectoring aircraft around traffic. The case involved an aircraft in the clouds which was advised of traffic by FAA and subsequently had a near miss. The pilot apparently felt that he should have been vectored around the traffic since he was on instruments. The fact that he was in the clouds has no bearing on the incident. Air Traffic Control does not — repeat does not — vector aircraft around unidentified traffic unless requested to do so, since the altitude of targets is not known. This may not seem like a very friendly attitude on the part of ATC but that's the way their regs are written.

We strongly urge that when you are in the soup at lower levels and are advised of traffic, you request vectors around the traffic. Let's face it! If you don't do everything possible to assure your own safety and are waiting for someone else to carry the ball, you'll be left with egg on your face.

Maxwell AFB Safety Bulletin.

Dear Aggie

I was the instructor pilot during a student training flight in a certain four-engine jet aircraft. Just after level-off, following takeoff, I got an elevator control malfunction and the airplane started porpoising. The stabilizer trim switch wouldn't work and elevator pressure got mighty heavy. I reduced airspeed and the porpoising stopped, but with full nose down elevator pressure the rate of climb was 2000 feet per minute. The stabilizer trim had stopped at two degrees up.

I placed the outboard spoiler switch in cutout position and extended the inboard spoilers to 30 degrees in an attempt to relieve enough pressure to trim manually. Stick pressure eased but I still couldn't manually trim the aircraft. Speed at the time was 210 to 220 KIAS. I manipulated thrust and the speed brakes to establish a climb of 500 feet per minute and 240 KIAS.

At 4000 msl I engaged the autopilot elevator axis. Elevator response was smooth and after about five minutes the autopilot moved the trim wheel and retrimmed the aircraft. I then checked out the bird and it seemed okay with no difficulties. I called the command post and after checking with supervisors decided to continue the mission.

We flew to a different base where we made eight landings. I made the first and fourth just to make sure everything was okay; the student made the rest. Our only problem occurred when we left the base for home and the porpoising and trim problem started again. However, we used the same procedures we used before and were successful. I declared an emergency and landed.

Maintenance found metal particles in the stabilizer trim actuator assembly secondary brake housing for the elevator trim system, and the brake was chipped. The autopilot stabilizer trim actuator assembly checked okay but was removed and replaced. The system then check out.

Four days later a similar event occurred on the same aircraft. It was found that the stabilizer trim forward cable drum assembly was intermittently binding and locking, which made both the electrical and manual stabilizer trim systems temporarily inoperative.

My question is this: Should I have continued the mission and made the eight landings before returning to base?

Kasey

Dear Kasey

You remind me of the jock who was also flying a four-engine bird, only it was a recip. First he lost one engine, but he continued the flight. When the second one quit he got a bit anxious but pressed on. Then the third one gave up. At that point he decided he'd better land. As I recall, he lost the last one on final approach.

Fortunately, your situation did not get quite as drastic. But did you know for sure what the trouble was? Did you know you wouldn't get a serious control malfunction during landing or takeoff? Finally, where was the supervision you referred to?

Aggie

BEHIND THE CURVE. The pilot drastically increased his angle of attack at about 50 feet of altitude and a sabre dance developed. The egress system worked normally when he popped out, but he impacted the ground before his chute could fully open. This fatal accident was the end result of attempting a no-after burner takeoff. Rotation to a very nose high attitude was accomplished with 2500 feet of runway remaining. Even this mistake might not have cost the pilot his life had he connected his zero delay lanyard to his "D" ring—it was still attached to the chute; not to the seat as it should have been. The board felt that the extra one second which the zero delay lanyard could have saved may well have meant the difference between life and death. He had also failed to connect his survival kit. The local personal equipment man stated that many pilots still do not connect the zero delay lanyard or survival kits in spite of constant emphasis because they are afraid that they will cause complications during egress.

A possible contributing factor to the accident was smoke and fumes breathed by the pilot taxiing out behind the lead aircraft with his oxygen mask disconnected for 15 to 20 minutes. This can be listed only as a possible factor because the non-military physicians

handling the remains did not take blood samples to test for carbon monoxide poisoning. However, there is no doubt that he should have been breathing 100 per cent oxygen for all ground operation, and wasn't. Any outfit that isn't using the final positive check of all critical items before taking the active should seriously consider doing so.

DURING THE PRE-START CHECKLIST the pilot of an F-105B inadvertently actuated the tailhook extension switch as he drug his hand away from checking the landing gear downlock switch. By experimenting with the system he determined the possible cause of the incident. He found that the switch could not be actuated with the guard cover completely closed; however, with the cover partially open, it could be triggered by merely dragging a finger over it. The seam of a gloved finger will exert enough pressure to do the job. There were no deficiencies in either the guard or the switch so the incident serves to warn all pilots to check that those switch guards are all properly closed—particularly those in proximity to other switches.

THE HAZARD OF BATTERY OVERFILL—We normally associate all batteries with the one we are most familiar with, namely, the car battery. Its preventive maintenance consists of scraping the terminals and, when in doubt, adding water to each cell.

The extent to which this philosophy has permeated the battery realm has been brought home by recent happenings at the Minuteman missile sites. Two separate incidents resulting in extensive damage to batteries and equipment have clearly demonstrated the need for strict adherence to the tech orders rather than handy axioms. In both instances, the basic cause of failure was cells overfilled with electrolyte. As the battery approached the fully charged condition, the electrolyte from one cell overflowed, due to gas displacement, creating a positive short to case (ground). Heat, fire and explosion followed with major damage to battery and nearby equipment.

Because of these incidents, a thorough check of the electrolyte level in each battery cell has been conducted. This effort resulted in approximately 60 gallons of excess electrolyte being removed from some 20 Minuteman LCF battery sets. Thus, the message is not to be "in doubt" but to follow the applicable technical data in detail.

Lt Col George J. Murphy
Directorate of Aerospace Safety

AERO BITS

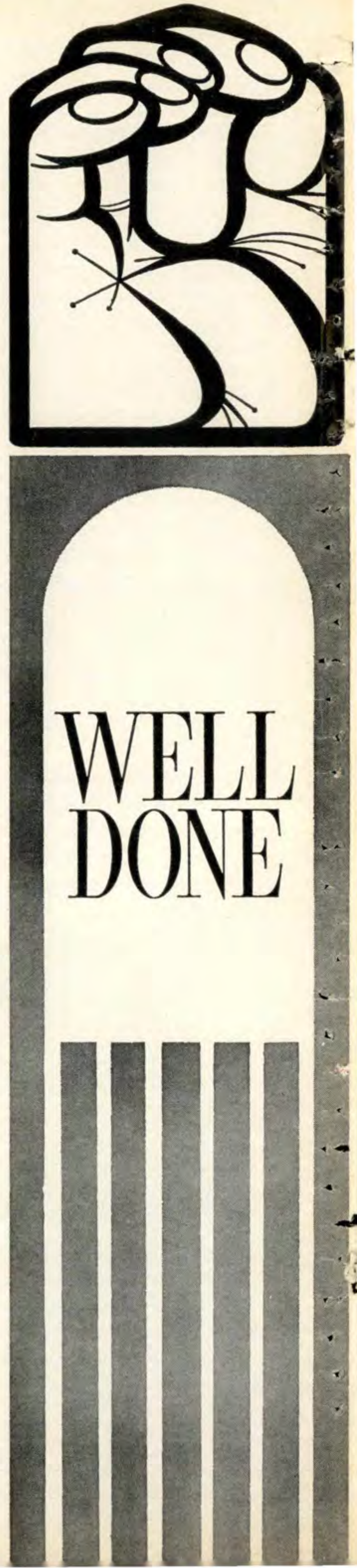
THE T-33 CHECKED O.K. with EGT stabilized at 640 so the pilot released brakes and headed her down the runway. He raised the nose at 85 knots. And that's when the pilot in command, who was in the aft cockpit, noticed EGT fluctuating between 640 and 300 degrees. The pilot in command chopped power and called for an abort.

The abort went by the book except one of the pilots accidentally extended the speed boards and the T-bird went through the MA-1A, stopping in the snow covered overrun some 300 feet beyond the barrier. Damage was negligible and trouble shooters soon located a loose connection on the aft EGT gage. The unit briefed all pilots to make sure they have speed brakes retracted before taking the barrier and talked to maintenance and quality control people about the gage (lock washers were left off the connection).

But there's another lesson to be learned from this near miss. The back seat driver reacted to a single instrument indication without confirming a thing. This sort of reaction is an invitation to trouble. You can argue that decision time was limited . . . that any delay would have increased the hazard factor had the gage been correct . . . that the pilot in command exercised his prerogative . . . that it is always easier to evaluate decisions after all the facts are in. But look through the accident files and you'll find a stack of accidents that resulted because someone reacted to single indication without evaluating the situation. A good number of the more serious occurred on takeoff with fighter type aircraft.

They can be prevented with a little foresight. If you're on takeoff roll and nearing liftoff speed in a T-bird or heavily loaded fighter you don't have very much time to look at a fluctuating needle and reason things out. You don't need to if you've reasoned them out ahead of time. In all but the heavier aircraft, marked valid fluctuations in EGT or fuel flow or RPM will be accompanied by noticeable engine surges. You'll be able to feel and hear them.

In *all* aircraft, an engine surge will be accompanied by changes in RPM, fuel flow AND pressure ratio, PT_5 or whatever thrust instrument your bird has. These gages are all nicely grouped so you can verify trouble in the flick of an eye IF YOU'VE SCHOOLED YOURSELF TO DO SO. Once you've spotted and verified the trouble you must evaluate. If you can abort with assurance that you can get set up for a barrier engagement, then start that course of action. But don't have tunnel vision to the point that this is the only answer you have to serious problems during takeoff. The salvo button may give you a chance to get airborne for a safe ejection or even a trip around to a landing. ★



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Capt. Willard G. Woodhull

349 STRATEGIC RECONNAISSANCE SQUADRON, DAVIS-MONTHAN AFB, ARIZONA

On 15 February 1967, Captain Woodhull made a normal takeoff and climb to above flight level 600 in a U-2C. While at maximum altitude, Captain Woodhull made a turn toward his next check point. As he rolled out of this turn, he heard a loud explosion and the engine flamed out. Weather at the time was completely undercast and the closest alternate airfield over 100 nautical miles away. Captain Woodhull promptly analyzed his situation and advised the Air Traffic Control Center of his intentions. The Center vectored him to his alternate airfield.

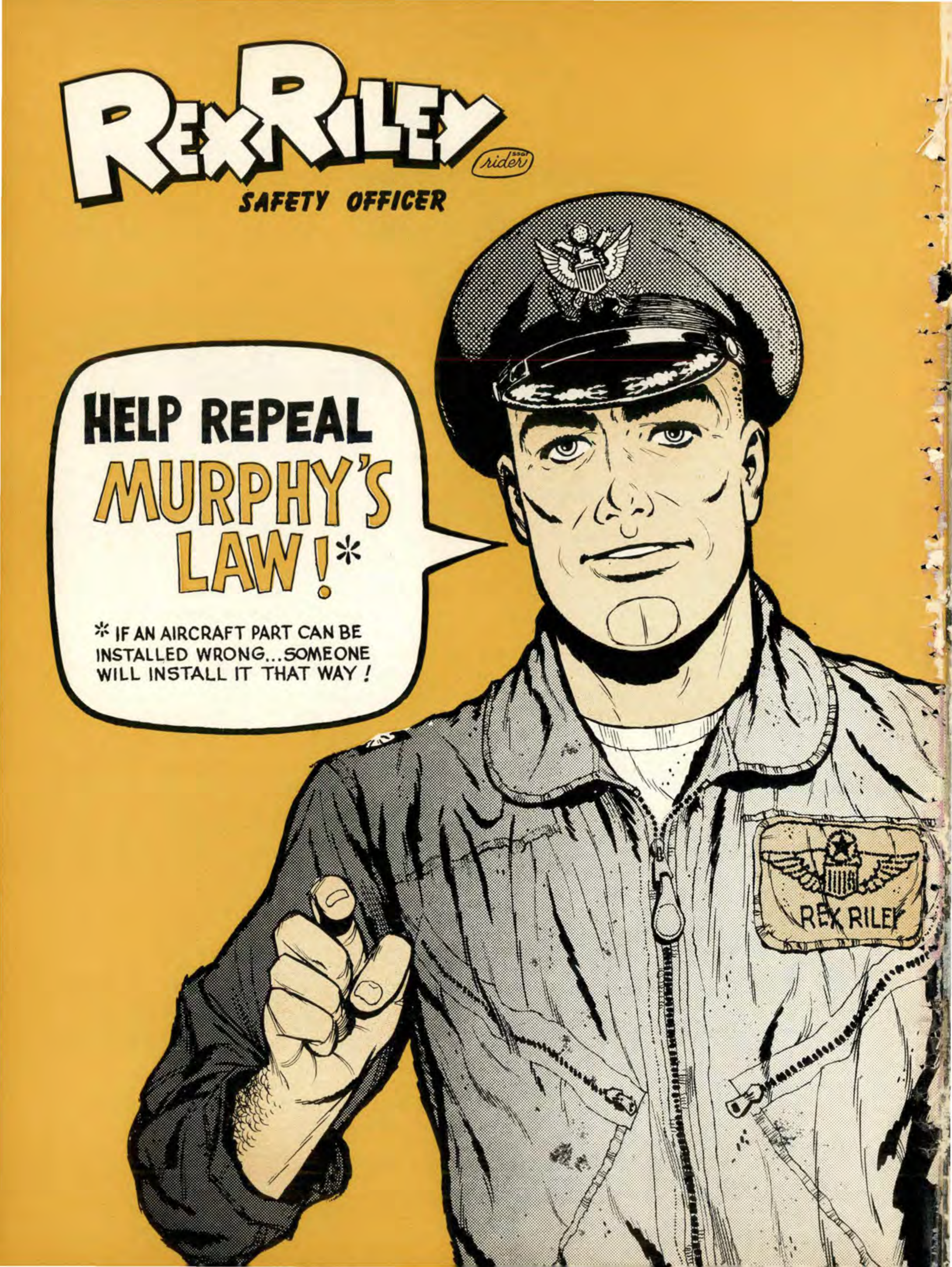
As pressurization was lost, the canopy began to frost over and Captain Woodhull proceeded to descend solely on instruments. Although partial pressure suit inflation, which occurred within 30 seconds of the flameout, severely limited Captain Woodhull's arm and body movements, he made periodic attempts to scrape ice off the canopy with his Weems plotter, and this allowed him small, intermittent glimpses of the weather below. As he approached his destination airfield, it became apparent, with the solid overcast, that a visual approach could not be made. After three airstart attempts failed, Captain Woodhull requested the Center to vector him to a point approximately five miles to the west of the field where he could continue his descent in orbit and remain clear of mountains lying just east of the field.

With weather reported as 1500 feet scattered, 3500 feet broken to overcast with 15 miles visibility and intermittent snow showers, Captain Woodhull decided that the ceiling was high enough to allow him to break out, get the field in sight, and set up a forced landing pattern. Then the primary microphone in his pressure suit facepiece ceased to function. Prompt action in attaching the bypass cord enabled him once again to have communication with the Center.

At 18,000 feet the aircraft entered the weather, which stayed solid down to 12,000 feet where it became layered. As Captain Woodhull continued his descent, it became apparent that he might not break out of the weather as soon as anticipated, and he requested the Center to place him over the field and on a heading aligned with the runway.

Still scraping away at the canopy with his Weems plotter, Captain Woodhull finally noticed a part of a taxiway through a small break in the clouds. Entering a high key, Captain Woodhull completed his checklists and made his turn to low key keeping the runway in sight. On the turn to base he once again entered the clouds, which forced him to estimate his turn to final. Breaking out once more, he had slightly overshot the runway, but by anticipating this possibility, he used excess airspeed to return to the final approach. A heavyweight landing was made approximately 3000 feet down the runway without the aid of a mobile controller who would normally transmit to him his height above the runway.

The superior airmanship demonstrated by Captain Woodhull saved a valuable aircraft. WELL DONE! ★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