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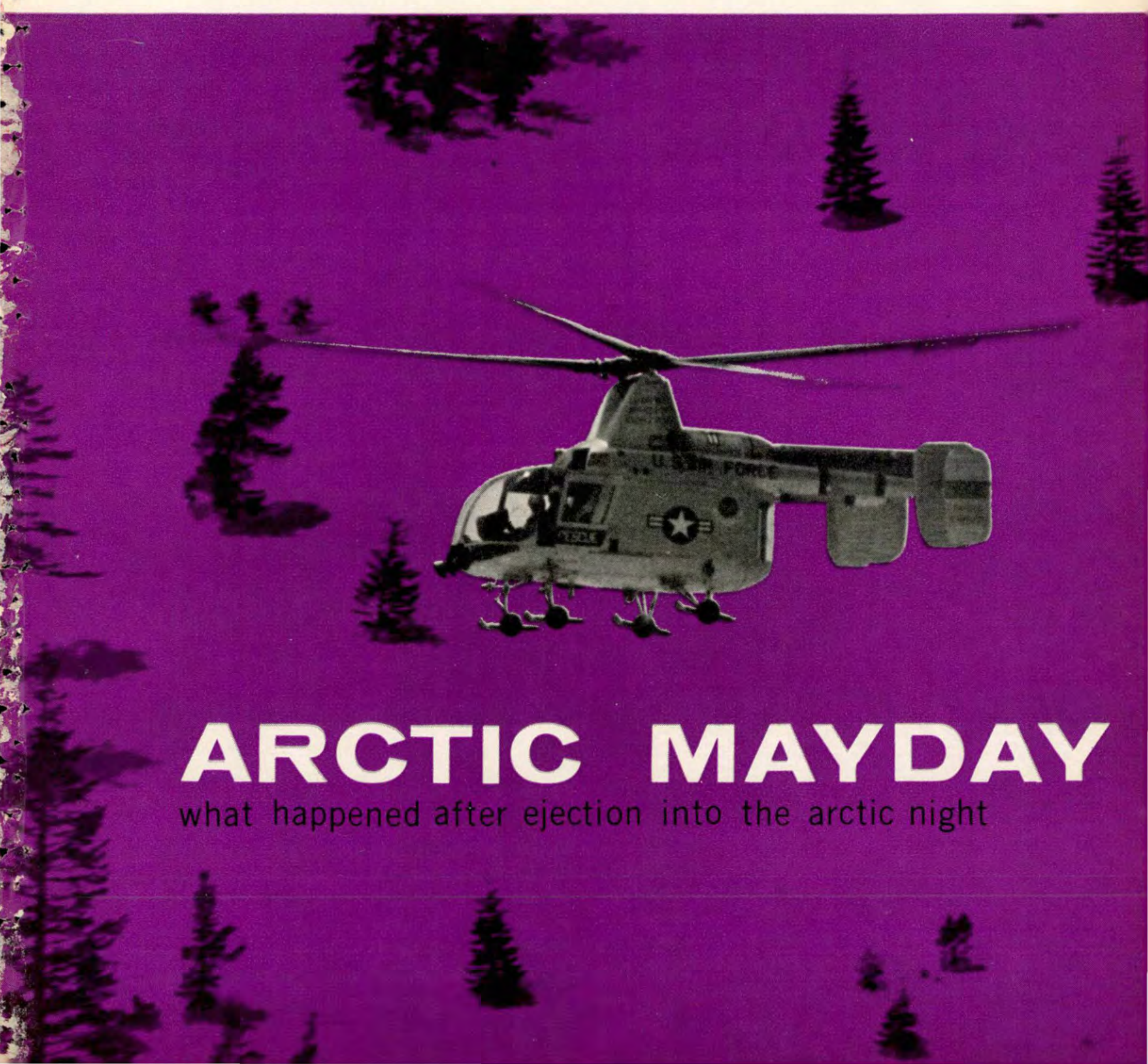
Aerospace SAFETY

MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

SLIPPERY RUNWAYS AND CROSSWINDS

FUEL FLOW GAGE - pilot's best friend at airstart time

THE ANNUAL PHYSICAL - moment of truth



ARCTIC MAYDAY

what happened after ejection into the arctic night

Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

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SPECIAL FEATURES

REGULAR FEATURES

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PREFLIGHT

That *Annual Physical*—one phase of a flier's career which causes him to wonder a bit, even when he *knows* he's healthy. A flight surgeon recently assigned to the Life Sciences Group starts his tour with an article emphasizing the importance of preventive medicine to every member of the Air Force team. The article *Slippery Runways and Crosswinds*, page 2, presents the combined effects of both conditions on aircraft ground performance. Watch out for them during the next few months of winter flying. Page 20, an F-100F pilot gives a first-hand account of a *Double Ejection* during which he discovered the advantages of the "cut four" procedure. On page 12, *Fuel Flow Gage*, generally thought of as a pilot's best friend at airstart time. Installment Three of *Lost in Space*, page 16, winds up a round-table discussion of pilot disorientation.

COVER: Photography by Ken Hackman, 1352d Photo Sqdn, Lookout Mountain AFS. The HH-43B is on its way to pick up a downed fighter pilot who was forced to eject somewhere in the wilds of Alaska. Read about his rescue in *Arctic Mayday*, page 6.

ANNUAL PHYSICAL ...FRIEND OR FOE?

Lt Col Robert H. Bonner, USAF, MC, Directorate of Aerospace Safety

EVERY year, as the time for our annual physical rolls around, we rated types (yes, even flight surgeons) start getting palpitations, sweaty palms, and paranoid suspicions about what the "ole doc" might find. We view the approaching day with apprehension and endure the annual poking, prodding, stabbing, and squeezing only because Air Force directives say we must. The purpose of this article is to allay some apprehensions and illustrate exactly what the annual physical is all about.

As aircrew members, we are conditioned to expect periodic maintenance checks on the complex machines we fly. In fact, as professionals, we demand these checks. Only in this way can we be sure that predictable malfunctions won't occur. The annual flight physical should be approached with the same rationale.

Unfortunately, many aircrew members believe that the flight surgeon is looking for things which will remove them from flying. Nothing could be farther from the truth. Just as the maintenance man's job is to keep them flying, so is it the job of the flight surgeon to "keep 'em flying." If this were not so, there would be no rationale or excuse for the specialty of aerospace medicine.

As man's knowledge about the complexities of the human body increased, so did his ability to detect early certain malfunctions which, if left unattended, could result in permanent grounding of an aircrew member. An example of this is the recent interest in diabetes screening. Until the last decade, diabetes was considered ground for permanent medical suspension from flying. It was always believed that discovering the defect after the fact was a waste of valuable aircrew manpower. Now, we have screening tests which can detect the tendency toward disease early. This enables us to institute certain preventive measures which allow the aircrew member to continue flying. Isn't this the same philosophy behind periodic maintenance checks of aircraft?

Many disorders are progressive in nature and could cause *permanent, irreparable* damage to the body and render it unfit for flying. If these problems are detected early, their effects can be reduced, altered, reversed or prevented. Instead of grounding, a long active useful flying career results. One problem of this type is hypertension (high blood pressure). There are numerous aircrew members with this disorder in its early controlled stage who are continuing an active flying career. If hypertension is not discovered early, it can have devastating effects on other subsystems such as the heart and kidneys. Once this has happened, flying safely is impossible and a preventable waste of aircrew manpower is the result. Other examples of diseases which can be detected early enough to prevent grounding are gout (painful joints), glaucoma (hard eyeballs), hearing loss, and peptic ulcer. There have even been cases of abnormal electrocardiograms which have become normal with proper exercise and diet programs.

You will notice that "early detection" is the key phrase in this discussion. Once the above mentioned problems have produced permanent damage, the effects are irreversible and the chances for continuing an active flying career are very remote.

A secondary gain from early detection of disease is the chance to enjoy many years of good health and active participation in the events of the world which surrounds us. For many, this is perhaps the primary reason for undergoing a good comprehensive annual physical examination.

A tertiary gain from annual physicals and early detection of progressive problems is the chance to document any changes which may occur from year to year. A study of these changes as they occur in many individuals provides us with guidelines from which we can make more accurate predictions about an individual's future ability to continue flying.

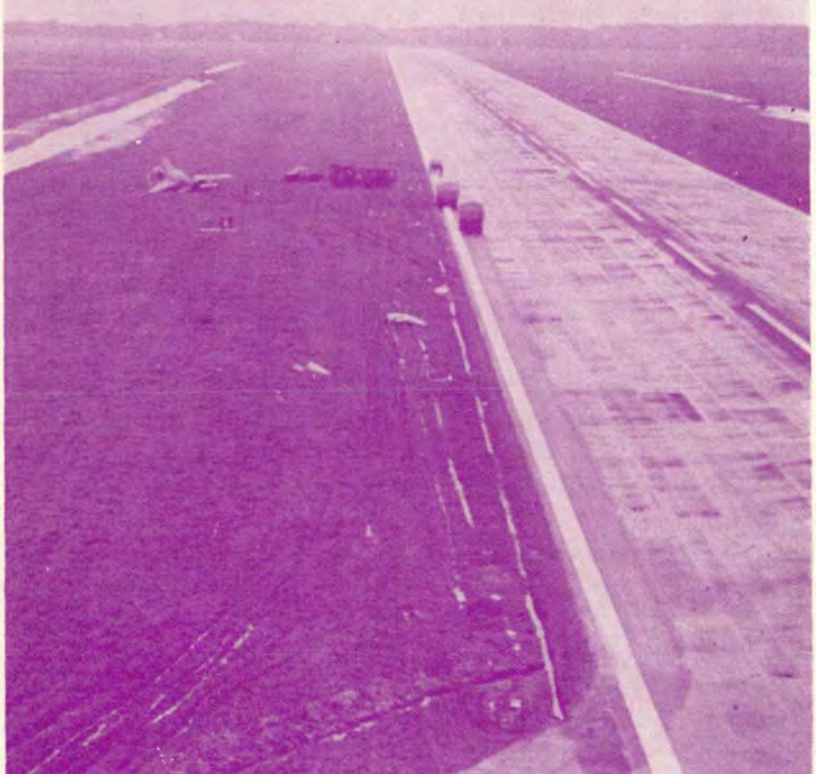
So, rated types, let's be a little more relaxed for our next annual physical, fully realizing that the poking and prodding is designed to keep us flying. After all, isn't that what we *all* want? ★

THIS WINTER PILOTS WILL FREQUENTLY ENCOUNTER . . .

SLIPPERY RUNWAYS

Maj John M. Lowery
Editor, TAC Attack Magazine
Hq TAC, Langley AFB

HAD AN ACCIDENT LATELY? One way to stay on the good guy's list is to expect slippery runways during the cold weather. Have an alternate (a swingin' place, one you'll use!) in case a sudden change in the weather drops the RCR on you. A wet, slick runway, plus a crosswind, can set you up for an embarrassing parking place, like the one shown here.



WHETHER discussing tactical operations from forward bases in a combat environment, or the launching of interceptors to identify a strange radar target on the borders of the United States, fighter pilots frequently face the hazards of operating from icy, wet, and snow-or-slush-covered runways. These runway surface contaminants can cause a complete loss of braking and steering control and lead to a major accident. This traction loss has been scientifically identified as tire hydroplaning.

The majority of our hydroplaning accidents occur under crosswind conditions. From January 1965 through November 1967 the Air Force suffered 31 mishaps (20 fighters) due to the occurrence of tire hydroplaning. The dollar loss for the period has been estimated at $15,000,000. From January to 1 April of this year TAC alone recorded five incidents involving hydroplaning of century series fighters.

Previous articles have explained the scientific principles involved in tire hydroplaning *(Aerospace Safety,* June 1968). This article will discuss the combined effects of crosswinds and slippery runways on aircraft ground performance.

TIRE DESIGN

Pneumatic tires are designed to perform three basic functions during aircraft ground operations:

• Support the weight of the air-

AND CROSSWINDS

craft under the varying stresses of taxiing, takeoff and landing.

• Develop high coefficients of friction during wheel braking for directional control purposes, and for stopping.

• Provide a high coefficient of cornering force (nosewheel steering) and side force (main wheels) to overcome the effects of external skid-producing forces such as crosswinds or changes in aircraft direction (example, high speed turns onto taxiways).

One of the operational problems involved with the first function—support the weight of the aircraft—is tire failure due to foreign object damage or blowout. The new radial ply aircraft tire offers encouraging relief from this age-old problem. The stiffer tread feature of this tire, combined with the absorption of all pressure stresses by the tire's internal structure, greatly reduces the possibility of tread laceration and blowout from surface debris such as stones, nuts, bolts, and the like. The radial design provides a larger tire footprint, operates at a cooler temperature, and appears unusually resistant to skidding due to its stiffer tread feature and absence of tread "squirm."

The inclusion of antiskid protection on most fighter aircraft has minimized the hazards of blowout due to tire skidding. The addition of locked wheel protection on touchdown, coupled with thermal blowout plugs, further reduces the chance of catastrophic tire failure.

RUNWAY CONTAMINANTS

The ability of tires to perform the second and third functions listed above depends on the surface texture of the runway and the presence of various surface contaminants—water, slush, ice, snow, dust, or molten rubber accumulation.

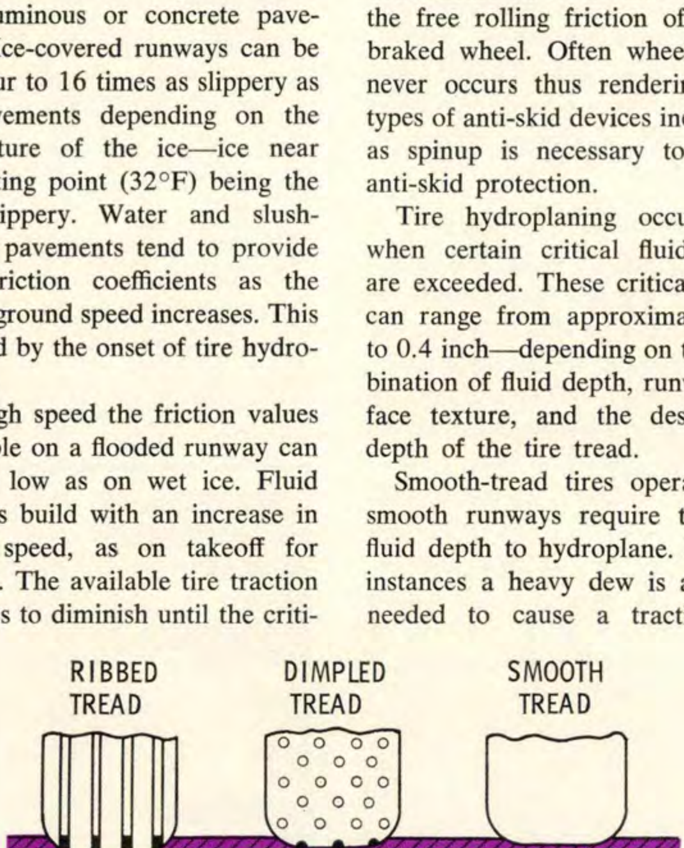
Some typical runway traction values are shown on page 4. For example, the graph shows that a snow-covered runway retains only about one-half the traction potential of dry bituminous or concrete pavements. Ice-covered runways can be from four to 16 times as slippery as dry pavements depending on the temperature of the ice—ice near the melting point (32°F) being the most slippery. Water and slush-covered pavements tend to provide lower friction coefficients as the aircraft ground speed increases. This is caused by the onset of tire hydroplaning.

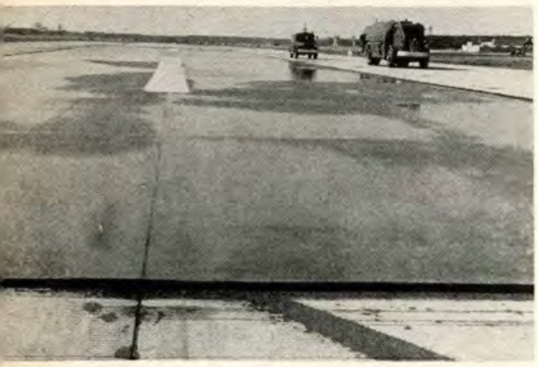
At high speed the friction values obtainable on a flooded runway can drop as low as on wet ice. Fluid pressures build with an increase in ground speed, as on takeoff for example. The available tire traction continues to diminish until the critical ground speed or total dynamic hydroplaning speed is reached. At this speed the tire is totally separated from the runway by a hydrodynamic pressure equal to or greater than the tire footprint pressure.

If you have just landed you may touch down under conditions of total dynamic hydroplaning since your aircraft is usually well above the critical ground speed required. Friction coefficients available to a pilot under these conditions have been measured at a value less than the free rolling friction of an unbraked wheel. Often wheel spinup never occurs thus rendering some types of anti-skid devices ineffective, as spinup is necessary to initiate anti-skid protection.

Tire hydroplaning occurs only when certain critical fluid depths are exceeded. These critical depths can range from approximately 0.1 to 0.4 inch—depending on the combination of fluid depth, runway surface texture, and the design and depth of the tire tread.

Smooth-tread tires operating on smooth runways require the least fluid depth to hydroplane. In some instances a heavy dew is all that's needed to cause a traction loss





Top photo at left: Maj Clark Price, 68 TFS, George AFB, landing an F-4D on NASA's flooded Wallops Island test runway. The March 1968 tests proved that the transverse runway grooves give a wet runway the same stopping potential as a dry surface. Left, NASA's grooved test runway for the F-4 wet runway tests. Results of this test were overwhelmingly favorable.

known as viscous (thin-film) lubrication skidding. On the other hand, rib-tread tires operating on a coarse surface texture require the greatest fluid depths. When the runway surface includes transverse grooves, then the critical fluid depth must be greater than the combined depths of the grooves, runway surface texture, and the tire tread.

HYDROPLANING SPEEDS

When runway fluid depths are exceeded for any combination of tire tread and pavement texture, the critical ground speed required for total dynamic hydroplaning is almost entirely dependent on tire inflation pressure. The basic formula used for calculating this critical speed in knots is nine times the square root of the tire pressure. For aircraft using MPH indicators the factor used is 10.3 times the square root of the tire pressure. It should be noted, however, that a pilot can lose control well below this speed as the hydrodynamic pressure build-up at lower speeds can greatly reduce the tire footprint area thus minimizing available braking or cornering traction.

CROSSWIND EFFECTS

Crosswinds push against the entire area of an airplane's fuselage and empennage. This creates a side moment of force on the tire tread. In the case of a light footprint runway contact, for example, just after touchdown, the result is a downwind drift toward the side of the runway.

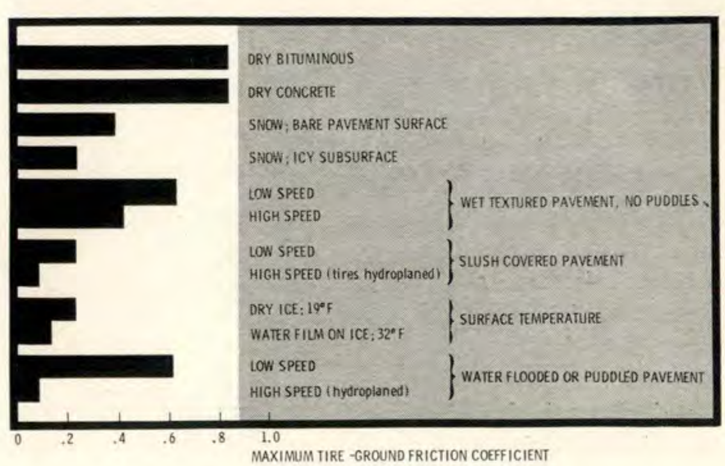
This sideways push can be surprisingly forceful, being proportional to the square of the crosswind velocity. To illustrate, a 10-knot crosswind produces four times the side force of a five-knot crosswind. The significance of this should be readily apparent to a pilot landing under critical crosswind conditions since Tech Order crosswind landing tables are based on a dry runway surface.

In most aircraft the center of pressure from a crosswind is located aft of the center of rotation—the main landing gear. As a result the aircraft tends to weathervane into the wind. A few aircraft, the F-102 for example, have more side area exposed forward of the center of rotation. As a consequence these aircraft tend to yaw or weathervane downwind.

The fact that aircraft directional control with differential braking or nosewheel steering can be lost below total hydroplaning speed has already been mentioned. During takeoff on a wet, or slush-covered runway, the pilot may be able to maintain runway heading by use of differential brakes and nosewheel steering. However, as the footprint area of the tires diminishes with increased speed (and resulting hydrodynamic pressure build-up), the aircraft will begin to drift toward the downwind side of the runway. Considering aircraft weight and fuel load during the takeoff phase of flight, this can obviously lead to serious consequences. As rudder control speed is reached it is possible for the pilot to allow a deliberate yaw into the wind and continue takeoff in a crabbed condition. The tires will not normally be damaged, because of the lubricating action of the water cushion.

On landing, the same principles apply. The aircraft will weathervane into the wind and drift toward the downwind side of the runway. While speed is relatively high aerodynamic controls may be used to maintain runway heading. However, this will not stop the downwind drift.

Deploying the drag chute may



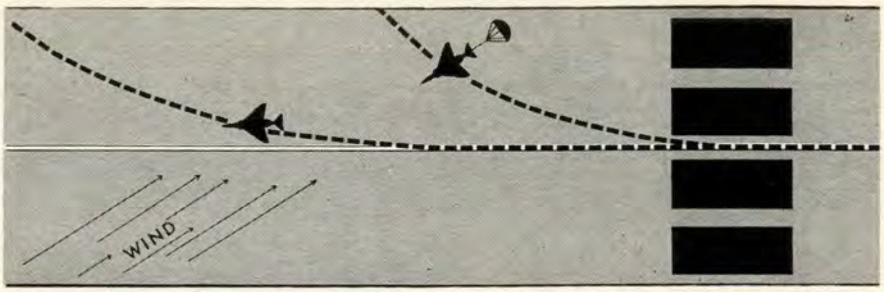
prove disastrous as the chute canopy provides a larger frontal area (a sail) for the wind to push against. This will increase the weathervaning tendency by moving the crosswind center of pressure further aft. This increased frontal area of the drag chute will amplify the force of the wind thus accelerating the downwind drift.

PILOT TECHNIQUES

An F-102 pilot is in a unique position. His aircraft will normally weathervane downwind without the drag chute so the rollout technique on a wet runway is, therefore, quite different from that of other aircraft. In this case the pilot must hold the nose of the aircraft well up, maximum aerodynamic braking, which increases the downwind yaw of his aircraft. He then deploys the drag chute which causes an opposite reaction—tends to yaw the aircraft into the wind. Although he will still tend to drift downwind these counter-acting aerodynamic forces tend to provide the F-102 pilot with the capability of decelerating to a point where tire traction becomes effective. Therefore, the crosswind factor is not as critical in a decision to land.

A TAC pilot landing an F-100, F-105, or F-4 on a slippery runway in a crosswind has three choices. The best plan is to avoid the hazard and proceed to an alternate airfield. The second possibility is an approach end, mid-field or overrun barrier arrestment. This relatively new technique appears best suited for the F-4 series aircraft since its tail hook was designed for routine use. Mid-field and overrun arrestment may provide a marginal safety factor as the downwind drift in a crosswind on a slick runway appears most severe just after touchdown.

The majority of wet runway-crosswind accidents seem to occur in the first one third of the runway. However, by using asymmetrical power an F-4 pilot may be able to keep his aircraft on the runway by utilizing thrust from the downwind engine. The thrust will work against deceleration; however, by remaining on the runway the pilot may at least be able to safely engage the barrier.



Traffic density may also become a consideration since this type of recovery is somewhat more time consuming, thus extending the planned landing interval.

Tests conducted at the NASA Langley Research Center, dating as far back as 1960, have shown that a cure for this costly problem is within current technological capability. The technique of cutting transverse grooves in the pavement surface was found to increase the friction potential of wet concrete and asphalt runways to that of the dry surface. This fact was recently verified by the March 1968 F-4 tests at NASA's Wallops Island facility.

Research during 1967 established that the most effective groove pattern consists of grooves ¼ inch wide by ¼ inch deep with a one-inch center spacing. This pattern proved two to three times as effective as using runway surface overlays and texturing in improving tire traction.

During the 1967 test series a KC-135 wheel was run onto a wet ungrooved concrete surface in a locked wheel (total skid) condition. When the wheel entered the grooved area the brake was unable to hold the tire in a skid. Wheel spinup developed and effective braking force was generated. Conversely, when the tire ran onto grooves with a two inch spacing the wheel re-entered a locked condition and the coefficient of friction dropped significantly.

To summarize, if you, as a pilot, find it necessary to operate from a slippery runway under crosswind conditions there are a few precautions you can take:

- First, avoid making formation takeoffs or landings for obvious reasons.
- Second, plan to land on the upwind side of the runway to provide maximum runway width as protection against a downwind drift.
- Use short field landing approach speeds and touch down firmly. A fast or smooth landing only encourages the onset of hydroplaning.
- With a crosswind be especially careful in attempting aerodynamic braking and drag chute operation.
- When the runway and wind condition look questionable consider a barrier arrestment.
- And finally, keep in mind that sometimes the best course is to proceed to your preplanned alternate. ★

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T. O. 1F102 — I Section II.

ARCTIC MAYDAY

SOMETIMES trouble sneaks up on you slowly, insidiously, one step at a time until the whole works goes to pot. At other times its appearance is sudden, and one's actions give meaning to that statement: "The quick and the dead."

Last winter, February 23 to be exact, Captain Harold C. Brost was flying a T-33 to Eielson AFB from Elmendorf when his bird gave up and he had to eject himself into the frigid cold of an arctic night. This isn't a suspense story so we'll tell you right now that he was rescued the following morning in good condition. But his experience, with some others we recall, is a reminder that the difference between a happy sense of well being and a grim survival situation can be as small as a lousy turbine bucket.

Captain Brost took off at 2100 to deliver a part to Eielson. The aircraft had flown previously during the day and this looked like a routine up-and-back, about 45 minutes each way. But as the bird climbed through FL 290 the pilot heard a mild explosion, and the engine began to rumble. The RPM fluctuated about five per cent and the overheat warning light came on. He could see a glow from the rear of the aircraft and sparks began flying from the engine section.

Captain Brost retarded the throttle as he began a turn back toward home base and declared an emergency on center frequency. With the RPM dropping rapidly, indicating a flameout, he pulled the throttle off and began a glide. Airstart attempts failed and it was obvious that an ejection was imminent.

Fortunately, the pilot got off one call on center freq, because with engine failure, the UHF receiver quit operating, although the transmitter continued to function and ground stations received distress calls on guard. (The accident report mentioned three instances of UHF radio failure in T-birds immediately after loss of the generator with the battery supposedly good.)

Ejection was at about 13,000 feet, and the landing was into deep snow.

. . . "It felt like I was going down about 40 feet into the snow. The next morning when I saw where I actually landed I had fallen backwards, was actually dragged a little bit. It was windy, probably about 10 or 15 knots, but I wasn't dragged a lot. I released one of the risers as I wanted to keep the parachute. I checked for injuries and I was O. K. I took my helmet off and my face was all covered with snow. I checked to see if I had all my equipment. I took off the parachute harness and looked around. I couldn't see anything. I looked out to one side and saw what looked like a little pile of rocks. I thought, that's a good place to make a shelter. Then I got a flashlight out. I didn't lose a thing during ejection. My clipboard was still attached.

"I got my flashlight out to look at the terrain. I beamed it down and up the side of the hill and it looked like it was a considerable slope down below and a considerable slope up above. I decided to stay put and move the minimum amount. With each step that I took I went down to my waist in snow. I laid my parachute out and put all my equipment on it. The first thing I got out was the radio. I decided to beep immediately. I beeped for about 15 minutes, and decided to beep at 15 and 45 past the hour as instructed on the radio. I got out my sleeping bag and I made sure that everything I had was zipped up so that it couldn't be lost. I also insured that everything was attached to the parachute and harness because I didn't want to lose anything. I dug a hole. I just jumped up and down and made a hole for my seat, a hole for my feet. I covered the holes with the chute, put all my equipment on the chute and then wrapped the remainder around me. It was raining at the time and I was getting wet. I didn't want to get the sleeping bag wet.

"After I got inside my little shelter I started inventorying things. I got a flare out and put it in my pocket. I got my strobe light out. I started looking for the other radio, but I couldn't immediately find it. I was also looking for the spare battery for the RT-10 which I never did find. I don't think there was a spare battery for the RT-10 radio. I put my radio inside my pocket to keep it warm. I was quite warm, I was dressed too heavily for where I was. My feet were cold and my seat was cold where they had contacted the snow. After a while I sat on the seat cushion. I'd beep for about five minutes and then I'd talk to see if anybody would answer me. I did this twice. Then I heard an airplane go overhead."

Meanwhile, Captain Brost's first call had alerted the Air Traffic Control Center at Anchorage where controllers immediately set about trying to plot the aircraft's position, which was about 90 miles NNE of Anchorage when the aircraft beacon ceased operating. When it was learned the pilot had bailed out his position had already been very closely established.

Then a C-141 enroute to Elmendorf appeared on the scope. This aircraft was vectored to the point where the T-33 had reversed course and then back toward Elmendorf. This was the aircraft Captain Brost heard overhead.

"I called, 'This is Captain Brost,' and someone answered, 'Roger, Captain Brost, this is MAC 602.' He turned around and after making several passes, he established my position on the 002 radial, 55 miles from Anchorage VORTAC. This was done by my giving my relative position to him when I saw him. I made sure he was using the Anchorage VORTAC versus the Elmendorf TACAN. I told him that I was all right and he passed the word back. We talked about different things and I answered questions relayed from the ground. It made me feel real good, because I thought, 'I 've got it made.' I talked with him for a while and decided to turn the radio off to save the batteries. I said I'd be back on the air in 15 minutes for other instructions. As the weather was bad, I didn't think they could get to me until morning and instructed him to relay that I would be settling down for the night and would wait till morning for the pickup. I was planning on spending up to two days because of bad weather. I told him I was going off the air until eight o'clock in the morning, or until I heard an aircraft overhead in the morning. I didn't expect anybody to come that night, and I'd rather they didn't because the weather was bad and they couldn't do anything for me.

"I couldn't go to sleep, I was a little wound up. I kept worrying about losing my goodies. I went to sleep about three o'clock and I woke up at six o'clock. At six o'clock it was just becoming light and I inventoried my equipment. At seven o'clock I laid out the red panels. I had my flares out. I heard an airplane so I called. Nobody answered. Then I heard one up north and it sounded like it was running up and down a valley. I had both the RT-10 radio and URT-27 beacon out. I looked out and saw a C-130 going down the large valley to the north. I was in a little valley that made a right angle with the big valley. It was down low in the valley and when I called he answered. I said, 'I'm at your two o'clock on your nose side of the valley just off your right wing.' He said, 'I don't have you.' He came back around. I let the smoke out and he said, 'I didn't see you.' I said, 'I'm about 3000 feet above you.' He said a chopper was coming and that he had the valley pinpointed.

"I heard the choppers come and they turned up the valley, saw me with my smoke. They had to go back and drop some tanks off. They said, 'We'll try to come up and pick you up.' I didn't think they could, because there was a complete whiteout up there. They came back, circled around, and then went back and landed in the valley floor. I said, 'Are you going to come up and pick me up?' He said, 'We can't; don't have any place to reference.' I said, 'O. K. I'll come down.' He said, 'O. K. We'll have someone to meet you halfway with snowshoes.'

"It looked like a pretty steep slope but it was much steeper actually than it looked. When I started down I was in a whiteout. The slope started at a 45-degree angle and got steeper as I went down. I sat on my seat and slid in a baseball slide, using my arms to propel me. I didn't have any trouble at all stopping. And it took me about an hour or so to get down. That was it."

Our purpose in bringing you this account of Captain Brost's experience is obviously to educate aircrews. There are several factors here which should be considered. For one thing, it happened in Alaska where there exists great awareness of the realities of a survival situation. One of the most impressive things to a visitor to Alaska is the evidence of this awareness among the aircrews. The result is a know-how based on experience, training and respect for the elements and geography. It doesn't really take much more than your eyeballs to make you realize how inhospitable this land is in winter. But much of the South 48 is just as bad during the winter months.

The RT-10 radio was probably the single most valuable piece of survival equipment used by Captain Brost. The value of survival radios (including locator beacons) has been demonstrated time and again in Southeast Asia and in survival situations elsewhere. In this case, Captain Brost could not find a spare battery. If the battery had failed, the weather being what it was, his rescue might have been delayed for some time. Along with his praise for the radio, Captain Brost recommended that a lanyard be attached. If the radio were dropped unnoticed in deep snow it might never be found, unless it was attached to the person. Also a lanyard looped around the neck would allow hanging the radio down inside one's clothing where it would be kept warm and readily accessible. The latter is important in mountainous country where obstructions can blank out communication with low flying aircraft even in the immediate vicinity.

This pilot had several things going for him:

- He was able to get off a call before leaving the aircraft, which led to a fairly good fix on his position.
- The temperature was rather high for the Alaskan interior in winter, 22°F. So extreme cold was not a problem.
- He was well equipped with both RT-10 radio and URT-27 beacon. In addition, he had a pretty good array of other survival items including flares and a down-filled overcoat. The coat did present a problem—he had difficulty closing the snaps which were clogged with snow. His recommendation was that velcro be used as the garment closer.

Most important, however, was the pilot himself. He kept his cool and didn't clank. Tragedies come to mind, such as uninjured men who died with their survival kits unopened and within a few hundred yards of help.

Survival experts say the mental and emotional condition of the man in a survival situation is paramount. That he must discipline himself not to panic, to force himself to take time to assess his circumstance and make rational decisions as to the best courses of action.

This requires preplanning—on the ground and based on the knowledge gained from our excellent survival schools. A plan firmly fixed in mind for handling the first traumatic minutes of survival is something that can't be packed in a survival kit. But it may be the most important thing you've got. Lock it in place and be prepared to use it when the time comes. It's your prepaid insurance. ★

REX RILEY'S CROSS COUNTRY NOTES

AFTER A SUCCESSFUL TARGET MISSION, the IP told the pilot of an F-106B to make a precision approach to field minimums, go around, then make a closed pattern full stop landing for termination. The approach and go-around were O.K. but the final turn to base leg was too tight for existing wind conditions and they approached the threshold at an angle. When he finally lined up on final, the pilot let the airspeed drop too low, flared out too high, and rotated to an extreme nose up attitude. At this point the IP took over, set military power, and lowered the nose. A go-around was accomplished after touching down on the main gear and the tail section.

Even though the instructor was a bit late in taking control, he probably averted a serious mishap; it could easily have become a major accident. Listed as a contributing factor was the pilot's last assignment where he rode back seat in an F-4 and consequently got very little experience in actually operating the bird.

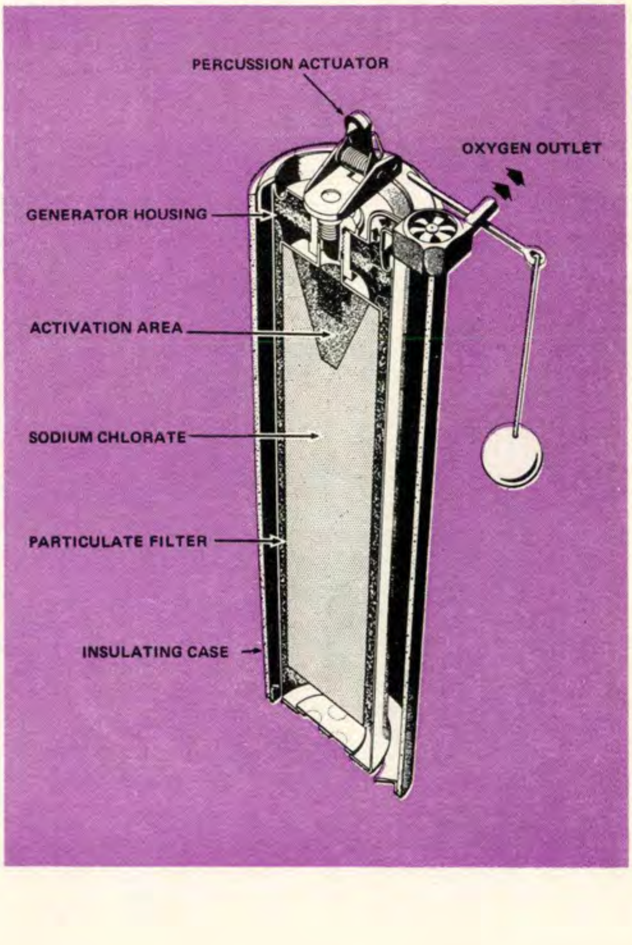
The investigator recommended that more emphasis be placed on the checkout of pilots with such low experience backgrounds. Stay on your toes, instructors, or you'll find yourself behind the same power curve as this IP—and you may not be as quick or as fortunate.

EMERGENCY OXYGEN SYSTEM. The C-5 jet transport will have a revolutionary new emergency oxygen system. The new concept uses solid-state chemical oxygen generators which contain a compressed block of sodium chlorate. When activated, the generator starts an internal reaction within the sodium chlorate releasing medically pure oxygen as its end product.

On jet transports of the future, an oxygen generator will be placed beneath each seat. In the event of a high altitude cabin pressure failure, the generators furnish passengers with a 30-minute emergency supply of oxygen while the plane descends to a safe altitude.

The new system has many inherent advantages for aircraft. Chemical oxygen generators weigh 80 per cent less than an equal number of conventional cylinders of compressed gas, and consume only one-third as much space, but are capable of producing the same amount of oxygen. With individual generators beneath each seat, the extensive oxygen piping systems presently used in aircraft will be eliminated. Unlike gas cylinders, oxygen generators have no pressure problems or danger of loss by leakage.

These systems are proven. Larger versions of the oxygen generator are currently being used on nuclear submarines.

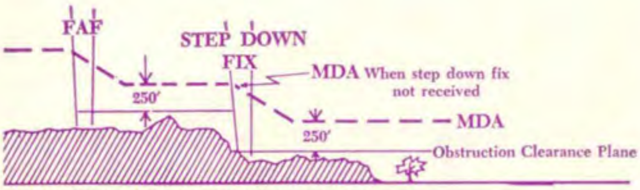


the I.P.I.S. approach

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

Q May an aircraft without dual receivers fly an approach which depicts an intersection (formed by a radial from another facility) as a stepdown fix on the final approach segment?

A Yes, the approach may be flown without receiving the stepdown fix. However, aircraft without dual receiver capability will be unable to descend IFR to the lowest published MDA. Descent to the lower MDA based on stepdown fix passage is limited to aircraft capable of simultaneous reception of flight course and a crossing indication. Under some weather conditions, the higher MDA requirement may preclude successful completion of the approach.



A final approach segment extends from the FAF to the missed approach point, and only one stepdown fix is authorized in any final approach segment.

Q A pilot whose clearance limit is a TACAN IAF experiences a two-way radio failure enroute. If the TACAN IAF (clearance limit) is not located in a published holding pattern and holding is necessary, where should the pilot hold and descend from his assigned enroute altitude?

A The pilot should proceed to the TACAN IAF and then to the published holding pattern. Descent from the enroute altitude or flight level to the initial approach altitude should be made in the published holding pattern in accordance with FLIP II, par III. S. 3. e. If no holding pattern is published (High Altitude), the pilot should hold at the IAF in a position from which the published approach can be conveniently initiated. If no holding pattern is published (Low Altitude), hold on the side of the final approach course to the fix on which the procedure turn is prescribed. When neither low altitude holding pattern nor procedure turn is depicted, select a convenient holding pattern at the low altitude IAF. Pay particular attention to obstruction clearance requirements when selecting an unpublished holding pattern.

Normally, high altitude approaches will include published holding patterns, and future depictions will eliminate many of the non-coincident holding patterns and IAFs.

Q May an aircraft equipped with a *flight director system* use the bank steering bar during holding pattern turns?

A FLIP III states: "Turns during entry and while in the holding pattern will be made at the rate of turn of three degrees per second (not to exceed 30 degrees angle of bank)." This requirement, without demanding bank angles in excess of 30 degrees, ensures that an aircraft will remain within the allocated holding airspace. With the exception of wind drift corrections, consider the three degree per second turn rate or 30 degrees bank angle as minimum values. If the bank steering bar commands less than these applicable values, it should not be used. If the minimum values or greater are commanded, the bank steering bar may be used. Aircraft and pilot capabilities should be carefully considered before exceeding 30 degrees of bank on instruments.

POINT TO PONDER

If you have any questions about the instrument approaches at your home base, we encourage you to drop us a note at FT-IPIS-PS (Attn: IPIS Approach), Randolph AFB TX 78148. All letters will be answered and some of the questions can be shared with others in future IPIS Approach articles.

THE FUEL FLOW GAGE

Harold Poehlmann, Tech Repr
Republic Aviation Division
Fairchild Hiller Corp

THERE is nothing a pilot dislikes more than a "nonrated" or maintenance man giving advice on how to run his machine. However, in this case I have a message that I am certain will prove to be a thought provoker. It is based on observations from experiences dating back to the early jet flying in 1946, and continuing, interestingly enough, into 1968.

In almost every accident and incident involving engine flameout which required a restart, the narration indicates the average pilot places his attention on the wrong instruments during the restart attempts. This sounds like an indictment, but it's true.

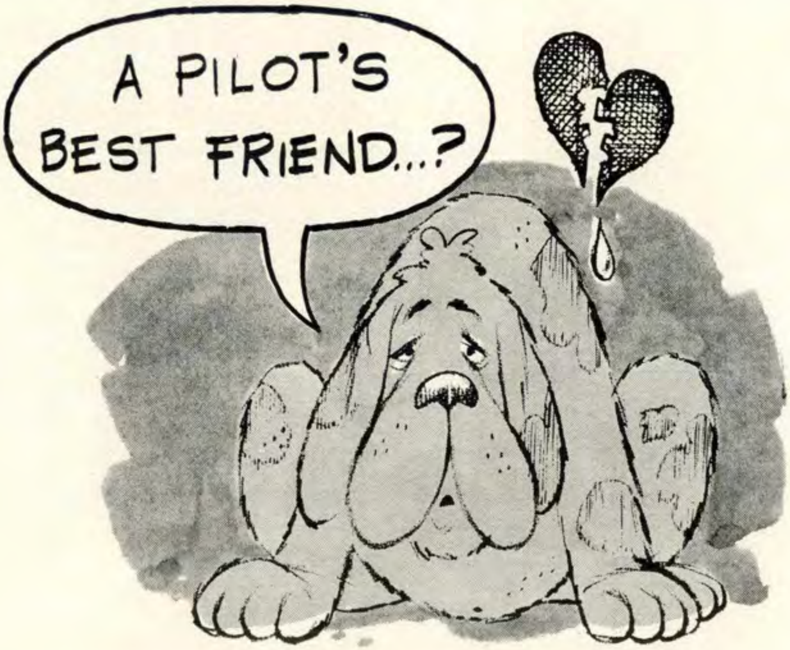
During the 1947 period, the F-

84B aircraft had a fuel system placard in the data case for the pilot to consult during moments of anxiety when attempting to locate some wayward fuel. Of course, this placard portrayed three tanks, two lines, and a couple of pumps and it didn't take more than 300 feet of altitude to "dope" it out. The present day machines are a bit more complex fuel-system-wise, and you'll be at "low key" altitude before you can figure out which side of the fuel system schematic is up (in fact the fuel system schematic is no longer required to be placed in the cockpit —I guess for this very reason).

The formal reports usually state "I opened the throttle and didn't get any rise in EGT, so I then . . .;" "I opened the throttle and the EGT didn't move, so I switched to emergency and still the EGT remained on the peg. . . .;" "I pushed the airstart switch and opened the throttle and the RPM didn't increase from the windmill speed . . ."

On every aircraft you fly, it is very necessary to be able to mentally picture the basic fuel system and remember the location of at least the following two items: main boost pressure warning transmitter (fuel supply inlet pressure), and the fuel flow meter.

This subject boils down to a simple statement of fact; you can't start an engine if there is no "juice" available. If fuel is not available, don't waste time making airstarts until you correct the condition. Your morale is bound to go out the tail pipe along with the ambient air on each non-start attempt, so favor the adrenalin producing organs by making the first start productive. This can only be accomplished by glueing your eye to the fuel flow instrument during the initial start technique. It is not my desire to get involved with altitude, airspeed and other special aircraft model requirements, but the fuel flow is the primary ingredient for a light-off. This is the most important instrument observation during an inflight airstart. It will indicate if the engine is receiving fuel; if it reads zero, save your time and put your limited attention on the aircraft fuel supply system, i.e., warning lights, selector position and liquidometer readings, and other fuel supply paraphernalia. A knowledge of the fuel flow instrument power source is a good idea in order to insure the instrument has power during the emergency period.



Obviously if the main boost light is illuminated, it is signaling there is low or no fuel flow from the aircraft boost system and in all probability the fuel flow indication will be nonexistent. The corrective action is obvious. As the saying goes, "first things first."

Correcting a fuel supply problem is a subject that varies with aircraft and obviously a good knowledge of the basic fuel system is of paramount importance.

Not only is the observance of the fuel flow indication important to the prompt restarting of the engine during those terrifying moments (tell the truth, they *are* terrifying—unless you have more than one "hot air generator"), but the most important gage reading for the ground crew or anyone attempting to reconstruct a flameout is "what" you saw on the flow meter.

The official records would surprise you by how seldom there is mention of the fuel flow reading. I remember one incident where nine airstarts were attempted, and at no time did the pilot observe the fuel flow. There is no doubt there are many instruments demanding attention, but increased use of this important fuel flow gage will prove to be of value in the successful inflight starting of your jet engine. ★

Award of Honor

This is the Safety Council's highest award and is given in recognition of having achieved 10 per cent (or greater) reduction in ground accident rates when compared to the average of the previous two years. 1967's recipients are:

COMMANDS:

- Alaskan Air Command
- Air Training Command
- Military Airlift Command
- Office of Aerospace Research
- Pacific Air Forces
- Strategic Air Command
- Tactical Air Command

NUMBERED AIR FORCES:

- 4th Air Force (ADC)
- 7th Air Force (CINCPACAF)
- 8th Air Force (SAC)
- 9th Air Force (TAC)
- 17th Air Force (CINCUSAFE)
- 22d Air Force (MAC)

WINGS:

- 24th Composite Wing (USAFSO)
- 26th Tactical Reconnaissance Wing (CINCUSAFE)
- 78th Fighter Wing (ADC)
- 438th Military Airlift Wing (MAC)
- 3800th Air Base Wing (AU)

GROUPS, REGIONS, CENTERS, AREAS, DIVISIONS:

- 5010th Combat Support Group (AAC)
- Electronic Systems Division (AFSC)
- European-African-Middle Eastern Comm Area (AFCS)
- Ogden Air Materiel Area (AFLC)
- Sheppard Technical Training Center (ATC)
- United Kingdom Communications Region (AFCS)

BASES:

- Cam Ranh Bay Air Base (CINCPACAF)
- Craig Air Force Base (ATC)
- Pease Air Force Base (SAC)
- Seymour-Johnson Air Force Base (TAC)

GRO
SAFETY

Presented by the Nati

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AIR FORCE RECEIVES NATIONA HONOR. Mr Howard Pyle, Pr Council, presenting a plaque t General Bruce K. Holloway, rec ment in reducing its ground 1967 compared to its 1965-19

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L SAFETY COUNCIL AWARD OF
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Air Force Vice Chief of Staff,
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cident rates 14.57 per cent in
average.

Award of Merit

This is the Safety Council's second highest award and is given in recognition of having achieved significant reductions in ground accident rates when compared to the average of the previous two years. 1967's recipients are:

COMMANDS:

Aerospace Defense Command
Air Force Communications Service
Continental Air Command
HQ Command USAF
United States Air Forces Southern Command

NUMBERED AIR FORCES:

1st Air Force (ADC)
5th Air Force (CINCPACAF)
12th Air Force (TAC)
13th Air Force (CINCPACAF)

WINGS:

17th Bombardment Wing (SAC)
60th Military Airlift Wing (MAC)
68th Bombardment Wing (SAC)
325th Fighter Wing (ADC)
507th Fighter Wing (ADC)
4252d Strategic Wing (SAC)
4453d Combat Crew Training Wing (TAC)
4500th Air Base Wing (TAC)
4780th Air Defense Wing (ADC)

GROUPS, REGIONS, CENTERS, DETACHMENTS, SERVICES:

57th Fighter Group (ADC)
4603d Air Base Group (ADC)
Aerospace Audio Visual Services (MAC)
Amarillo Technical Training Center (ATC)
Spanish Communications Region (AFCS)
TUSLOG Detachment 170 (AFCS)

BASES:

Blytheville Air Force Base (SAC)
Clinton-Sherman Air Force Base (SAC)
Columbus Air Force Base (SAC)
Dyess Air Force Base (SAC)
Fairchild Air Force Base (SAC)
Goose Air Base (SAC)
Hickam Air Force Base (CINCPACAF)
Homestead Air Force Base (SAC)
MacDill Air Force Base (TAC)
Malmstrom Air Force Base (SAC)
McConnell Air Force Base (TAC)
McCoy Air Force Base (SAC)
Naha Air Base (CINCPACAF)
Nellis Air Force Base (TAC)
Offutt Air Force Base (SAC)
Vandenberg Air Force Base (SAC)
Webb Air Force Base (ATC)
Yokota Air Base (CINCPACAF)

LOST IN SPACE

THE following concludes this three-part series on spatial disorientation/vertigo. The series resulted from a discussion which was taped and edited slightly for clarity. Participants were Col Thomas Collins, former Chief of the Life Sciences Group, Directorate of Aerospace Safety; Lt Cols Charles Sawyer and Victor Ferrari, who like Dr Collins are flight surgeons; Dr Anchard Zeller, psychologist in Life Sciences; Major Robert Bond, fighter pilot and project officer; Lt Col Henry Compton, transport pilot and editor of *Aerospace Safety*, and Bob Harrison, managing editor.

Part III

Dr Collins What about reliance on instruments? What about the level of confidence in instruments? I've been around instrument schools a lot and they play this one down, and I can understand it from a psychological standpoint. These instruments are reliable, but instrument training must emphasize the necessity for cross-checking the pertinent instruments.

Col Compton You do have to trust your instruments, but you have to qualify that trust with a quick cross check. The T-29 now has the gages common to a lot of jet flghters. The other day I had vertigo on take off in the soup and the artificial horizon froze in about a half inch dive position. I had a good cross check going, and I kept my rate of climb, with the turn needle centered, and realized that I had a frozen instrument.

Dr Ferrari Did you get an OFF flag?

Col Compton Nope, no OFF flag.

Mr Harrison It only comes in

on loss of power to the instrument, doesn't it?

Col Compton That's right. I just brought that up to say that you have to qualify that trust with rapid cross check.

Dr Ferrari Whether you are flying visually or flying instruments, personally I believe in the school that says there is no difference between the two although you have a different horizon presentation. In the one case, you are using the real horizon as a reference; in the other, the horizon is represented by a bar on an instrument. They both tell you the same thing. But you have to cross check whether you are flying visually or by instruments. This should be ingrained in you, and I think this is basic pilot technique. I have often thought that the people who have problems doing satisfactorily on instrument flying and instrument checks, especially hooded ones, don't have very good basic pilot technique either. Because basic technique in any maneuver is to establish power and attitude, hold these two things until your performance stabilizes and then trim hands off. This is basic pilot technique. I don't care what your reference is, whether it is artificial or actual. If you do this, you can devote most of your thinking to the problem of procedures and navigation and it becomes reflex. But take a man who doesn't do this, who does everything, say, but trim. Visually, this doesn't bother him because he is used to holding a certain amount of pressure and he doesn't notice it. Put him under a hood and he has trouble, not because of his instrument flying but because of his basic flying technique. This again is training.

Dr Collins One big void in our knowledge is, what happens to a fighter pilot, or any pilot, when he is screaming down toward the earth, and he is not transmitting on the radio? Unless he is completely panicked, and this may be in some cases, he must be doing something. What is he doing all the way down from 10,000 feet to the ground?

Maj Bond Trying to get his brain to lock on again as to where he is and what he is doing.

Dr Collins He is probably cross checking, isn't he?

Maj Bond He is trying to sort something out.

Dr Collins Maybe he doesn't understand what he is doing.

Can we teach him as a part of his training to, under any circumstance where he is in trouble, transmit something, not just MAY-DAY, but something that would give an inkling of what has gone wrong, what he is doing?

Col Compton You mean, say "instruments" or something like that over the radio?

Mr Harrison If he is so disoriented or shook up that he can't read those, how are you going to get him to respond to anything else?

Dr Collins All you've got to do is say something. It isn't a matter of another procedure.

Maj Bond Anything the pilot is taught to do is *another* procedure. Any additional requirement of the pilot during this confusion may be the one factor that could prevent him from recovering the airplane. We have had students freeze up on the radio transmit button, requiring the IP in the airplane to recover the airplane while the student remained frozen—with his mouth open.

Dr Zeller Dr Collins, I think your idea is real sound except that hope springs eternal, and a pilot thinks he will get out of it. Then, if you do succeed in training the pilot to talk on the radio you have the problem we had in a recent airline crash. They were amazed the pilot gave such a normal, routine call "we are spinning." Obviously he was having no emotional difficulty. It seems somewhat illogical but that is the conclusion.

Dr Collins At least he gave them something that led them to think what was going on there. They may have thought he was a suicide. He was just very calmly saying, "We are spinning." There was no panic, seemingly no problem at all.

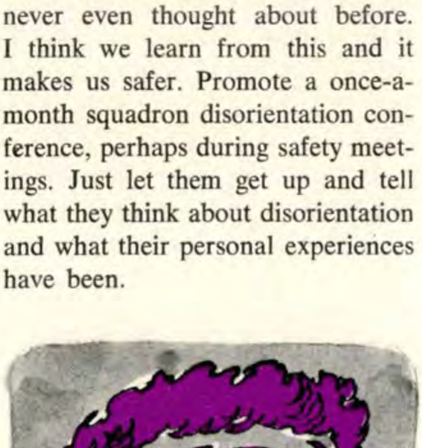
Maj Bond You are addressing a problem that is very similar to one that we perhaps experience in fatal flameout landing approaches, where a man stays with the airplane well past the decision point. He is in daylight most of the time, in control of the airplane, right side up. The thing he is facing is a sink rate that greatly exceeds anything he has previously experienced. So there, with all these things to look at, he mentally gets behind. Perhaps it's fear, for lack of a better term. Not having been in that environment, his mind stops functioning properly. What are those human traits that would make a man stay in an airplane when he knows very well it is going to kill him if he hits the ground in it? I am sure some of those traits—whatever it is that makes a man get behind the airplane—are even more intensified at night, when you are trying to sort it out on instruments.

Dr Collins I think our instrument training programs have been very good and I certainly wouldn't want to say anything against them. At the same time I think the facts speak for themselves—a lot of good pilots have gone through instrument training, but under certain circumstances get involved in unrecoverable positions where they don't recognize them in time. We can look at these things retrospectively and say, "That was a pretty unstable kid, he probably panicked, or this guy couldn't have panicked, he was a Rock of Gibralter." So maybe he had a faulty reading on his instrument. But we are still in the realm of speculation. Maybe we just haven't been wise enough to figure out all these variables that change the picture under different sets of circumstances. Even if we did, it might be so complex that we would never be able to prepare every pilot for every eventuality. We've got a ways to go because we've got to come right back to this 12 per cent "cause undetermined" accidents every year and it is too high.

Dr Ferrari I still think the one most important basic safety factor in this type of thing is convincing this guy that "it can and will happen to me."

Maj Bond You mean an attention step before you start your training program.

Dr Ferrari That's right. Pilots have got to say to themselves mentally: "I'm going to make a mistake," or: "I am going to get vertigo and it is going to happen, going to happen," repeatedly. Then this guy who goes about learning to fly on this premise, as he builds his habit reflexes in this fine environment, has already cranked this stuff into the computer and he is not so apt to get into this situation and clank. The man, I believe, who says, "I'm human, it is going to happen to me and I'm going to prepare for it ahead of time," is going to be a lot safer. Along this line, if you are looking for a program to promote better instrument flying safety or decrease disorientation accidents, what would be wrong with proposing just what we have done here today. We have many disciplines right here in this room, many different ideas. Everyone of us has come up with many ideas we had never even thought about before. I think we learn from this and it makes us safer. Promote a once-a-month squadron disorientation conference, perhaps during safety meetings. Just let them get up and tell what they think about disorientation and what their personal experiences have been.



Dr Collins I think that is a good idea. I think a lot of the conscientiousness of a program to prevent spatial disorientation accidents comes from the kind of leader who is willing to get up at a Wing flying safety meeting and tell about what happened to him yesterday. I remember one commander telling about flying for a long ways through clouds in which he was convinced that his airplane was in a vertical position but he stayed on his gages anyway. But he said he came pretty close on several occasions to not trusting his instruments. Now he got up before all the other IPs and his student pilots and told this. This is what we need more of.

Dr Zeller Another thing enters into it a great deal, particularly among younger pilots who are emulating their elders. If they ever get a feeling that to admit these things is a sign of weakness, that it would hold them up for ridicule or put them in an inferior position, they wouldn't admit it on a bet. A lot of good honesty at the top will certainly help the young man at the bottom.

Dr Sawyer Certainly it is hard to differentiate this lack of communication that one sees after spatial disorientation, whether it is due to the confusion factor that we discussed earlier, or a reticence to admit, in that particular case, that they were spatially disoriented. Sometimes you almost get the feeling that the pilot is withholding information. But, on the other hand, it is a part of the confusion of the situation.

Maj Bond That may be a good point, but I think if he were withholding information he'd eject.

Dr Sawyer Well, I was talking specifically of the guy who did punch out and he still has a lack of information, which is really characteristic of the pilot story from the few definite cases that we have. The inability to describe what actually happened.

Mr Harrison How does fatigue affect disorientation as a contributing factor? Have you got anything concrete on it?

Dr Ferrari This has been investigated, I guess every way under the sun, but fatigue is such an illusive quantity. MAC did an extensive study in EASTAF when I was down at Charleston. They put a flight surgeon and psychologist on board some MAC aircraft that were going out on 27 hour crew duty times. They did two things: Number one, they evaluated the proficiency of these crews and the number of mistakes and how smooth their performance was in doing the actual approach and flying the aircraft. This was done by someone with enough flying background to make a valid evaluation. Also they did periodic psycho-motor testing of these people. And they did better on their approaches at the end of the mission than they did when they started, almost invariably. Of course, this was an abnormal situation because these people knew they were being evaluated for fatigue, which emphasizes the role of motivation. These people were primed; they knew they were being evaluated for mistakes. So they were primed by motivation and an emphasis on the problem.

Dr Collins Getting back to the mechanics of disorientation, vertigo. I don't recall any studies, in which there was a clear association between the severity of confusing symptoms from your inner ear sensations and your ability to recognize and cope with them. It seems logical that you would expect a loss of ability to cope with these things. I don't think it has been proven that the actual sensations originating there would be altered in any way by fatigue.

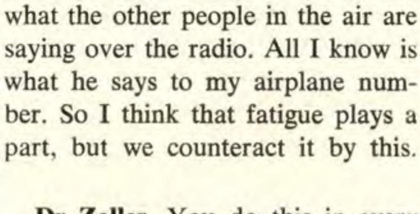
Dr Ferrari Some of the psychological stresses you would get from these failings might even tend to be masked by the overlying fatigue.

Col Compton I felt like the point you were trying to make was that when you know you are tired you tell yourself, "Man, you gotta pump yourself up for this approach or you'll never hack it."

Dr Ferrari But you contrast this with a guy who is out there doing this month after month and it is another routine mission. He is tired but he is used to being tired. He is a bit careless; he hasn't keyed himself up to the fact that he is tired. He is more prone to making mistakes; therefore, he must be more careful. He is complacent and he is tired, too. This is a dangerous situation.

Maj Bond Most people who deal in jobs that are potentially hazardous, as they get tired, channel their attention and concentration. It is almost like tunnel vision. Your attention span tunnels just like that. I no longer care whether he is humming in the rear seat or not. I'm not doing anything but flying on that block of gages. I don't really care what the other people in the air are saying over the radio. All I know is what he says to my airplane number. So I think that fatigue plays a part, but we counteract it by this.

Dr Zeller You do this in every task. There is a standard curve of proficiency. At the end of the day there is a sweep where your efficiency and effectiveness increase. In your day to day work this is quite true, providing that you know when the end is. Right at the end you are in pretty good shape. You can throw this off completely just by telling a man he has to work some more when he thinks he's about through . . .



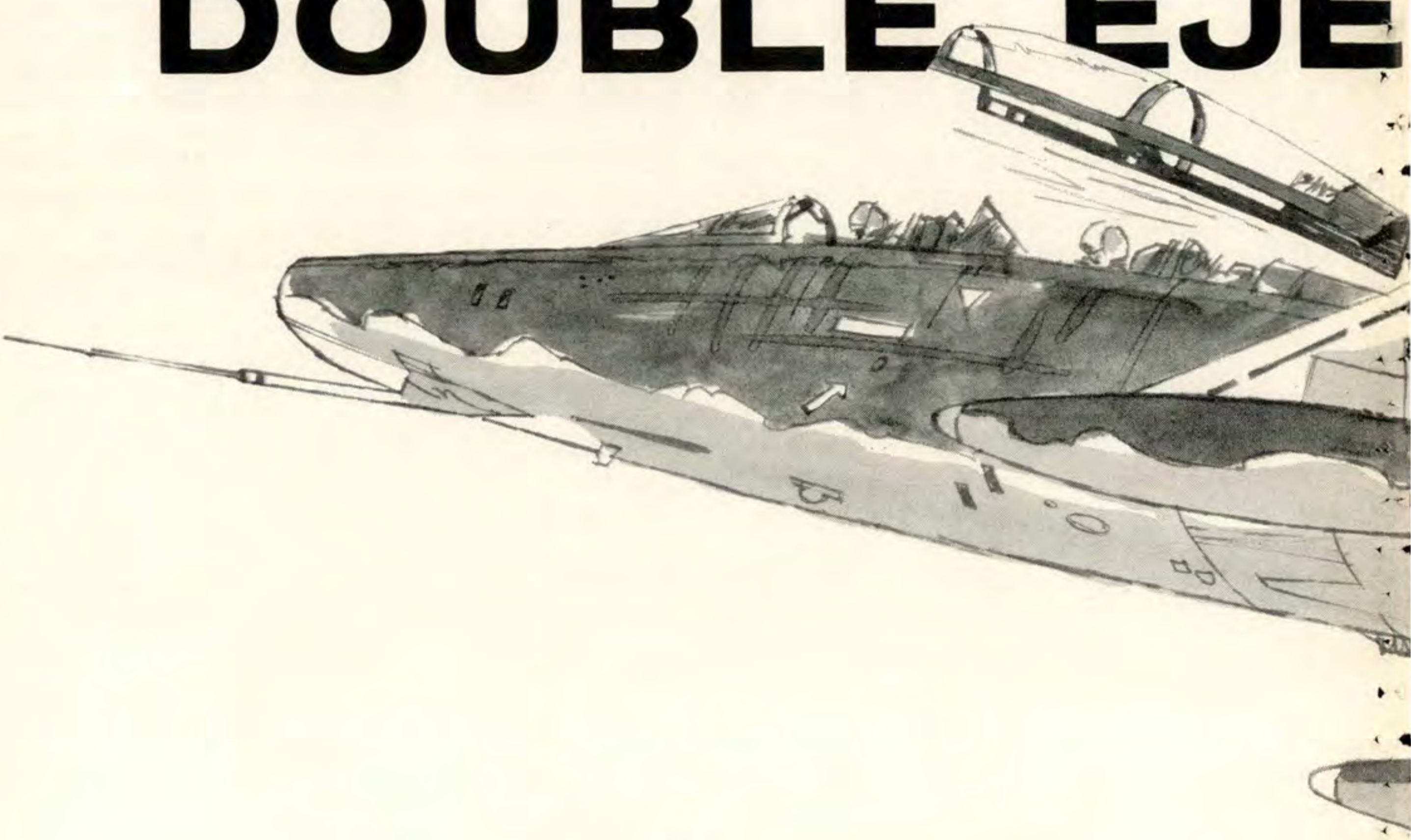
This concludes this series of three articles on spatial disorientation. The editors thank the participants in the discussion which led to this series. Since the session in which these thoughts were expressed, several members of the group have moved elsewhere. Dr Sawyer has accepted a fellowship to study at Harvard medical school; Dr Collins has retired, and Major Bond has been reassigned back to the cockpit flying fighters.

While this series presented little that is new, and no specific do's and don't's, it touched on many of the problems faced by pilots everyday. These are the same problems pilots have had for sixty years, but they may be more serious today with the kind of aircraft we fly, despite our more sophisticated instrument systems. This brings up some of the subjects touched on in this series. For example, the necessity for a pilot to establish, as early as possible in his career, good instrument cross check technique. And the value of cross checking pertinent instruments during both visual and instrument flying, as well as during formation flying.

Also discussed by the group were the role of trim in preventing, or overcoming, spatial disorientation; visual illusions, particularly during the takeoff and landing phases. A related subject was the load on the pilot during these phases of flight, particularly during instrument conditions.

This taped discussion turned out to be a problem presentation session rather than the formulation of solutions. Many readers may not agree with some of the statements made. Some may not see any value in this series. But the editors believe that as long as Air Force pilots die in spatial disorientation/vertigo induced accidents, every effort toward prevention must be made. This series has been one small step toward increasing understanding of this problem which may eventually lead to its solution. ★

DOUBLE EJE



Maj W. C. Sager
4510 CCTW, Luke AFB

AT A FLYING SAFETY MEETING LAST SUMMER MAJOR SAGER GAVE THE FOLLOWING FIRST-HAND ACCOUNT OF AN EXPERIENCE WHICH HAS A VITAL MESSAGE FOR ALL AIRCREW MEMBERS

I was joining up my flight after a tactical range mission when the nose of the aircraft started to fall below the horizon. Additional back pressure on the stick had no effect. I asked the passenger if he was touching the stick (which was kind of irrelevant. Obviously he wasn't because I had the stick in my hand and was pulling it back). It was a completely foreign feeling. Something unusual was happening yet there was no indication in the cockpit that anything was wrong. Rather insidious when you think about it!

In 1958 I had to eject from an F-100D. I was on a LABS run, on the deck, doing about 450 knots when the whole world lit up. There wasn't any question in my mind about what was happening; fire warning lights, caution lights, everything was coming on. I zoomed and ejected. It was a straightforward ejection situation.

This time, however, no such thing. I added full military power to help turn the nose around and maintained back pressure on the stick and this combination did get the nose started up. Now, all of a sudden, the aircraft was in a full noseup situation. I pushed on the stick. In fact, I pushed it right up to the instrument panel and held the trim button forward, but the airplane's nose kept going up.

I carefully looked at all the dials but there was no indication of anything wrong. Then a strange thought crept into my mind. I've had radio

CTION: F-100 F

failure or a complete electrical failure. Then I realized I was talking to my wingmen, saying, "Get out of the way. Looks like I'm going to have to punch out of this thing." And they did and I did.

O.K., let's consider what we jumped into. It was rocky, barren country—not very hospitable terrain by any means. And I was fortunate —I landed out on the desert where it's more or less flat. The boy in the back seat ended up on the side of the mountains. I will explain how this came about, but first let me go through the ejection sequences.

I had briefed the passenger before takeoff, so when it came time to jump, I said, "This is it, we're going to jump; set it up for ejection," which he did. When I asked, "Are you ready?", and he replied, "Yes," I blew the canopy. I asked him again and I think because I was going slow I was able to hear him very well. (I did nothing to the radio volume, but he answered very clearly that he was ready.) Then I ejected us both. In my favor was that I expected the half-second delay that we have in the F-100. It wasn't a surprise, but that half-second seems like an eternity!

The seat itself worked very smoothly, but the acceleration was very rapid. The first time I jumped it was the old 20 mm seat that really kicked you in the fanny. Also, on my initial jump I had just the seat cushion, not a seat pack. This time I don't know whether it was the pack seat or not, but the acceleration was nice and smooth. I did have my chin strap fastened, my visor down and the whole bit. I usually fly that way. I didn't lose a thing. I remember tumbling forward, started to beat the system, about that time the butt snapper said, "OOF," and away I went. The chute opened and bang! I'm hanging there; it worked beautifully.

Then we started down. I looked down and I talked to my passenger. I was close enough to talk to him. As I recall, when I first saw him he had his helmet in his hand. It had come off in the ejection, but the mask had been fastened properly so the helmet stayed with him. He put it back on his head. This was a smart move because he landed in a mighty rough spot. I hollered to him, "Deploy your kit," and in the meantime I went ahead and deployed mine.

I did get one glance at the airplane. I wasn't really too interested about that time, but it was flying away from me in a nose-high attitude and I thought, "That thing's going to go clear into the next county." About 10 seconds later it flipped over on its back and spun in.

I yelled at the passenger again, "Deploy your kit!" He had had a briefing on all his gear including the ejection procedures and all the other training. I wouldn't say he was the most thoroughly briefed person in the world, but he had a pretty good idea of what was what. He just got a little panicky.

If they had told me to "cut four" on my first jump, I would have said, "You're crazy!" If you're hanging in that chute and you've got good silk over your head, you're not going to do a damn thing if you haven't got a plan of action in your head.

By now I had deployed my kit. I had to kick the kit open. I went through the proper motions but nothing happened. So, I got my heel in there and gave it a good boot and as soon as I got the zipper popped initially, the raft inflated and everything fell down. I was great except that I was oscillating so bad that the raft was over my head. "Cut four" was the answer!

I looked for my knife—it was right where it was supposed to be; no problem reaching it. It had fallen right down in front of me. I got it out, took the little cover off of it, pulled the shroud lines down to me, very plainly marked with a red flag, and I cut two on the right side first. Beautiful! I stopped oscillating just like that. It made a little pocket in the back of the chute and I'm fat, dumb and happy.

That was so good, I thought, "I'll cut the other two. I'll go ahead and do the whole thing." So I did and now I'm coming straight down. I turned the chute into the wind and I looked through my feet. I came straight down as if I were in an elevator. At this time my passenger and I had separated by almost a mile. He really blew away while I had perfect control over my chute. I landed in the open and he landed on a 35 or maybe 40 degree slope. He was lying there among rocks about the size of an office desk. I think his helmet saved his life.

I landed in a pretty good spot, an almost level area. I was going slightly into the hill and traveling in the direction toward the chute, just ever so slightly with the wind. I had turned so that I sort of quartered into the wind. No trouble landing. As I was coming down, I could pick out the area and I landed almost exactly in the spot I had picked.

In fact, there was one thing I thought about all the way down. (Something which really bugs me. I'm the kind of person who hates to jump off things. That's why I didn't like water survival school, jumping off the back of that landing craft really bugged me.) So I thought all the way down, I've got to make a landing and it's really going to be grim. It's the one part I don't like.

With the forward velocity the chute gave me and everything, I hit the ground and fell over to my left side and that was it. I was on the ground. It seemed like a lot easier landing fall than it had the first time several years ago, much easier. That was a surprise. So, again, I advocate cut four, and I missed all those big cacti around there.

Now, of course, if you don't want to jump out of airplanes, or if you hesitate, or if you don't know what you're doing, you're in bad trouble. There's no doubt about it in my mind and I'm sure there's no doubt about it in yours. And, as I say, an accident like this one was pretty insidious—not a light in the cockpit, really nothing to indicate trouble other than the fact the airplane wasn't going where I wanted it to. Everything else was beautifully normal, in the green, and I had that comfortable feeling. I was sitting there in my office and the engine was running and I was comfortable. That's why they put butt snappers

in the seats, for instance, because people held onto the seat right into the ground, because they were still comfortable, so to speak. And, of course, it gets awful uncomfortable all of a sudden!

So now I've come to what I consider the meat of the whole thing: You've got to know your equipment and then when something happens it will make it easier to get out of that airplane. That's the easy part. Once you squeeze that trigger, you're on your way, right? You can't stop any more. There's no way. So you're gone, you're going to be in the chute and it's going to be great.

Then to make it easy on yourself coming down, you've got to be able to use your equipment and I really do advocate the *cut four*. Cut four is terrific. It will make a difference. You just feel more comfortable coming down. There's no oscillation and you have control over your chute. You are ready now to go on to the next step. And, of course, part of *cut four* is what? Deploying your kit. Then, your next step is to get a good landing fall and get into the right place.

Now you're on the ground. What have you done? You've jumped from one bad situation out here in the west right into another. You've jumped into the desert which is not exactly pleasant. You should do a few things. The next thing you've got to know is what's inside your kit. You go to the kit and open that baby up and you get out your radio.

I got out my radio and talked, and the radio went "squawk, squawk" and it quit. So I promptly thought, "O.K., bad battery or something," got my other battery out and the thing didn't even go "squawk." It just didn't work at all. That's not too good, so I got out my can of water and I drank that because I know from past ex-

perience and from what I've read that you're in a state of shock. I thought I was the coolest, calmest son of a gun in the world. O.K., I got out my kit, got out my radio that didn't work, and I drank my can of water because I'm in a state of shock, and I thought, Now, I've got to get over to my passenger.

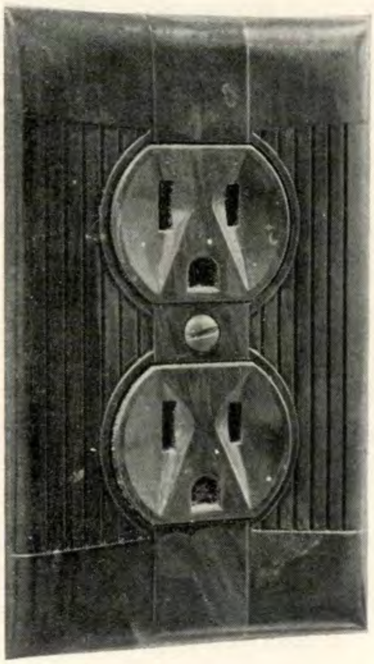
I had landed before he did (which surprised me; for some reason or other I thought that with four cut I would go down slower) and I had seen his chute go down out of sight behind a ridge. It didn't look far so I decided I would walk over there. I went back to my kit, put two day-night flares in my G-suit pocket, got out my yellow and brown hat and put it on, yellow side out, got my compass and away I went.

About halfway there, I thought, you know you've already made one mistake, but it's not serious. I had left my signalling mirror behind. It was not a fatal mistake, but it could have been an uncomfortable one. However, I do carry some signalling devices in my G-suit pocket and that's another thing I thought about at the time—I really didn't have to have my G-suit on. I could have taken the stuff out of the pockets and put it in my flying suit pockets. In fact, I didn't take my G-suit off until we arrived safely back at our home base. I wore that hot, cotton-pickin' thing for four hours. That's crazy, you know. So it proves a point—you are in a little bit of shock.

So the fourth thing I want to say is: Know your equipment, know what's available to you when you get on the ground, because it's so much better, psychologically. You feel so much calmer when you know you have the situation in hand. I just can't explain the difference between this ejection and the first one. It's just so different, the two of them. But this one just went so smoothly. If you have to jump out, make it as easy as you can on yourself.

There you are. That's what's going to happen. Realize it and be ready for it. It can happen to you at any time without any indication at all. Some of us are going to fly for years and never have anything happen, but we're not all going to be that lucky.

Comment from the F-100 Project Officer: "The Board found that someone had improperly installed the bolt which connects the horizontal stabilizer control system override bungee assembly to the hydraulic flight control stabilizer trim impulse lever. Result: the bolt fell out, causing complete loss of horizontal stabilizer control. The odds are there's also some supervisory factor involved since someone had to sign off the work on the flight control system before this bird was released for flight. Incidentally, this isn't the first time this sort of thing has happened; there are several more cases on record. But, it is exactly the type of accident we expect to prevent by using self-retaining bolts. AFLC has approved the funds, and the first bolt kits should be available in the next few months. ★



WARNING LOW VOLTAGE

Maj Warren C. Hoflich, Jr
Directorate of Aerospace Safety

NORMALLY we think of electrical hazards being associated with high voltage—600 volts or higher. We seldom concern ourselves with hazards associated with low voltage; yet, this is the area most of us are subjected to on a daily basis. In our missile systems, for example, the highest voltage normally used is 480 volts and this is only accessible in a few well protected areas.

Current is the real killer in cases of contact with low voltage; in fact, the current necessary to operate a 100 watt light bulb is eight to 10 times the amount needed to kill a person. Many factors are involved and the controlling one is the relationship between the voltage one may be in contact with and the resistance of the circuit of which his body is a part. If this resistance is low, the voltage can also be low but still sufficient to cause death. Fatalities from an ordinary 110 volt circuit are frequent.

When a person's body becomes part of an electric circuit through which current flows, he receives a shock. This shock can have the effect of discomfort or when sufficient current flows, can cause involuntary contraction of the muscles, affect or stop the heart, stop breathing, or cause burns.

The course of current flow through the body may be local such as, hand to hand, or it may go through the heart or central nerve system. The shock may come from contact between a live part and ground or, between two live parts at different polarity or phase.

The severity of injury from electric shock can be determined by any of the following: amount of current that flows through the body, path the current takes through the body, length of time the body is in the circuit, and the physical condition of the person.

Current flow through the body depends upon the voltage of the circuit contacted, the insulating qualities of the area surrounding the shock scene, the resistance of the skin/clothing, and the area and pressure of contact with the live conductor. Current takes the path of least resistance through or over the surface of the body. Wet clothing may furnish a lower resistance path than that through the body, or part of the current may flow through the body and part over its surface. Current of sufficiently high frequency heats but does not cause shock. Direct current (DC) is generally considered to carry less shock hazard for a given voltage than alternating current (AC), but since DC arcs are more persistent than those from AC, it is likely to burn more severely.

PHYSICAL condition of an individual may be a factor in some shock incidents but the importance is probably overrated. Investigation of deaths from low voltages rarely justifies the frequently heard comment, "He must have had a bad heart." Some of the causes of injuries from low voltage are touching live parts, short circuit, accidental ground, overload and breaking connections.

We mentioned human resistance to electrical current. A good thing to remember regarding this is the difference between dry skin and wet skin resistance. Dry skin will afford a resistance value of 100,000 to 600,000 ohms of resistance. Internal body resistance works in the area of 400 to 600 ohms when the current flows from hand to foot, and 100 ohms when it travels from ear to ear.

With these facts in mind, let us set up a situation where an individual makes contact with 120 volts and has skin plus internal resistance totalling 1200 ohms. We could have 1/10 amperes or 100 milliamperes of electric current, and the following summary of effects will give you an idea of the danger to this low voltage shock victim:

- One to eight milliamperes of current causes a sensation of shock, not very painful, and the individual can let go because muscular control is not lost. Eight to 15 milliamperes causes painful shock but the individual still has muscular control and can let go at will.
- Fifteen to 20 milliamperes causes painful shock, loss of muscle control and the victim cannot let go.
- Twenty to 50 milliamperes causes painful shock, severe muscular contractions, and breathing becomes difficult.
- One hundred to 200 milliamperes causes ventricular fibrillation (a heart condition that disrupts the rhythm of the beat), and results in death.
- Two hundred and over milliamperes causes severe burns and muscular contractions are so severe that chest muscles clamp the heart and stop it during the shock (this prevents ventricular fibrillation and if proper first aid is administered soon enough, the victim may survive). It is a generally accepted fact that fewer low voltage shock victims can be revived than those receiving 1000 volts or more.

AS you can see, our victim, with possible wet skin, making contact with the right parts of his body, falls in the area where ventricular fibrillation takes place and will quite possibly be a fatality.

One of the insidious hazards associated with low voltage and one that causes many injuries and deaths is the fright reaction or "re-coil" when the body makes contact with a live circuit. People have fallen from ladders and other high locations, they have bumped heads and injured other parts of their bodies after reacting from low voltage shock.

At one of our missile wings a facility electrician went to a power distribution area and proceeded to test the equipment to locate and repair a reported fault. The power in the area was all low voltage so the electrician decided to do the job by himself. First mistake: he knew there should always be a buddy near by when one is working on electrical circuits. But this was all harmless low voltage, so why tie up two men when one could easily do the job? After making a few tests from the ground this man climbed up between some overhead pipes and other equipment to test a 110 volt circuit. He touched the 110 circuit with his hand. The shock causes him to re-coil and in so doing, he struck his head causing unconsciousness and during the next several minutes he remained in a position with his right hand on the live circuit and his left foot completing the ground with the current running through his heart. He was found dead in this position some time later. The current passing through his heart had caused fibrillation and subsequent heart failure.

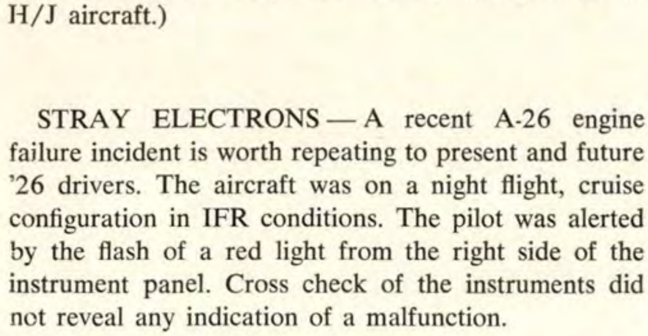
The safety rules for protection from electrical hazards have been published and distributed in all areas where personnel may come in contact with electrical circuits. In addition, first aid methods for treatment of electrical shock victims have been perfected, identified and made available during safety and numerous other training programs. Each of us during an average day are involved with electricity in one form or another. Accepting this as a fact, doesn't it make sense that we should be completely aware of the associated hazards and also the first aid treatment for the unsuspecting and unfortunate shock victim? Of course, that couldn't be you or me because these things always happen to the other guy! ★

LIFE SUPPORT — For F-4 crews: OOAMA has recommended approval of an MK-H7 seat leg restraint system mod submitted by the contractor. According to the AMA's message: "This change will lengthen the leg restraint cord to 49 inches, revert back to the one to one ratio, and add another garter above the knee. The modification of MK-H5 seats to MK-H7 configuration will continue on an expedited basis. Most occurrence of short leg restraint cord discrepancy is during ground operation and seldom during flight; therefore, recommend aircrew men be oriented accordingly."

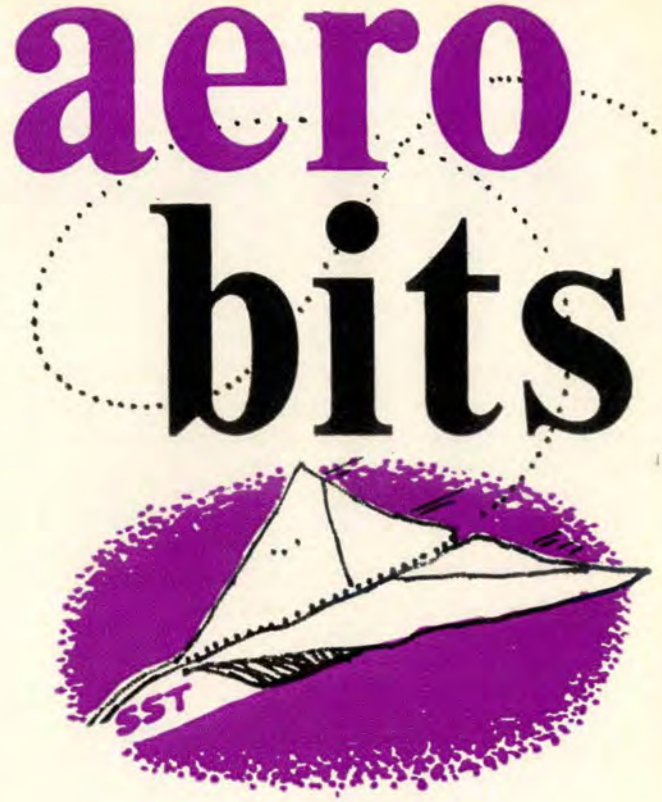
For A-1 crews: "Safety time compliance TCTO 1A-1-527 will install cross connector straps between parachute risers on A-1E/G aircraft parachutes. As a result, pilot training in quick release of both harness fittings immediately at touchdown is imperative. Installation of cross connector straps is an interim fix pending availability of a modified parachute release fitting." (Cross connector straps are already incorporated in H/J aircraft.)

STRAY ELECTRONS — A recent A-26 engine failure incident is worth repeating to present and future '26 drivers. The aircraft was on a night flight, cruise configuration in IFR conditions. The pilot was alerted by the flash of a red light from the right side of the instrument panel. Cross check of the instruments did not reveal any indication of a malfunction.

Transfer of bomb bay tank fuel was initiated with the bomb bay fuel selector positioned to "both" engines and booster pump on high boost. Main tank fuel selectors were positioned to the respective engine with booster pumps on low boost. Approximately two minutes after start of fuel transfer, the pilot noted the Nr 2 engine fuel flow indicator fluctuating 400 pph. The mixture controls were placed in auto rich and shortly the Nr 2 engine fuel flow and fuel pressure dropped



to zero, the low fuel pressure warning light came on, and engine power was lost. The Nr 1 engine continued to operate normally.



The pilot reconfirmed that both fuel selectors were in the main tank positions and placed the main tanks booster pump switches in high boost position. The failed engine throttle was retarded to idle and the engine permitted to windmill in attempt to restart. After approximately one minute fuel flow and fuel pressure still remained at zero and the engine was secured using the engine-failure-during-flight checklist. Ground investigation revealed that oil seepage into a cannon plug had caused a short circuit that partially closed the fuel shutoff valve causing subsequent fuel starvation. Electrical contacts in the cannon plug were cleaned and the fuel shutoff valve operated normally.

Maj Edward W. Johnson
Directorate of Aerospace Safety

PILOT VIGILANCE. The FAA is stressing the need for pilot vigilance in a new rule. This is particularly significant in light of Air Force emphasis on the subject. The Federal Aviation Administration has amended Part 91 of the Federal Aviation Regulations ("General Operating and Flight Rules") to spell out the specific responsibility of pilots to maintain a vigilant watch for other air traffic in order to avoid midair collisions.

FAA said this responsibility is now implied in various sections of FAR Part 91 and is generally understood by pilots. However, the agency feels that "a specific statement of the requirement is desirable to emphasize its importance."

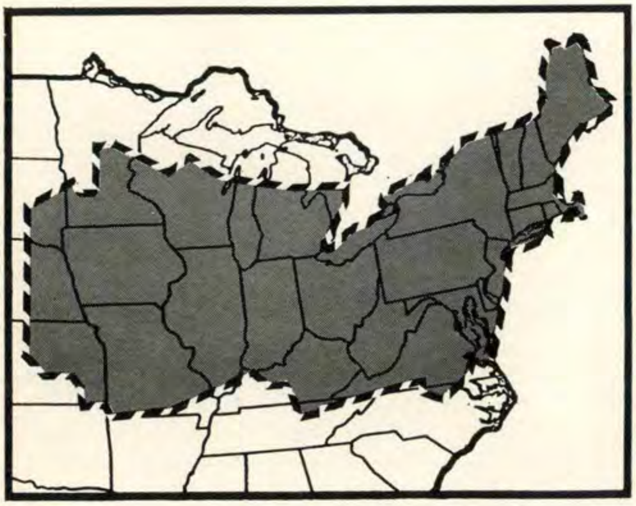
Specifically, the new rule states: "When weather conditions permit, regardless of whether an operation is conducted under Instrument Flight Rules or Visual Flight Rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. . . ." The rule becomes effective immediately.

NORTHEAST PCA AREA ALTITUDE CHANGE—Two recent violations of the northeast area of positive control, indicate some folks haven't got the word on VFR altitude restrictions within that area. On 9 November 1967, FAA lowered the floor of the area of positive control (APC) from 24,000 to 18,000 feet over the northeastern and north central United States. Full IFR procedures prevail with prior ATC approval mandatory within this area from 18,000 msl to 60,000, inclusive.

The geographic area involved covers approximately 24 per cent of the United States (see map), bounded roughly by a line from Presque Isle, Maine; south to Danville, Virginia; west to Salina, Kansas; north to Minneapolis, and back east to Presque Isle.

See FLIP (Enroute) IFR-Supplement, page 348, for procedures. This area is depicted on Enroute Chart H-3.

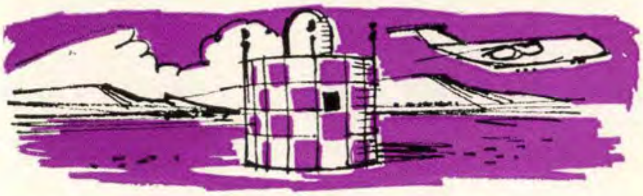
LtCol Robert D. Lutes
Directorate of Aerospace Safety



ALTITUDE OVER THE OUTER MARKER. Many pilots ask why no maximum permissible tolerance between observed and published final approach altitudes is specified when on glide path over the outer marker. The answer is that due to the many variables it is difficult to provide a simple, yet precise, yardstick.

The published altitudes on final are calculated on the basis of published glide path angle and distance of the markers from the glide path antenna. For example, with a two and one-half degree glide path and a distance of about 3.8 nautical miles, the altitude published for over the outer marker would be 1000 feet above the ILS reference point.

Non-standard air temperature is the major cause of discrepancies between published and observed altitudes. Assuming that the temperature in the above near sea level example was $-25°C$, the pressure altimeter would over-read and indicate 1162 feet when the aircraft was on glide slope over the outer marker. With steeper glide paths and more distant outer markers the errors due to non-standard temperature are proportionally greater.

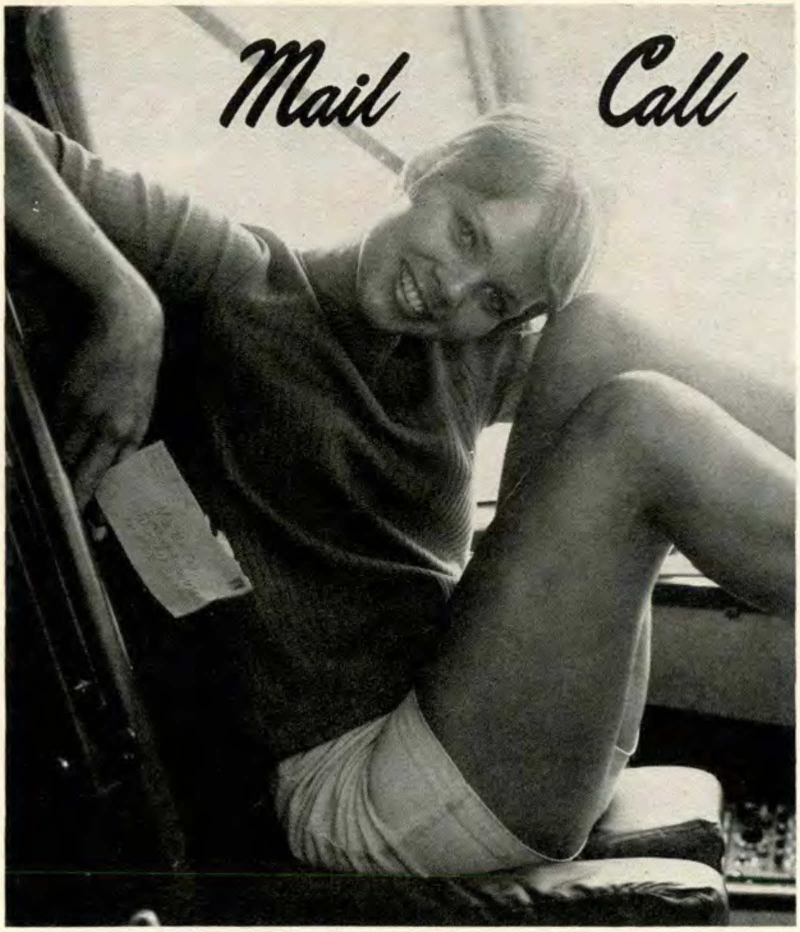


Glide paths are maintained within a tolerance of $\pm 0.1°$. Should the transmitter in the above example be on its upper permissible limit, the aircraft would be 1040 feet and not the published 1000 feet above the ILS reference point when on glide slope over the outer marker. If it was $-25°C$, the pressure altimeter would read 1209 feet.

The instrument and position errors of a serviceable pressure altimeter could add a further 50-foot error in the above example. Thus, without even considering other factors, such as tolerances in glide path receivers, glide path indicators, and QNH settings, it is conceivable to have discrepancies of over 250 feet between the published and observed altitudes over the outer marker.

The probability of all the errors being in the same direction as in the above example is very low. However, even after allowing for the major factor of non-standard temperature, you can expect discrepancies of almost 100 feet when on glide path over the outer marker. ★

Reprinted from TECH TALK
Air Line Pilots Association.



and take measures to keep it from happening again. Those who use OHRs to "hang" others are mis-using them.

Keep that welcome mat out; many of us enjoy an occasional visit with the facilities experts. Ed. ★

PILOT AND CONTROLLER

Regarding the article "That Ageless Pitcher" in AEROBITS of the May issue, it is our opinion that this item was not written in the interest of those who are daily concerned with the safety of flight.

First of all, tower controllers are not in the habit of "sleeping at the switch." It is impossible for a pilot, experienced or not, to obtain the traffic picture that a tower has. Granted, mistakes are made by both tower, pilot and aircrew people. But there are countless times when a pilot makes a mistake that merits an OHR and it is never written. Why? If a pilot realizes he has made a mistake and is able to correct it and be alert enough to prevent it from happening the next time, it isn't necessary to smear his record or his ability. If the tower wrote an OHR for every pilot or aircrew that crossed an active runway, made an 180-degree turn on a runway or even took off without a clearance, we would need a part-time secretary. Rather than instigating a paper war between controllers and aircrews, we should take a little more time to insure that these incidents never happen. We can never hope to achieve any kind of teamwork or any common ground for zero defects by handing each other OHRs at every situation.

The OHR should be used—but with a little more discretion than a method of telling someone he has made a mistake or by calling someone names. All controllers would be more than happy to get together with the pilot or an aircrew to discuss problems or situations rather than meeting "in court" so to speak.

Air Traffic Control facilities are open to all aircrew personnel at all times, and our welcome mat is out!

Sgts Robert L. Wheeler &
Thomas W. Brown
Tower Air Traffic Controllers
Wright-Patterson AFB

Quite the contrary, the article in question was definitely written in the interest of safety. Agreed, tower operators are not in the habit of "sleeping at the switch," but are they above learning from the occasional mistakes of their constituents? We hope not! The author has a healthy respect for all tower personnel and is fully aware of the hours of researching records and listening to tapes that these dedicated people spend investigating OHRs. Hazard reports are not written to tell individuals they have made mistakes or to call them names. They are made to find out why a particularly dangerous situation occurred

JULY WELL DONE AWARD

Reference July 1968 *Aerospace Safety* Well Done award winner, Captain Ronald D. Clisby.

Perhaps someone may wonder what Captain Clisby is doing subsequent to his harrowing O-1E experiences in Vietnam. The 1375th Mapping and Charting Squadron is very pleased to have him as a member. Captain Clisby is presently working in South America as a pilot for our 1370th Photo Mapping Wing's Aerial Surveying and Mapping project team. The same skills he demonstrated as a pilot in Vietnam are now being utilized for peaceful and progressive purposes for our South American neighbors. We are happy to have him.

Lt Col William G. Watts, Jr
1375 Mapping & Charting Sq
Forbes AFB KS

SPECTACLES IN THE COCKPIT

The following comments are submitted with reference to the item, "Spectacles in the Cockpit," published in Rex Riley's Cross Country Notes in the August issue of *Aerospace Safety:*

Following the publication of "Spectacles in the Cockpit" in the June 1968 issue of the *Medical Service Digest*, the authors were informed of a spectacle lens fogging problem pilots experience when rapid thermal changes occur in the cockpit.

There are a number of commercial defogging agents available in a liquid or solid state. One is an effective and easily applied de-fogger which comes in a lipstick-type dispenser. The material is applied to the lens in an "X" mark on each surface and then rubbed clean with a non-lint tissue or cloth. A home-type solution is to use a common liquid detergent, such as Joy or Vel. A small drop of undiluted fluid is placed on each surface and then wiped off as thoroughly as possible. The thin film that remains should not be apparent on the clean, dry lenses. The anti-fog measure should be taken sometime prior to each flight.

Thank you for your attention and courtesy.

Col Thomas J. Tredici, USAF, MC
Lt Col Benjamin Kislin, USAF, BSC
Brooks AFB TX

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WELL DONE

Lt Colonel Andrew Henry

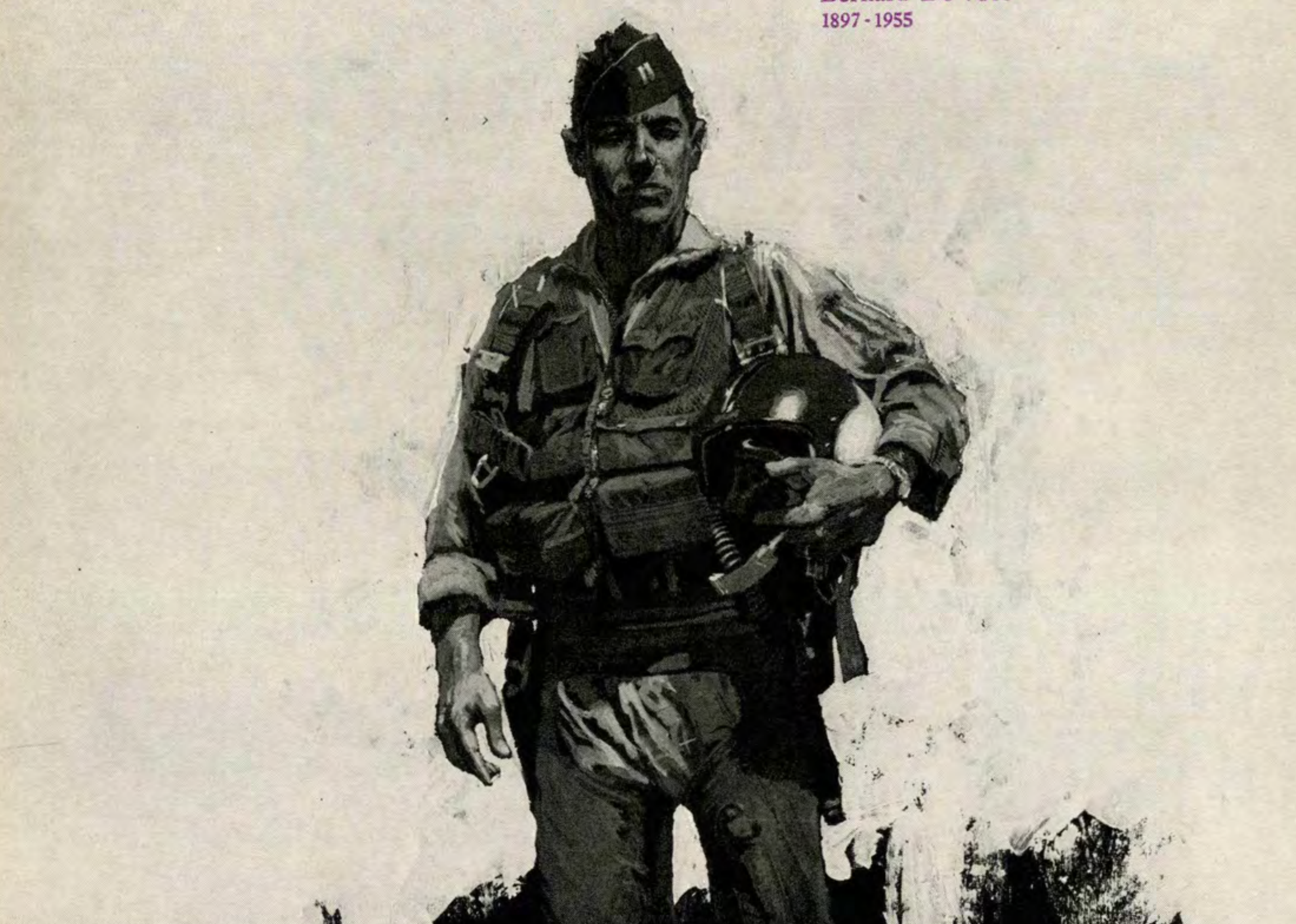
63 Military Airlift Wing, Norton AFB, California

On 28 November 1967, Lt Colonel Henry successfully "dead-sticked" a T-33 after encountering a flameout during a functional flight check. Lt Colonel Henry was performing a functional flight check as the result of an engine change. The aircraft had been flown previously on 24 November for a FCF, but was not cleared for flight due to the emergency fuel system not operating properly. The linkage to the emergency fuel control was readjusted and the system checked out operationally on the ground.

On 27 November the aircraft was again flown with the same conditions occurring to the emergency fuel system in flight. The emergency fuel control was removed and replaced and the aircraft again operationally checked satisfactorily on the ground. On 28 November Lt Colonel Henry flew the FCF. While flying at 15,000 feet, 200 KIAS, he reduced the power to 80 per cent RPM and switched to the emergency fuel control, and the engine flamed out. Several airstart attempts all proved unsuccessful. On final approach, Lt Colonel Henry lowered the landing gear. The mains indicated down and locked, but the nose gear indicated unsafe. He then activated the emergency system and just prior to touchdown got a safe indication that the landing gear was down and locked. He then completed a perfect flameout landing. WELL DONE! ★

Between the amateur and the professional...
there is a difference not only in degree but in kind.

Bernard De Voto
1897 - 1955



FLY SAFE!