# flying

SAFETY

DECEMBER 1982

**HYDROPLANING**
**— A Slippery Subject**

**FA LA LA . . . tis the season**

**On The Road (Again)**

**What Is Your IIQ?**

# THERE I WAS

■ . . . diving at the desert sand in my 20° pop-up maneuver to a diving delivery of BDU-33 during a composite fighter forces exercise. I had flown carefully as Number 2 trying to be a good wingman, staying in position. I had prepared for my flight in plenty of time and had done target study with the limited photos and with charts of the area. The target was known to be the most difficult target to acquire in all of the range's complex. At engine start, I was committed to a safe, conservative flight; there would be no silly violations of good, disciplined fighter employment flying.

But I had not thought about the effect of circumstance prior to the target area influencing my decision-making. We joined with a flight of two F-16s and two more F-4s. After a who's-got-the-lead moment, my leader got the lead as planned. We blasted off toward the short, low level leg inbound to the nondescript IP picked by the other guys in the composite flight. The radio was noisy with jamming, and I was working hard to coordinate with my WSO because of the distractions. I was flying a complicated series of turns so as to gain spacing prior to pop-up. I flew those turns as well as I knew to do them but had not flown them in that sequence before and certainly not to look for a difficult target.

There I was — looking for the target that is supposed to be there and needing to pickle and pull out — I mean, I can't spend all day looking. So I heard inside me, "Pickle anyway, the target must be down there; you've done everything right so far." I pickled and pulled off.

The truth is that the target was 2 miles at 6 o'clock and I had violated a basic tenet of discipline in delivering weapons visually — if you don't see the target, don't drop. I had failed to remind myself of these words in my planning. ■

*Sometimes our desire to succeed overcomes our better judgment. A "short round" is difficult to explain.*

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■ A break in habit patterns very often contributes to or causes a mishap. In this particular case I was lucky, since all I got was a very bad scare. As Number 2 in a 2-ship formation of T-33s, we were returning from a target exercise. On this particular leg the front seater (FCP) asked me if I would like to make the wing take off. I readily accepted, since as an instructor pilot I rarely got the chance to do so from the rear cockpit (RCP). The FCP taxied the aircraft to the hammerhead and then gave me control.

As we were cleared for take off I lowered the canopy from the RCP but did not lock it since that has to be accomplished from the FCP. I went through the motions of calling "pins, canopy, lanyards" without even glancing at the canopy not latched warning light since I assumed the FCP had done it when I lowered the canopy.

Since I was doing a wing take off and watching lead to my left, the light on the right went unnoticed. Other than the fact that it was noiser than normal, the unnoticed light remained undetected until in the weather at 8,000' AGL and 240 knots. I instinctively sensed that something, somewhere was wrong.

Looking away from lead and around the cockpit what I saw made me sick. There sat the canopy not latched warning light glowing red. The canopy was unlocked! I immediately notified the FCP that the canopy was unlocked, and he quickly locked it. We were both stunned that we could have missed that light in our checks.

Fortunately for us, the T-33 canopy is strong and remained with the aircraft. All that got damaged was our pride. In any other type of aircraft it could have been much worse. ■

*This is a classic example of how it can happen to any of us. I guess the moral of this story is be alert 100% of the time – check and double check. Don't call it unless you've done it.*

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## SPECIAL FEATURES



## REGULAR FEATURES



DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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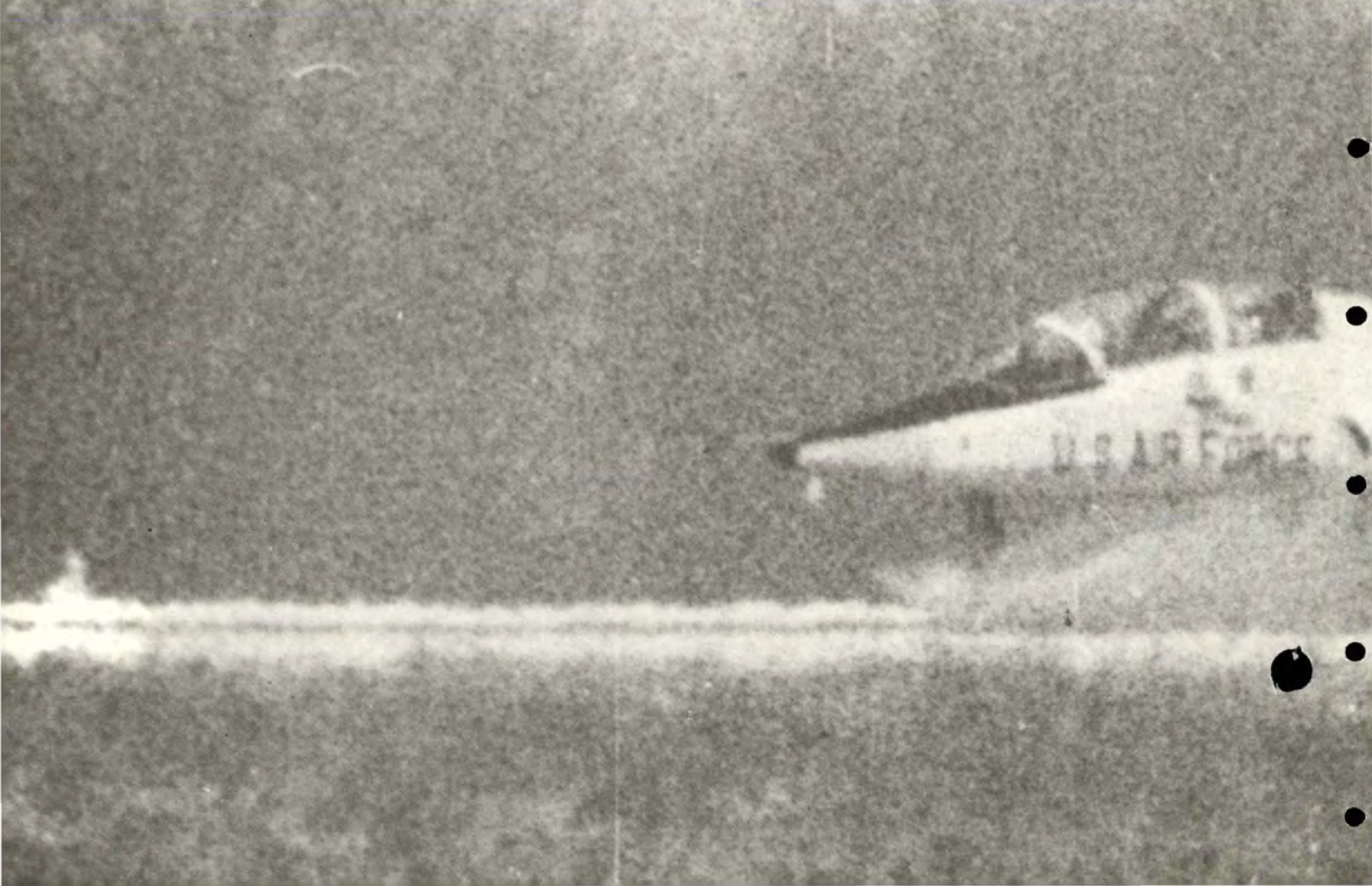
# HYDRO-PLANING ..A Slippery Subject

**CECILIA PREBLE**
Assistant Editor

■ Touchy about my reputation as the still-wet-behind-the-ears assistant editor of this magazine, I overcompensate by doing extensive research on topics assigned to me. Last Friday afternoon, when the editor subtly remarked, "It's been a while since we've done anything on hydroplaning, how about it?" I was relieved. It seemed like something I could handle — not too technical, but timely and of interest to anyone who flies or even drives.

I began by poring through a 3-inch file of clippings and articles in hopes of learning all about hydroplaning. Looking for a new angle, I was disappointed to find that every article said exactly the same things: There are three types of hydroplaning, these are the conditions under which they occur, and here's how to avoid them. How could there be a fresh approach to enhance or expand upon that?

Luckily it was Friday and by the time I was done with the file, it was happy hour. Walking across the street to the club, I related my



dilemma to some of the pilots who work down the hall. I got a lot of sympathy, but the only good suggestion came from an F-4 driver who said, "While you're making idle conversation this evening, why don't you ask around to see just how much these guys really know about hydroplaning?"

Never one to rely on the old lines, "Buy me a drink fly boy?" or "What's a nice boy like you . . ." I decided to kill two "birds" with one line, "Hello handsome, tell me all about hydroplaning." Oh there were the expected blank stares at first, but once they realized my question was not the opening to a joke, I got what I was after. I also found out how much they knew about hydroplaning.

Most aircrews are well informed on the subject and seem prepared to avoid it or cope with it once it occurs. However, there are a few who need to reread their Dash Ones. Since they might not get around to that, here goes . . . .

There are three types of hydroplaning: dynamic, viscous, and reverted rubber.

When a fluid separates the tires from the runway surface, you have DYNAMIC hydroplaning. Under this condition, the tires are lifted off the runway by the pressures between the runway and the tires. Therefore, a nonrotating tire, such as you have when landing, will not spin after touchdown, or a rolling tire will slow down its rotation and may actually stop. Here the coefficient of friction is down to zero, making steering and braking totally ineffective.

The threshold for dynamic hydroplaning is usually thought of as nine times the square root of the tire pressure ($9\sqrt{P}$). This applies when the tire is rotating. If your tire is not rotating, is locked, or has stopped spinning, the threshold is different — $7.7\sqrt{P}$. Therefore, in some aircraft the touchdown speed is always within the dynamic hydroplaning range. For instance, in the T-38, $7.7\sqrt{250} = 121.7$ kts.

As the depth of water on the runway and the tread wear increases, the minimum speed for dynamic hydroplaning is even lower. Since the tread groove is lessened, the tire can cut through less water. If you're landing with worn tires on a runway with standing water, the speed at which dynamic hydroplaning could occur is well below $7.7\sqrt{P}$. If you experience total dynamic hydroplaning, your loss of cornering ability makes aerodynamic controls your only method for directional control. If you've ever had to rely on this method alone, you probably remember that it's not a good feeling.

But let's say you're coming in slowly enough so that dynamic hydroplaning is not a problem. Here is where VISCOUS hydroplaning, otherwise known as skidding, lurks ominously. Viscous hydroplaning occurs only on runways with a smooth surface. However, even on more porous runways, the touchdown areas can be made

# HYDROPLANING
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continued

smooth by rubber deposits or paint.

At speeds above 30 to 40 knots, the combination of this smooth surface with a thin film of water, even a light dew, can produce viscous hydroplaning quite easily. It's a good idea to reduce speed adequately during rollout prior to the far end of the runway, where rubber deposits are also heavy.

So once you're below 30 knots you're OK, right? Wrong! Here you can still encounter hydroplaning of the third kind. REVERTED RUBBER hydroplaning can occur down to zero knots per hour. This condition occurs when the tire temperature begins a chemical reaction. The rubber reverts to an uncured state, a phenomenon characterized by steam emission from around the tire, a scalded appearance on that part of the tire, white streaks on the runway, and loss of part of the rubber. The braked tire's contact is believed to produce enough heat to change the water to steam and begin a chemical reaction. Since the rubber is made up of carbon and hydrogen, this self-perpetuating reaction changes the rubber into gases, carbon dioxide and steam, explaining the loss of rubber. During reverted rubber hydroplaning, the soft rubber could form a seal that allows the tire to ride on a layer of steam.

A skid test on a Boeing 727 proved this type of hydroplaning can last up to 30,000 feet without resulting in tire failure. It takes very little molten rubber to bring about this skid and to avoid it — DO NOT lock the brakes.

Now that you know the types of hydroplaning and the conditions under which they occur, here (surprised?) is how to avoid them.

First, get to know your tires. Find out what your tire pressure is and make your calculations while still on the ground. The last thing you'll want to be thinking of as you approach a wet, sleety runway is $7.7\sqrt{P}$. Also, check the treads. Smooth or worn tires will hydroplane in shallower water; as little as 1/10 inch of water, as opposed to 2/10 to 3/10 inches of water with ribbed tread tires.

Get to know your runway, too. Will it be of concrete or asphalt? A concrete runway reduces the likelihood of viscous hydroplaning. The drainage and runway grooving should also concern you. Know the length of the runway and whether or not there is an overrun. You should seek the same information for your alternate.

No matter how recent your RCR, it will not be current for your landing. It can be changed by wind, rain, a taxiing aircraft ahead of you, or a difference in temperature.

The RCR is not precise because it relies on the accuracy of the person performing the reading, the recorder, and the equipment used. Finally, the reading is not accurate on the entire runway. The best RCR is at the middle and if upon landing you veer from the center, the RCR is unknown. Also, the reading on taxiways differs from that taken on the runway.

It is also a good idea to get back into the Dash One and refresh your memory on your braking system, your antiskid, and (if applicable) thrust reverse procedures.

Anticipate problems with hydroplaning when you're landing or taking off on wet runways. If you suspect trouble at the runway at which you planned to land, your best course is to proceed to your alternate. However, if you must land in hydroplaning conditions, be aware of crosswind and its effects. If you use a drag chute, be especially prepared for the hazards of crosswind on wet runways.

Use short field landing techniques and proper approach speeds. Line up with the center of the runway and keep in mind that a smooth or fast landing raises the likelihood of hydroplaning and increases landing roll distance.

Use as much aerodynamic drag as possible and stay off the brakes and nosewheel steering until you're below the hydroplaning speed you have calculated.

Exercise caution in the way you apply brakes throughout your landing. The best technique is to apply smooth and steady pressure to maximize the braking force without locking your wheels. Intermittent braking is useless because the period between braking produces little or no cooling.

Although hydroplaning is more commonly a fall/winter problem, it occurs year round and can have catastrophic effects on both aircraft and ego. In order to ensure a long healthy life for both, be familiar with this hazard and be prepared to cope with it. ■

# Fa La La
## Tis The Season To Be Jolly


ANCHARD F. ZELLER, PhD
Directorate of Aerospace Safety

■ Christmas comes but once a year, and with the holiday season come all the activities associated with the joys of good fellowship and socializing. With the socializing come stacks of good food, delicacies, frequently hand-made for no other time of the year, and to wash them all down, a delectable variety of drinks from the world over.

While late nights and gastronomic delights may exact a price from the reveler the next morning, it is the liquid portion which most frequently causes that unhappy feeling in the head and stomach. It gives pause for thought and is sometimes so preoccupying that temporarily the joys of the season are forgotten. The arch enemy in this drama is none other than our old friend, alcohol.

Since man discovered that a tremendous number of fruits, vegetables, and grains would ferment and create a sometimes pleasant tasting drink, the use and control of alcohol has presented some problems. As a politician once said, "You ask how I feel about alcohol, so I'll tell you. If when you say alcohol, you mean the devil's brew, the poisonous scourge, the bloody monster that defiles innocence, dethrones reason, destroys the home, creates misery and poverty; if you mean the evil drink that sends good men and women from the paths of righteousness, gracious living into the bottomless pit of degradation and despair, and helplessness and hopelessness; then, certainly, I am against it with all my power.

"But, if when you say alcohol, you mean the oil of conversation, the philosophic side, the side that is consumed when good fellows get together, that puts a song in their hearts, and laughter on their lips, and the warm glow of contentment in their eyes; if you mean that drink, then certainly, I am in favor of it.

"This is my stand. I will not compromise."

This remarkably astute stand may serve to cover the waterfront philosophically, but practically, there are some cautions that Air Force members particularly should be aware of. First among these is that there are two effects of alcohol which are remarkably incompatible with such skilled activities as flying an airplane or driving a car. The first of these is the direct effect of alcohol on various bodily functions including vision, reaction time, and especially mental activities such as reasoning and judgment. These effects have been documented over and over so that there is little need to belabor them. The general result of this documentation has been that for most of the United States a blood alcohol content of .10 of 1% is presumptive evidence of being

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under the influence. If one is apprehended while in this state, one can anticipate stiffer and stiffer fines. It should be noted that .10 is a generous quantity. In some parts of the world, it is .08, and in some if alcohol is found on the breath or in any measurable amount in the blood or urine, it is enough to cause the individual considerable inconvenience as well as financial trauma.

The second problem caused by fruits of the vine is the long-term effect which persists after there is no longer any measurable alcohol in the body. Alcohol metabolizes at the rate of about 1/3 to 1/2 ounce an hour which is the approximate equivalent of one drink per hour — rule of thumb, 7 drinks, 7 hours. While the blood content has been reduced to zero, there is, however, increasing evidence that the behavioral effects are still present and may be for as long as 24 hours. This certainly comes as no surprise to any who have experienced a hangover. The scientific community, however, has been slow in developing data to show that the refractory aftermath of alcoholic consumption can continue to affect how one acts for so long a time.

The Air Force has a very enviable aircraft mishap record with respect to alcohol involvement. Once in a while an event occurs which demonstrates a gross violation of good sense. These events are relatively infrequent. The actual alcohol involvement in aircraft mishaps as documented by blood tests is quite minimal. The association is also frequently tenuous, with little indication that the alcohol was a causative factor. Some years ago, a research organization doing a major study on the role of alcohol in aircraft mishaps voiced suspicions of the statistics presented to them. They apparently felt that the number of alcohol-related mishaps reported should have been larger, but they were wrong.

What isn't known, however, is how many mishaps involving faulty perception, slow reaction times or judgmental mistakes have been caused by the aftermath effect of a bout with alcohol.

There are times in life when personal maturity and good judgment have to be the deciding factors in many choices. Some of these choices include whether or not to use alcohol, when to use it, and in what quantities. Air Force regulations cover almost everything except a "bottle-to-throttle" time. So, unlike situations involving fatigue, crew rest, and most other facets of Air Force life, there is no technical crutch to fall back on. The key is personal choice and common sense.

The FAA 8-hour rule is based on the assumption that the blood alcohol will be reduced to zero by then. This is usually true, but not always. Even so, technical compliance with this rule does not cover the recent findings suggesting that long after the blood alcohol has been reduced to zero, during the hangover state, the drinker's performance is as poor as when he was drinking.

It seems a pity to dwell on doom and gloom at a time as happy as Christmas, so let's not. But before abandoning the subject, it should be pointed out that one of life's unhappiest experience must be to have someone you love injured or killed because someone else was drinking. About the only thing worse is to know that you were the one doing the drinking.

I just followed a car which had a bumper sticker that said, "It's OK not to drink," and it is if that's your choice. It's remarkable that this has to be said. Some, probably most people, don't want to cut out drinking altogether, but the choice of how to use alcohol is one everyone must make. The Air Force gets justifiably upset when its nice, shiny airplanes are destroyed. These aircraft are the essence of our national defense. The Air Force gets more upset when people are killed. They are even more essential to the defense of the country, plus those people can never be replaced, whereas hardware can be.

So, eat, drink (with discretion) and be merry; not because tomorrow we die, but because tomorrow we want to live even more fully than we did today. So, ho, ho and a merry, merry, and God bless us every one. ■

# ON THE ROAD (AGAIN)

**PATRICK HENRY**
Chief Experimental Test Pilot
McDonnell Aircraft Company

■ McDonnell Aircraft has gone on a road show! Well, not exactly the whole company, just a few of the F-15 pilots. A few years ago, company pilots routinely traveled to USAF organizations that flew the F-4 for the purpose of providing insight and information from the perspective of a company test pilot. Now we have begun a new series; this time for the F-15.

Our purpose in conducting these briefings is twofold: To provide squadron pilots with in-depth information on the airplane and its systems, and to gain feedback from the wing level on the strong or weak points of the aircraft. The briefings will be conducted on a continuing basis by one of three company pilots: Pat Henry, chief experimental test pilot for McDonnell; Gary Jennings, experimental test pilot; and Glen Larson, engineering test pilot. I have been associated with the F-15 program from the very beginning and have extensive flight test experience in a variety of other programs, including the newest McDonnell fighter, the F-18. Gary Jennings was an instructor at the USAF Test Pilot School before joining McDonnell and is the project pilot for the F-15E (Dual Role Fighter) program. Glen Larson had a broad tactical background as an instructor in the F-15 and F-4 before joining McDonnell and is currently involved in F-15 DRF development and F-18 test programs. Gary and Glen are also fully mission-ready in the F-4 with the Air National Guard.

Currently, there are eight general areas that cover 16 specific topics plus a condensed briefing that lasts about 45 minutes and touches very briefly on all the topics. Before making a presentation at a wing, we will be in touch with the Safety and Ops officers. The staff safety officers may be interested in accompanying us during the individual briefings in order to see the material first hand, judge reception, and hear the feedback. We plan on at least a two- or three-day visit at each F-15 wing, if required, and will be presenting information at two (or more) sessions a day. We will be happy to cover all the information we have formally prepared; and if another topic is of concern, just let us know, and we'll gather as much information as we can. We want to

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# ON THE ROAD (AGAIN)

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be flexible and responsive to the needs of the entire F-15 community.

**Introduction/Safety**

The introduction reviews some basic design goals of combat survivability and a brief look at safety records.

**Engines/Performance/JFS**

Engines have always been a high interest item, and this presentation explains how the top speed of the airplane is affected by engine trim levels, ambient temperature, and aircraft configuration. Included in this presentation is a brief look at engine trim in terms of past, present, and future trim levels. The JFS is presented in a brief review of airstart envelopes. Fuel leaks are discussed in terms of where they happen, the causes, and pilot actions.

**High AOA**

High angle of attack is a subject of continuing interest. Here we cover the biggest contributor to loss of control and how to recognize the signs of impending control loss. We also explain the autoroll; and as an extension of autorolls, the roll coupling phenomena, which is especially relevant to "jink out" maneuvers.

**G-Loads/OWS**

G-loads, especially over-Gs, have plagued fighter aircraft for years, and the F-15 is no different. In this presentation, we take a look at how G loads affect the aircraft and how we integrated the OWS to open the G limits to 9.0 Gs symmetrical.

**Flight Controls**

The flight control system isn't really a deep, dark mystery; and in this briefing, we go back and explain some basic design goals and how they were implemented, along with a discussion of malfunctions. Also included is a section on c.g. position and how it affects turn performance.

**Maneuvering Performance**

One question we are asked constantly is: "What is the AOA for an optimum turn?" This briefing answers that question in terms of maximum and optimum turn performance and also explains the best acceleration profile for the F-15.

**Landing Gear**

Landing gear problems have been with the F-15 for some time, and a final change has been implemented that eliminates all single point failures and adds some extra features to warn of any gear not being extended. The pulser brake system is currently entering service, and this new system is explained from a pilot's viewpoint. Late rotating airplanes are still a problem, so a review of the causes, solutions, and pilot techniques for slow or late rotating aircraft is provided.

**New Programs**

Several new programs are coming down the pike, and this final presentation covers the latest changes in the MSIP program, the Dual Role Fighter (F-15E), and the yet to be approved design studies such as new engines, electronic flight controls, integrated flight and fire control, drag chute, and several other items.

Our schedule is presently flexible, and our goal is to visit all F-15 units before spring. The first visit was made in November. Remember, if your wing has an area of special interest that isn't listed in the synopsis, just let us know. We will either get the information or bring an expert with us — sometimes we can get the guy who designed the system! Again, we encourage safety officers from the major commands and numbered Air Forces to accompany us during our visits.

We want to give you, the pilot, as much information as we can to help you fly safer and more effectively. Also, we want the communication to be two-way — we want to hear from you! ■

# FLIGHT SAFETY CROSSFEED

# LOSING CONTOL

**MAJOR JOHN E. RICHARDSON**
Editor

■ A TV commercial is being aired presently in which an obviously hero type pilot is in a World War II vintage aircraft. The aircraft is in a steep dive with flak exploding all around. Draped over our hero's arm is a beautiful girl who cries "The plane's out of control." The response from our pilot is "But I'm under control!"

While this is an amusing way to sell hair spray, pilot-induced control loss in Air Force aircraft is not humorous. Since 1978, 84 pilots have lost control of their aircraft resulting in Class A or B mishaps. That's the biggest problem with control loss; in the environment where we fly today there is almost no margin for error.

In many cases, we are outside the recovery envelope, so the minute the aircraft departs it's lost, and if we aren't quick and/or lucky, we go too. But if we can't hope to recover from a control loss and must still accomplish the mission, must we accept the control loss mishap as inevitable? No, of course not. It's like a disease for which there is no cure. We go back to the start and avoid those situations where we can be exposed to the disease. In the same way, the majority of pilot-induced control losses have elements which, if avoided, could have prevented the mishap. This is where we should look first.

**Disorientation**

A widespread factor in pilot's loss of control is disorientation, in particular, spatial disorientation in marginal or instrument conditions. Every Air Force pilot has been trained in instrument procedures, but the situation of transitioning from VMC to IMC is still a killer.

■ A flight of four F-15s was on a Standard Instrument Departure in heavy clouds when departure control requested all wingmen cease IFF squawk. Shortly thereafter, No. 4 went lost wingman followed by No. 3. Lead continued climb to on top where No. 3 rejoined. Number 4 never made it out of the clouds. Evidently the pilot became disoriented and crashed in a near vertical dive.

■ An OV-10 pilot had just returned from an extended layoff of nearly a month. Scheduled for a weather reconnaissance mission, the pilot took off and headed toward the area he was to check. Shortly thereafter, the aircraft entered a cloud and then reappeared in a steep dive. The pilot made no attempt to eject, and the aircraft was destroyed on impact.

■ An F-101 took off on a routine intercept training mission. Shortly after take off, the aircraft was

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# LOSING CONTROL

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observed in a slightly nose low, steep, right banked attitude, descending through a 400-500 foot ceiling. The aircraft struck the ground after 90 degrees of the 180 degree departure turn. The aircraft had entered a low ceiling shortly after take off. The pilot became disoriented in the turn and allowed the aircraft to enter a steep banked descent. After the aircraft broke out and the pilot realized his problem, he applied abrupt control inputs to prevent ground impact. The aircraft departed controlled flight too low for recovery or ejection.

■ A C-130 was on a visual approach to a remote radar site. While on final approach, the aircraft entered some snow showers which greatly reduced the crew's forward visibility. The crew became involved with maintaining visual references and failed to monitor airspeed until the aircraft stalled. Witnesses observed the aircraft descend out of the clouds and impact about one mile short of the runway.

■ A four-ship flight of F-15s had launched on a night intercept mission. Climbing through about 20,000 feet, the flight entered cirrus clouds. The flight continued climb to 27,000 feet and then began a right descending turn. During the descent, No. 2 became disoriented. He communicated this to Lead but was unable to overcome the symptoms and went lost wingman. However, the disorientation was severe enough to cause the pilot to lose control of the aircraft. The aircraft entered a high-speed, diving spiral which continued to ground impact.

### Motivation

This may seem a strange word to use in connection with a mishap cause, but it is one of the big players, particularly in fighter/attack loss of control mishaps. The problem starts because, for most pilots — particularly fighter pilots — failure is not an acceptable condition. In any fight, each pilot will do everything possible to: (1) Achieve a "kill" and (2) Prevent being "killed." As a result, when the adrenalin flows, it sometimes causes a mental lapse, and the aerodynamic parameters are exceeded. Unfortunately, all too often there is insufficient time or altitude to recover.

■ An A-7 pilot was No. 3 in a four-ship engaged in DACT with a flight of F-5s. The F-5s made three successful attacks against the A-7s. On the fourth, the mishap pilot initiated a hard defensive descending turn into the attacking F-5. The A-7 departed in the turn, too low for recovery.

■ An F-111 was part of a low level strike force. The first two aircraft successfully completed the mission and initiated a rejoin. Meanwhile, No. 3 strayed outside the operating area due to a crew navigation error. When he realized the error, the pilot made an abrupt, steep, banked turn to return to the MDA. The maneuver was not appropriate for the airspeed and wingsweep and so the aircraft departed controlled flight.

■ An RF-4 crew was involved in a unit competition to select the crews to participate in an exercise. The aircrew intentionally flew their low level mission 120 knots below fragged groundspeed to enhance their target acquisition and thereby score high in the competition. In an effort to acquire the last target, the pilot initiated a hard, steep, banked turn which resulted in a low energy state. While attempting to roll wings level, the pilot's control inputs caused the aircraft to depart controlled flight and crash.

■ A UH-1 was on an actual SAR mission. The crew received instructions to fly up a canyon high in the mountains to search for the downed aircrew. To improve the chances of finding the survivors, the aircraft commander elected to search at an altitude of 100-150 feet above the trees and a groundspeed of 30-40 knots. As the aircraft proceeded down the canyon, an observer spotted footprints in the snow and called them out to the pilot. The pilot then initiated a turn back up the canyon which was also downwind. This, plus the high altitude and left rudder, placed the helicopter in a power settling condition. The aircraft entered an uncommanded descent which the pilot was not able to stop before the main rotor struck a tree forcing the aircraft down in a ravine.

**Supervision**

Sometimes what is called a pilot-induced control loss is instead a supervisory control loss. That is, the pilot got in that predicament because somebody dropped the ball up the line. The problems run from lack of proficiency to lack of control

continued

# LOSING CONTROL

continued



of crew behavior. Whatever the problem, the result was a mishap that should not have happened.

■ A flight of A-7s had been scheduled for a low level mission. Enroute to the target area the flight split into elements for ingress. While still in the holding pattern, the flight lead was advised that the low level weather was unsuitable for the mission. He acknowledged the call, but did not ensure that his other elements heard it. One element lead did not hear the call and proceeded with the mission. Once below the clouds, the element lead realized that the weather was below mission minimums and called for his wingman to "close up." The wingman interpreted this call to mean join to fingertip and initiated a joinup. While he was joining, lead pulled up into the weather. The wingman lost lead and failed to transition to instruments. He maneuvered the aircraft so aggressively that it departed controlled flight. The pilot was unable to recover the aircraft and ejected.

■ A flight of two F-4s entered their operating area for a BFM mission. Because clouds restricted the operating area to below 16,000 feet MSL, the flight lead restricted the engagements to military power. The first engagement was designed to allow the No. 2 pilot to practice maneuvering against a gun attack. The pilot performed a 6-G defensive turn, followed by a break maneuver and an attempted reversal underneath as the attacker overshot. Because the aircraft was using only military power, the airspeed bled off rapidly. During the break, the mishap aircraft entered a cloud. The pilot attempted to recover from the dive resulting from the reversal. However, he stalled the aircraft until recovery was impossible. The IP in the rear seat seeing that recovery was not possible, directed ejection at about 1,600 feet AGL.

■ An RF-4 was engaged in defensive maneuvering against an aggressor aircraft. During the third engagement, the RF-4 pilot maneuvered the aircraft into a position of 9,000 feet AGL, 20 degrees of dive, .90 degrees of right bank, and 300 KIAS. The pilot was inadequately trained for the mission and so misjudged the flight conditions to be critical for recovery. In fact, a proper recovery technique would have recovered the aircraft in about 2,000 feet. The pilot simultaneously applied excessive back stick and aileron resulting in a stall and adverse yaw. The pilot recognized the stall and relaxed the stick pressure, but then stalled the aircraft twice more until the situation was hopeless. Both crewmembers ejected at 3,000 feet AGL.

■ While setting up for a BFM engagement, an F-15 pilot initiated a maximum performance, nose-high rudder reversal to the right. This maneuver, although permitted by operational guidance, placed the aircraft in a maximum performance maneuver in the least departure resistant air-to-air configuration and at an altitude with no margin for safety. During the reversal, the pilot exceeded the operating envelope of the aircraft and it departed. The pilot then failed to neutralize the controls, and the aircraft entered a post stall gyration. The pilot ejected without injury.

We've looked at the "big three" in control loss mishap factors. Now, just so you won't get overconfident because you can answer "None of the above," here are some more problems.

■ An F-4 was on a single-ship, low level navigation mission. Approaching a turn point, the crew deviated right of course to ensure separation from some other aircraft. During the left turn back to track, additional traffic was sighted passing 1,000-1,500 feet behind the aircraft. While clearing for the traffic, the pilot inadvertently initiated a shallow descent. Neither the pilot or WSO detected this descent until the pilot's attention was redirected to the front of the aircraft. He then saw a 400-foot tower directly in front of the aircraft. Believing collision with the tower imminent, the pilot abruptly applied excessive aft stick, and departed controlled flight, too low for a safe recovery.

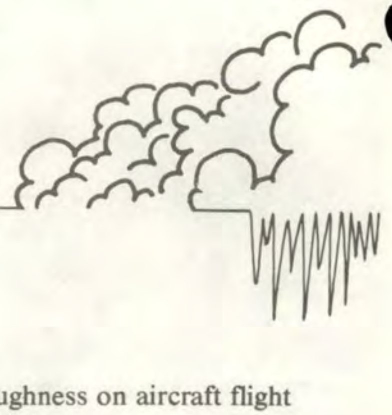
■ An F-111 crew returned to base and was directed to hold at maximum endurance airspeed. The pilot entered holding at FL 230 and, while on autopilot, retarded the throttles to reduce speed from 300 to 250 knots. The crew then became engrossed in other duties and failed to monitor the decaying airspeed. At 210 knots, the aircraft began to buffet and lose altitude. The pilot added power and applied backstick which induced a rapid increase in AOA beyond the maximum allowable. The aircraft departed controlled flight, and the aircrew, unable to recover, ejected.

■ While leading a two-ship flight on a low level nav mission, an A-10 pilot saw a large bird at 12 o'clock. He pulled up into a 10- to 15-degree pitch attitude to avoid the bird, then rolled inverted to check the wingman. The nose fell through and the pilot tried to roll out, using full right aileron and substantial right rudder. The aircraft rolled upright in a 30-degree dive at 500 feet AGL and 220 knots. The pilot believed that he could not successfully fly out or eject from that position and so flew the aircraft to minimize sink rate and successfully ejected just prior to impact with the trees.

Pilot-induced control losses continue to plague the Air Force in their attempts to reduce aircraft mishaps. As the examples in this article have shown, there are no easy solutions. But with knowledge of those elements which can lead almost inevitably to a mishap, we, the aircrew members, can function as a last line of defense in the attempt to prevent such mishaps.

One final post script. If you are unfortunate enough to be involved in a pilot-induced control loss situation, try to recover if it is feasible, but DO NOT violate minimum ejection altitudes. That is what the seats are for. Use them. ■


# Wing Surface Roughness cause & effect



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Principal Engineer, Aerodynamics

■ Most flight crew members are aware of the highly adverse aerodynamic effects of large amounts of wing surface roughness, such as the irregular shapes that can form on the leading edge during an icing encounter. However, what is not so popularly known is that seemingly insignificant amounts of wing surface roughness can also degrade flight characteristics . . . roughness caused by frost, snow or freezing fog adhering to the wing surface, large accumulations of insect debris, badly chipped paint, or a distribution of "burred" rivets over the wing surface.

In some countries, regulations do not permit takeoff when frost, snow, or ice is adhering to the aircraft. Elsewhere, however, dispatch is permitted if, in the judgment of the flight crew, the accumulation will not affect the safety of flight. Thus, a flight crew may be called upon to decide if a particular amount of roughness and its location are sufficient to significantly degrade the aircraft's flight characteristics.

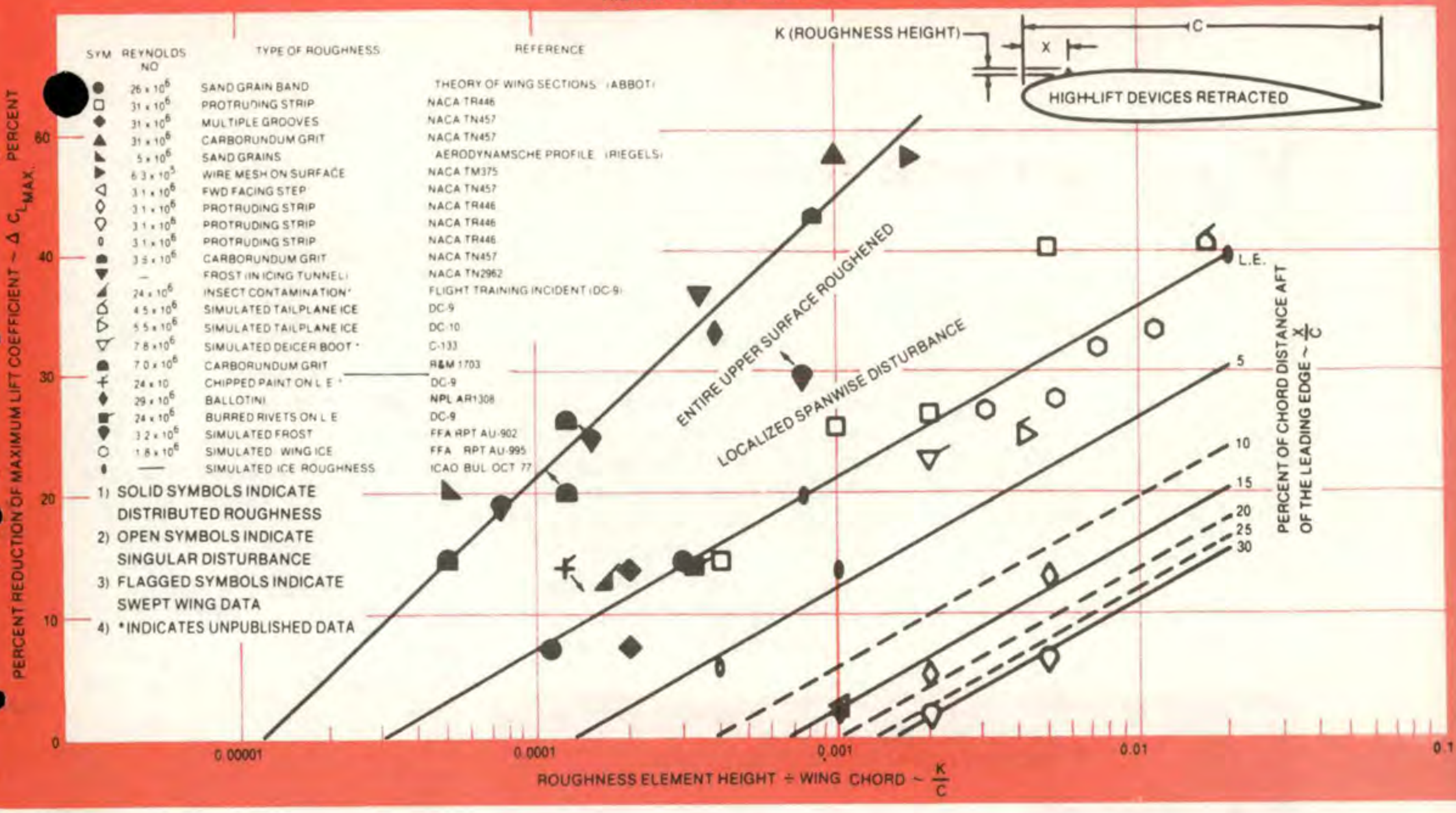
The intent of this article is to assist in that decision-making by providing an insight into the effects of small amounts of wing surface roughness on aircraft flight performance.

For full wing span upper surface roughness beginning at the leading edge and extending varying distances aft, the typical effects are a reduction of the maximum lift coefficient (increase in stall speed), a reduction in the angle of attack at which stall occurs, and a rapid post-stall drag increase. The effects become more adverse as the size and chordwise extent of the roughness increase. They may also be accompanied by a reduction in lift at a given angle of attack and by

**Figure 1**

REDUCTION OF MAXIMUM LIFT COEFFICIENT DUE TO WING SURFACE ROUGHNESS

HIGH-LIFT DEVICES RETRACTED




an increase in the wing parasite drag.

Figure 1 is a correlation of wind tunnel and flight data showing the effects of surface roughness on the maximum lift coefficient of a wing with high-lift devices retracted. The effects of various forms of wing surface roughness differ when high-lift devices are used.

Typically, the deflection of trailing edge flaps tends to increase the effects shown. Full-span leading edge high-lift devices tend to suppress the adverse effects of small levels of roughness, but have little influence over large levels of roughness.

Further complicating the overall situation is that premature stall due to surface roughness effects occurs at a lower than normal angle of attack. Therefore, it is possible that angle of attack-dependent stall warning systems such as the alpha (α) vanes used on most current jet transports may not provide warning prior to actual stall.

As might be expected, the leading edge portion of the wing is most sensitive to surface roughness. The effects of surface roughness on the maximum lift coefficient decrease as the forward-most extent of the upper surface roughness moves farther and farther aft of the leading edge. Also once slightly aft of the leading edge, moderate amounts of roughness on the lower surface have little or no effect on stall speed.

Most aircraft are designed for the stall to begin inboard in order to maintain lateral control as long as possible, and to achieve satisfactory pitching characteristics throughout the stall. Therefore, roughness extending less than full span may have a lessened effect depending on its location with respect to where the smooth wing stall initiates. Unsymmetrical roughness accumulation may result in premature stall of one wing, with resultant wing drop or rolloff.

What all this boils down to is that an aircraft affected by wing surface roughness will stall prematurely, possibly before reaching the angle of attack for stall warning actuation. Further, any reduction in lift at a given angle of attack will obviously require a higher than normal airplane angle of attack to produce the desired amount of lift. This could, for example, require rotation to a higher than normal takeoff pitch attitude in order to achieve a normal liftoff and climb. Unfortunately, the higher angle of attack further reduces the already degraded margin to stall.

These effects are particularly important for early transport aircraft having no leading edge high-lift devices. Extension of the wing leading edge devices of more advanced aircraft will generally recover most of the stall speed degradation resulting from the low levels of roughness cited here.

The effects of small amounts of wing surface roughness may not be particularly noticeable to a flight

continued

# Wing Surface Roughness continued

crew operating within the normal flight envelope. Since all transport aircraft operating speeds have some margin above the actual smooth wing stall speeds, the roughness effects may have only decreased that margin. For example a 1.3 $V_S$ approach speed may have had the margin reduced to $1.1V_S$, leaving little actual stall margin for maneuvering or gust tolerance.

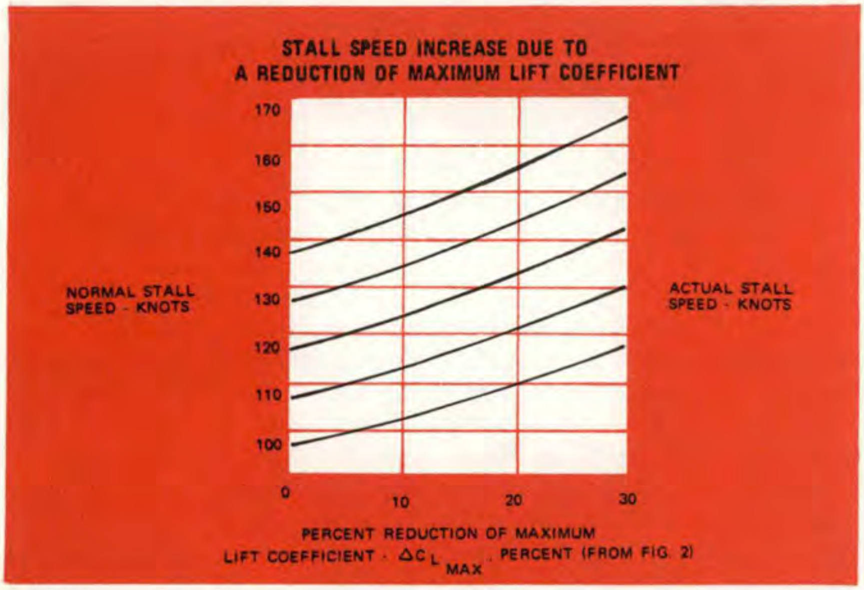



**Figure 2**

In a recent accident, a flight crew decided that because they had experienced no problems during approach and landing through a mild icing encounter, they would dispatch without removing a small amount of ice that had accumulated on the leading edges. During takeoff where the margin to stall is typically less than that for landing, the aircraft apparently stalled upon leaving ground effect and impacted at the end of the runway. This is not the only known incident. Frost appears to have been a contributing factor in at least two other recent take off accidents of transport aircraft.

Decisions to take off with some frost or snow on the wings may have been influenced by discussions of tests on military aircraft showing that frost appeared to cause no degradation in take off performance. But the tests were directed only at establishing if the particular aircraft would take off at the handbook speeds. No attempt was made to determine how much the stall margin had been reduced by the frost.

How rough is rough? Distributed roughness elements having a height of only 1/10,000 of the wing chord can adversely affect the maximum lift co-efficient, significantly increasing the stall speeds as shown in Figure 2. This height corresponds to about 0.015 inch on a DC-9 type aircraft and to about 0.030 inch on a DC-8 or DC-10 type aircraft — about the roughness of medium to coarse sandpaper.

How does this compare with the roughness due to frost? Literature on frost indicates a seeming threshold where individual frost grains appear on a surface and are much like fine salt grains having effective diameters of about 0.004 inch. As frost progresses, the grains grow to about 0.010 to 0.015 inch in effective diameter. Further progression is usually of two forms: The layering of frost grains and the development of frost needles. The layering can develop into an irregular surface of hills and valleys composed of numerous 0.010- to

0.015-inch grains — much like ripples in desert sand. In this case, the height of the irregularities will be more important than the individual grain sizes. The needles are usually closely spaced and have been observed up to 0.100 to 0.125 inch high. However, they are generally frail and have been known to break off to some lesser height at speeds of about 40 to 60 mph.

Observed on rare occasions is the development of "vertical frostplates." Such plates can present extreme roughness as they are strong, thin, vertical surfaces that have been observed from 0.125 inch to 0.250 inch high and 0.250 inch to 0.500 inch long at the base. They look much like closely grouped miniature vortex generators.

Crew members who have tried to brush off accumulations of frost (or snow) are also familiar with the rough surface that can form if the underlayers of an accumulation had melted slightly and then refrozen to the surface.

An operational problem occasionally encountered is the instance of an aircraft landing in a humid area after having been cold-soaked during high altitude cruise. During the ground time, the fuel in tanks remains at a below freezing temperature, causing frost to form on the underside of the wing in the region of the fuel tank. Keeping that area frost-free becomes an almost impossible task. As the frost is removed it re-forms and will continue to form until the fuel temperature and the ambient temperature spread is more in line. While moderate accumulation will not affect stall, the surface roughness will increase the wing parasite drag and can affect take off performance.

All forms of roughness tend to degrade the lifting capabilities of a wing; therefore, other sources of small distributed roughness should not be overlooked.

Observations have taught us that stall speeds in the cruise configuration can be increased significantly due to chipped paint, "burred" rivets, (i.e., flush head rivets along the wing leading edge whose edges have curled up) and the buildup of insects on the leading edges.

One known experience with insects relates to a training mission of a particular aircraft. At 15,000 feet in the clean configuration, the crew prepared for a series of stalls. The calculated stick-shaker speed was 136 knots with stall at 131. At 140 knots, and without any warning, the aircraft went into a stall with a rapid roll to the left. During the recovery, the stick shaker activated and the stall warning came on. After recovery, a second stall was attempted, with identical results. A third stall with flaps at 15 degrees and slats extended, and fourth stall in the landing configuration, also with slats extended, were executed and the aircraft behaved normally.

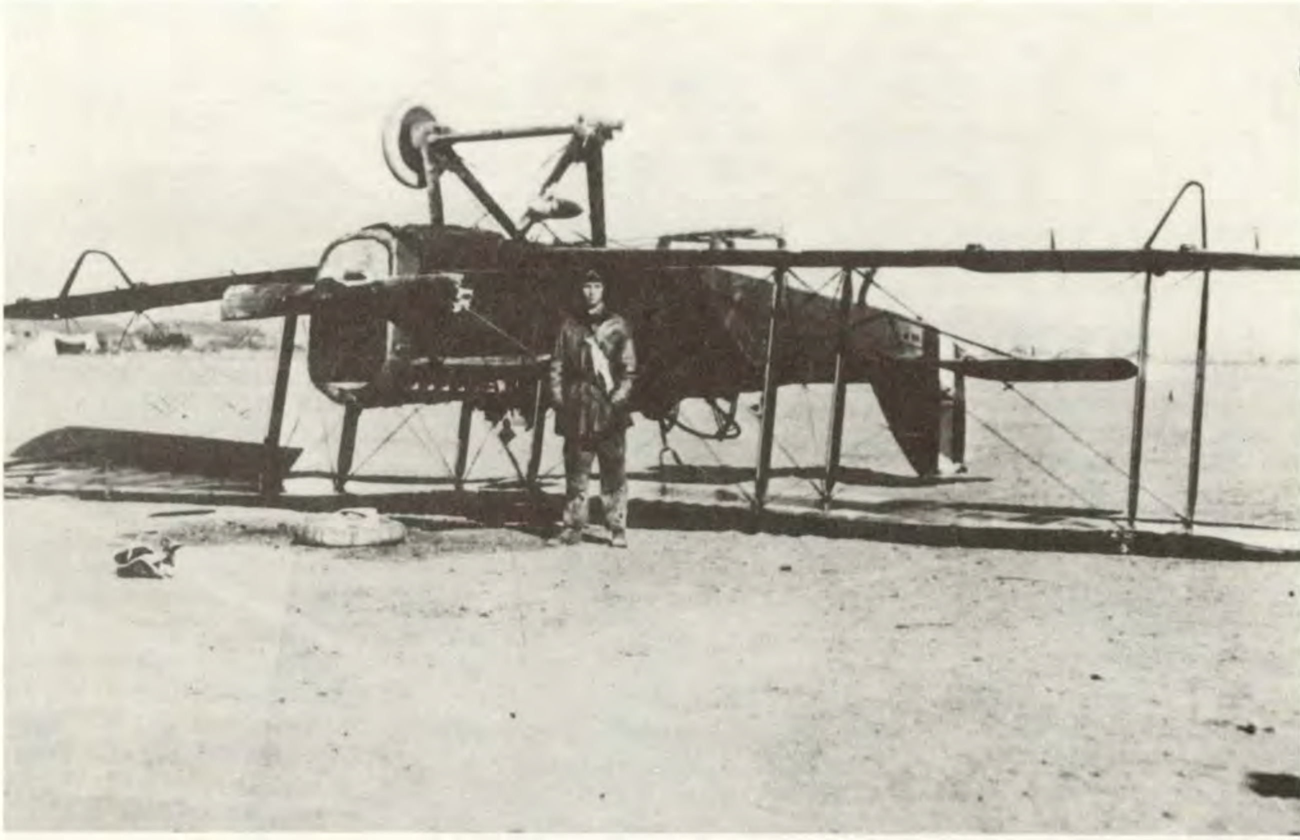
After landing, an inspection of the aircraft revealed heavy insect accumulation on the nose section and along the wing's leading edge.

The following day, after a thorough washdown, the same aircraft was flown again through the same stall series, under the same conditions. This time the aircraft performed on the numbers according to the book.

It is interesting to note stalls resulting not only from insect accumulation, but from the "burred" rivets and chipped paint, were also abrupt and without prior warning. Available data from several occurrences are included in the correlations of Figure 1.

In recapping the details of this article, the following appear to be the most pertinent:

- Accumulations equivalent to medium or coarse sandpaper covering the full span of the wing's leading edge can cause a significant increase in stall speeds, leading to the possibility of a stall prior to the activation of stall warning.
- Wing leading edge high-lift devices, even in the extended position, will provide little or no benefit in recovering degraded lift due to large amounts of roughness. They will, however, recover most of the degraded lift caused by small amounts or roughness.
- Unsymmetrical roughness can cause wing drop, or rolloff, at stall.
- Moderate roughness present aft of the leading edge, a distance of about 10 or 15 percent of the wing chord length, will have little or no effect on stall.
- Roughness occurring slightly aft of the leading edge on the wing's lower surface will have little effect on stall, but it does increase parasite drag which will affect take off performance. — Adapted from *DC Flight Approach*, McDonnell Douglas Corp., and reprinted from *Aerospace Safety*, Nov. 79. ■



# HISTORY REPEATS ITSELF

■ Since the days of Orville and Wilbur, human error has been a factor in aircraft mishaps. With technological advances designed to improve performance as well as safety, there is the increased possibility for making new errors. Orville Wright never made the mistake of pulling an emergency egress handle when intending to pull a D ring.

Although safety in aviation has improved remarkably, many of the mistakes plaguing aircrews at the beginning of aviation history are still with us. Except for the differences in aircraft, these mishaps, taken from 1948 issues of *Flying Safety*, could just as easily have come from this year's issues.

**To Sleep, Perchance To Dream**

It was fly, fly, fly night and day for an instructor giving first phase to pilots just out of flying school. At the time, I was instructing in B-24s at Geiger in the summer of 1942. Every squadron was in the race to see which could keep its Liberators in the air the most hours out of each 24.

We would take two new pilots up for four to six hours of familiarization flight, then land and take a brief rest and report for another six-hour hop with a different duo. I had flown a high-altitude practice mission that morning, and it had been hot in the afternoon so that I couldn't sleep. That evening two spanking new lieutenants reported to me for their first ride in the B-24. They were eager, their eyes wide in amazement as I showed them through the big bomber.

After a complete cockpit briefing, I took the plane off with one of the student officers in the copilot seat. I found they had been reading the B-24 manuals all afternoon in anticipation of the flight. "This is a break," I thought. "These kids are going to get a quick check-out."

As we climbed up to about 11,000' the cool air freshened me. We started a trip "around the horn" — to Euphrata, to Walla Walla, and back to Geiger, a round-robin so familiar to me by then that it was boring.

By the time each of the two students had had a go at the controls, my boredom had been replaced by drowsiness. I fought to keep awake. My eyes smarted. The instruments blurred under the fluorescent lights. Then I did what has haunted me ever since. I turned the plane over to the two lieutenants and sat down on the floor behind them.

When I awoke, cramped and cold, it was still dark. The two pilots were seated in the same position as before I went to sleep. I looked at my watch. We should be past Walla Walla en route back to Geiger.

I leaned over the aisle between my students and asked, "Where are we?"

One of them planted his finger on a map and indicated a general area near Walla Walla. I motioned the student out of the pilot's seat. Glancing at the compass as I buckled the safety belt, I noticed we were heading in a westerly direction still at 11,000 feet. I looked out the window to see if I could identify our position by city or airway lights.

I saw no lights through the side window, but did see a shape that stopped my breath — a mountain! I grabbed the controls and did a quick right turn. The peak I had seen towered above our altitude, and the plane's left wing seemed almost to be touching it when I first saw it.

After the turn we spotted the lights of Yakima. We had almost ploughed into Mt. Adams!

This report makes a good case for observing adequate crew rest regulations. It also serves as a warning not to rely too heavily on student pilots, no matter how proficient they appear to be.

### Required Reading

It had been a good flight. It was fun to get back up into the air again — particularly after being in a civilian job for the past two months. Yes, it had been a good flight, even if it was a trainer, an AT-6.

I hadn't flown one of these planes since flying school back in '43, and here I was, out of school five years and still flying an AT-6. "Doesn't compare with the fighters overseas," I thought, feeling a bit too hot for an AT-6. "Wonder when those P-80s are coming through for the reserves."

This landing is going to be a cinch, I thought, when it was time to go in. It's going to be a "grease job" to end a perfect flight. Easy now. Yes, sir, this is going to be a good . . . clunk, screech, shoulder straps tight . . . and plop. Of all the dumb, unforgivable things . . . to land with my wheels up.

Too bad this pilot thought he was too "hot" to use the checklist. Following this incident, there were probably quite a few more "hot" people to contend with.

### Use That Alternate Field

The weather at Memphis had been forecast as ceiling 600 to 800 feet, visibility two to three miles, temperature 38, dewpoint 36, light rain and light fog. This didn't seem to bother me at the time, however, nor did it seem to matter much to the man who signed my clearance. So with only four hours of instrument (under the hood) in the last six months, I took off in "Uncle's" AT-6 at 1854 and headed for Memphis, which was one hour and forty minutes away. At 2015, over three hours later, I landed "wheels, flaps, and head up" in a plowed field 20 miles west of Memphis.

Here's what happened. At 1730 I started the engine, received taxi instructions and taxied out for my take off. I checked the engine and asked for my ATC clearance. The Tower told me there would be a delay so I shut off the engine to save gas. At 1835 clearance came through and take off was made at 1845. I was cleared to climb and maintain 8,000 feet until further instructions from Memphis Radio. At 2000 I gave Memphis Radio a position report of "25 minutes out of Memphis at 8,000 feet."

Memphis Radio came back with instructions to descend to 2,000 feet and let them know upon reaching that altitude.

During this letdown I encountered severe turbulence (that put the AT-6 into some 60-degree banks), hard rain, and some snow.

After reaching the vicinity of Memphis, I circled for an hour and thirty minutes trying to contact Memphis Radio to get permission to make a letdown. But "old man static" thwarted every attempt. I did manage to pick up a Memphis weather report giving a ceiling of 800 feet, so thinking it safe, I let down.

I became contact at 1,100 feet and found a town which I circled. I tried, with no luck, to get Memphis Radio. After a few minutes Memphis Tower was contacted and I asked for a heading to Memphis. After I described the town which I was circling, Memphis Tower gave me a heading of 90 degrees! I flew this heading about five minutes, whereupon the weather became so bad that I returned to the small town which I had been circling. Again I contacted Memphis Tower and they told me a heading of 40 degrees. I did this for a few minutes, but because of the weather and low gas I returned to the town. At 2215 my engine ran out of gas and with the aid of "several angels," made a successful belly landing in a rye field 20 miles west of Memphis.

Next time I hit bad weather I was ready for it. I had made it a point to practice instruments and practice more instruments. I flew to my alternate field, rather than find out how good I was on instruments.

Although these pilots learned their lessons, their stories will have been especially worthwhile if they prevent similar mistakes by modern aircrews. ■


# What Is Your IIQ?*

## *ICING INTELLIGENCE QUOTIENT

**MAJOR KURT P. SMITH**
Directorate of Aerospace Safety

■ Last winter, the commercial airlines experienced several tragic winter-related accidents. In one of these accidents, the NTSB identified the flight crew's limited experience in jet transport winter operations as contributing to the accident. Although the Air Force did not share the same experience, we cannot afford to become complacent about winter flying. We must make every effort to avoid the pitfalls of winter weather. Since knowledge is the key to avoiding winter weather traps, the following quiz was developed to test your understanding of aircraft icing and its effect upon aircraft performance and flight characteristics.

- T ☐ F ☐ Slight surface roughness can have significant effects on stall speed and power required to achieve or sustain flight.
- T ☐ F ☐ Surface roughness on the afterbody of a wing can have the same effect on aircraft performance as on the leading edge.
- T ☐ F ☐ Increasing surface roughness due to ice formation on the leading edges and afterbodies will produce additional drag and further reduce lift.
- T ☐ F ☐ Aircraft certified for flight in icing conditions cannot take off with ice formed as a result of ground storage or operations.
- T ☐ F ☐ Ice formation on the wing surfaces decreases stall angle of attack and, in some aircraft, the stall will occur prior to activation of stall warning devices.
- T ☐ F ☐ Icing changes the aircraft's stall characteristics and, depending on aircraft design and the nature of the ice formation, can either cause violent stall or a slower progression of stall.
- T ☐ F ☐ Ice on wing leading edges may increase pitch-up and roll-off tendencies.
- T ☐ F ☐ Icing may reduce controllability and require greater stick deflection for maneuvers or stall recovery.
- T ☐ F ☐ Power available may be reduced due to ice formation on jet engine inlets.
- T ☐ F ☐ Ice has been known to cause control surface flutter.
- T ☐ F ☐ Trim effectiveness can deteriorate with the accumulation of ice.
- T ☐ F ☐ Aircraft ice protection systems are designed basically to cope with the supercooled cloud environment, not for ice formation while the aircraft is on the ground.
- T ☐ F ☐ Avoid positioning your aircraft in the exhaust of aircraft ahead of you when precipitation is present.
- T ☐ F ☐ Deice areas in view of the pilot first so that he may have assurance that other areas of the aircraft are clean. (He can monitor the area deiced first.)
- T ☐ F ☐ Power failures may occur due to ice ingestion.
- T ☐ F ☐ Ice formation can reduce the efficiency of communication and navigation equipment.
- T ☐ F ☐ Ice formations, under certain conditions, may not have noticeable effects on aircraft performance and flight characteristics; however, the effects may become quite apparent in the event of an engine failure or other emergency.
- T ☐ F ☐ Ice formation may result in airspeed, altitude, and EFR instrument errors.
- T ☐ F ☐ Use of reverse thrust can result in blowing snow adhering to the aircraft.
- T ☐ F ☐ Close inspection for ice formation just prior to take off remains the most important factor for assuring a safe take off when conditions conducive to icing are present.

Hopefully, you answered all questions as "*True.*" If not, the quiz may have sparked further study. A little knowledge now can make a big difference later for successful winter decision making. ■

# YOU'RE NEXT

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This is the first in a series of four articles dealing with cold weather survival. This article will present true survival experiences; these episodes will pose questions but give no answers or guidelines. The three follow-on articles will give some answers and guidelines for cold weather environments.

■ "It won't happen to me." This is the attitude many aircrew members have when the subject of bailing out of their aircraft arises. This had been the attitude of the copilot and seven other B-52 crewmembers before they were forced to abandon their aircraft one December night in upstate New York.

Following his experience, the copilot had a few general comments about survival: "There is one word I would like to bring up and this is 'complacency.' Everyone is complacent to some degree; you won't admit it; we won't admit it to ourselves; but nevertheless it is there. There is always the attitude that 'it won't happen to me,' but it did and it may happen to you. Survival knowledge, preparation, and the will to live — these will get you home. Loneliness, fear of the unknown, and other factors will combine to make it a harrowing experience."

The pilot had an interesting experience: "When I came to a stop, I was hanging upside down with my parachute caught in a tree. I tried to right myself but it was too hard, so I oscillated myself back and forth, got hold of a branch, and pulled myself over to the tree. I tried to pull my parachute loose but was unable to do so. I took my knife out to cut the harness free so that maybe the wind would blow the parachute out of the tree. While cutting the shroud lines, I got a cramp in my hand. To get the cramp out, I opened my hand and my knife dropped. I finally finished cutting the lines using the split part of a ration tin from the survival kit and let the harness fall to the ground. The survival kit and life raft were entangled around the tree and I was unable to free them. When I reached the ground, all I had was the flashlight and matches from the survival kit, the parachute harness, and my jacket. There was no moon, about two to four inches of snow on the ground, and a temperature ranging 5 to 25 degrees Fahrenheit. My situation looked mighty dismal."

A passenger on the flight experienced a different set of circumstances: "I briefly heard the breaking of branches, and then I was slammed full-length into the trunk of a tree. I guess I got knocked out. The next clear memory I had was sitting on a branch with my arms around the trunk of a tree and my legs out. I

continued

was cold and stunned with many aches, and I suspected broken bones. My canopy was over the top of the tree, so for a short time I sat there going over the situation in my mind, trying to figure out what to do. I had lost my helmet and a pack of cigarettes which ripped out of the small pocket on the left arm of my flight suit. The cold was getting to the point where I was pretty uncomfortable sitting in the tree, so I decided I'd better climb down. I took out my personal knife and cut the parachute shroud lines. This was the only way I could get down without leaving the parachute in the tree. I made my way about 20 feet to the ground and pulled the canopy out of the tree. I was not a regular crewmember on this flight, so I did not have a survival kit. The only personal items I had were a knife, cigarette lighter, a pack of gum, and my gloves."

Had these two people done things correctly up to this point? Were they properly equipped to survive? Did they seem adequately informed?

Being properly prepared for any emergency is an obvious necessity. Emergency procedures for possible aircraft malfunctions are repeatedly practiced by aircrew members so they may bring their aircraft home. But there are instances where they are unable to return the aircraft. So, being properly prepared and equipped for a stay on the ground are necessities. This does not only apply to knowing what survival equipment the Air Force supplies for you, but also to having equipment of your own to assist in your survival.

What sort of equipment do you carry? How much and where do you put it? These and other questions are normally asked by people concerned with returning from a survival episode.

The first thing that must be considered is the environment. Let's examine the case of a bomber crew which crash-landed in Greenland when the temperature was 40° below zero.

"If you want to know what it was like for the first seven days," said the pilot, "take two of your best friends, climb inside a steel cylinder, and set the temperature at -40°. For food, eat half a dog biscuit a day; for water, suck the ice your breath forms on the walls of the cylinder."

During the first day, temperatures were -34°F with 62 mph winds. Their shelter was the inside of the aircraft with parachute material to wrap up in. The three would huddle together for warmth.

The following morning, temperatures had risen to -28°F but the blizzard continued. Hunger that second night was the worst they would experience during their life on the glacier. Fear that their feet would freeze and of gangrene setting in kept them shuffling around. This is the way it went for three days.

At about 2300 on the third night, the wind died down. They exited the aircraft for the first time. The navigator calculated their location to be just inside the Arctic Circle, about 15 miles from the Atlantic and 110 miles off of their map. They decided to make for the coast where they intended to use their raft to paddle that 110 miles. Snow shoes were improvised and equipment collected, which included a raft, Very pistol, three distress signals, a compass, and a box of biscuits. Just then, the winds picked up and everything became grey with blowing snow. They decided to stay with the aircraft. There was no let-up in the wind and snow for three more days. The inside of the aircraft became covered with ice about three inches thick. Their mouths became sore and bloody from sucking snow and ice, yet they still couldn't quench their thirst.

The seventh morning, the weather took a turn; the temperature shot up to 54°F and rain started. They began their 15-mile walk for the coast. That night, their flight suits and boots froze to them like armor. They propped the raft up with oars and crouched on the lee side for the next 17 hours of darkness.

Was the aircraft indeed the best shelter they had? Should they have left the aircraft to walk to the coast? Do you believe they made the

correct decisions for the environment in which they were living?

As you can begin to see, it is vitally important to be properly equipped and knowledgeable of extreme cold environments. Extreme cold should not be a limiting factor in preparation for winter flying. Take the bomber crew that bailed out 250 miles north of the Canadian-United States border one fall. Five crewmen parachuted from their aircraft — one was dressed for the climate. It was raining and cold with very few if any clear days in the days to follow.

Somehow, three of the crew managed to link up. This in itself was surprising considering the thick vegetation, mountainous terrain, and inclement weather. After four days in one location, they packed their equipment and moved to the east, presumably for the Atlantic seacoast. From that moment on, they lived in a nightmare of hopelessness and desperation. None was a woodsman nor had any previous experience in the outdoors. They didn't know how or where to achieve footing; they continuously stumbled and fell. Limbs were constantly slapping in their faces and about their ankles. All this began to wear their nerves thin and patience completely out.

Two of the men carried birdshot in their pistols for hunting. This allowed them to kill small game but not nearly enough to control the hunger of three men and replenish the loss of calories from the cold and extensive walking.

By the end of the sixth day, they had seen approximately four aircraft but were unsuccessful at signaling them. On the seventh day, they decided to stay put — mostly because of their depleted health and low morale. All around them were discouraging signs; hills, one after another; no rations; not enough game animals available to keep up their strength; and their inability to signal rescue aircraft. The rain and cold had taken their toll, clothing was continuously wet, and hypothermia was a very real threat.

Were these men equipped to handle this type of environment? The answer is probably no, but why? Was it the time of year that caught them off guard? Should they have left their initial camp? Was inclement weather a factor in determining if they should travel?

The preceding episodes are true. Deciding what you would have done in these circumstances is easy when relaxing in your warm office, but have you taken "all" factors into consideration? The next question is, what happened to these airmen?

Future articles in *Flying Safety* will expand on these incidents and provide you with some insight into preparation for winter flying and how to cope with the various cold climates. Oh, yes, you'll find out the ending to each survival episode.

Next month: "Are You Ready?"

Questions or comments concerning this article should be directed to the Stan/Eval Division, 3636 CCTW/DOV (ATC), Fairchild AFB WA 99011, or AUTOVON 352-2371. ■

# OPS topics

## Tigers and Fools

■ "A tiger knows the limitations of his aircraft, and can make it perform to the extent of these limits.

A fool either doesn't know the limits or tries to get 'just a little more' than the book allows.

A tiger knows his personal limits and operates within them. A fool figures he can push himself a little more and really show everyone what a tiger he is.

A tiger can take an (OR) aircraft and perform a mission to perfection. A fool will take a marginal aircraft and try to do the same because he thinks he can hack it.

A tiger knows the rules and regulations and, while observing them, gives a professional performance.

A fool feels he has to break rules and regulations to show what a tiger he is.

A tiger is not a fool, but . . .

A fool usually thinks he is a tiger." — Lt Col Jack Drummond, USAF, Retired.

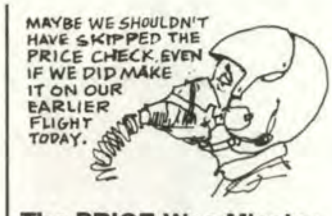

## No Flow

When a T-33 pilot made his PRICE check, the oxygen regulator would not indicate any oxygen flow. Based on a misunderstanding of the oxygen system, the pilot concluded that the oxygen flow indicator might not work below 5,000 feet and that this condition was acceptable.

The pilot took off as planned. When he completed the 5,000 foot check the oxygen blinker still did not work, but he pressed on. Passing 18,000 feet the blinker was still inoperative, and the pilot then began to check his oxygen connections, and placed the diluter lever to 100 percent. He found that the connections were OK and that if he inhaled deeply, the blinker worked. He selected a pressure setting (safety) on the regulator but got no mask pressure. Nonetheless, he continued the climb to FL 330.

After level off at 330, the pilot realized that he was having trouble holding headings. Recognizing the onset of hypoxia, he declared an emergency and began a descent. Once back at lower altitude the symptoms disappeared, and the recovery was normal.

After landing, maintenance investigators found that the ejection seat had been removed for maintenance. When it was installed prior to this flight the seat to floor oxygen connections were not properly mated. This effectively prevented the pilot from receiving anything but ambient air through the mask.

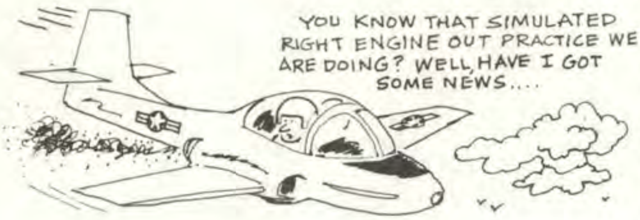



## The PRICE Was Missing

An F-4 was on its second mission of the day with the same aircrew. On the first mission, the crew successfully performed the required oxygen system PRICE checks. The second sortie was a simulated air defense scramble. The crew did not perform a PRICE check on this sortie even after level off.

The aircraft climbed to FL 370 and ran several intercepts. After 30 minutes of flight (20 minutes at altitude) the pilot recognized his hypoxia symptoms. The WSO observed the cabin altitude indicator showing 13,000 feet. The aircrew then performed an oxygen system check. The rear cockpit checked OK, but the pilot could not get any oxygen flow.

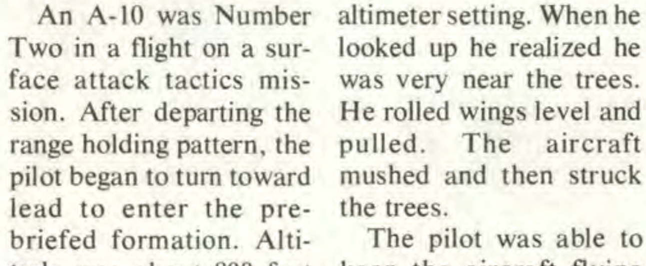
The crew declared an emergency and began a descent — with the WSO in control — until the pilot's symptoms disappeared. The oxygen hose to the front cockpit oxygen regulator had become disconnected because of a loose connecting clamp.


### Simulated-Uh-Real Engine Out Pattern

A student pilot and IP entered the pattern for a prebriefed simulated single engine approach. The IP pulled the right throttle to idle and told the student to simulate loss of the right engine. After configuring with gear and slowing to 130 knots, the student asked which engine was simulated out. The IP replied that it was the right engine. The student then began to advance the right throttle.

The IP grabbed the right throttle and "forcefully" retarded it while reemphasizing that the right engine was simulated out. The IP then noticed the right engine rpm decreasing through 30 percent. He continued the single engine pattern to a full stop landing.




### Low Altitude Maneuvering

An A-10 was Number Two in a flight on a surface attack tactics mission. After departing the range holding pattern, the pilot began to turn toward lead to enter the prebriefed formation. Altitude was about 800 feet AGL.

The pilot looked inside the cockpit to check the altimeter setting. When he looked up he realized he was very near the trees. He rolled wings level and pulled. The aircraft mushed and then struck the trees.

The pilot was able to keep the aircraft flying and made a successful recovery despite substantial damage to the aircraft.


### Wrong Runway

An aero club pilot had filed to a stopover base on VFR cross-country flight. Upon arrival, he was cleared for a right hand pattern and landing on the main runway. Because he had been stationed at this base previously, the pilot was familiar with the shorter secondary runway used by the local aero club. He, therefore, advised Tower that he would make his approach to the shorter runway.

During the approach, visibility was very limited although technically still VFR. The pilot believed that he had acquired the proper runway, but at about 1/2-mile and 200 feet a large military aircraft and the parking ramp became clearly visible. Realizing his mistake, the pilot made an S turn to line up with the main runway.

During the S turn the aircraft's rate of descent increased and it touched down firmly on the runway, bounced on the main gear, and touched down again — nose first — allowing the propeller blades to strike the runway.

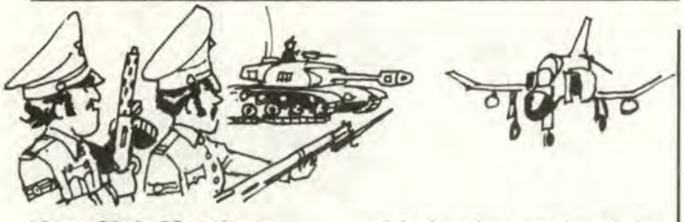
continued

### AIR FORCE RECOGNITION RIBBON

■ The following 1982 safety award winners will be authorized to wear the AF Recognition Ribbon. (For details see page 23, October *Flying Safety*.)

- Chief of Staff Individual Safety Award, 1982
  Lt Col Edward L. Hubbard
  Capt Robert J. Tomczak
  1Lt Roy L. Gresham
  CMSgt Ronald C. Christiansen
- Kolligian Trophy, 1982
  Capt Larry E. Faber
- Director of Aerospace Safety Individual Special Achievement Award, 1982
  Maj Daniel P. Kallenbach
  Maj Bobby R. Quisenberry ■

# OPS topics continued

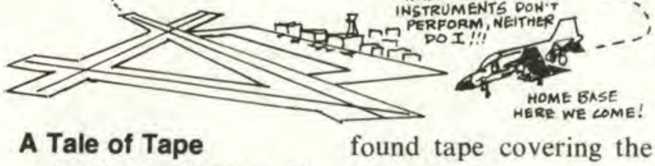



### New Club Members

Recently we welcomed a couple of flightcrews to the ranks of pilots who had landed successfully — but at the wrong airports. Regrettably, we now have a couple of new applicants for membership in that not so very exclusive group.

. . . turn was made to intercept the inbound course on the VOR approach as the haze had obscured the airport . . . the airport environment seemed to fit (the VASI lights were out) so a landing was made. Our mistake became apparent when we noticed the armed personnel along with the abnormal activity of the people on the runway. . . .

Sure enough, the bird alighted at a military airfield in close proximity to the intended destination. Foreign country, but not so far from home. Embarrassing — and alarming — but perhaps productive of a vivid lesson for others. Use all available aids and stick with prescribed procedures; failure to do so can be, at the very least, inconvenient for everybody involved — and it may put you eyeball-to-eyeball with a hostile native. — Adapted from ASRS *Callback,* No. 36, June 1982.



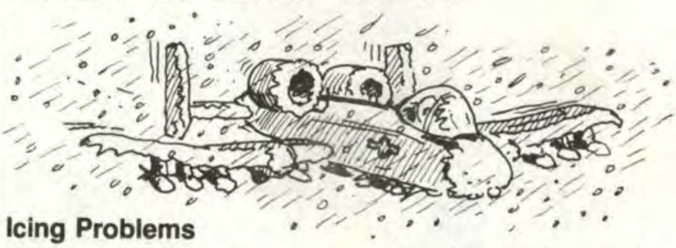

### A Tale of Tape

A pilot preflighted his F-4 and took off. Shortly after take off, the pitot static instruments began to malfunction. The pilot was able to recover using angle of attack and VASI indications. After landing, maintenance investigators found tape covering the static ports.

The aircraft had been washed earlier in the day, and the tape had not been removed. Neither the crew chief who performed the preflight nor the pilot saw the tape before the flight.

### A Real Pain

It had been a reasonably good contact sortie for a T-37 student. As the aircraft descended through 12,500 feet on recovery, the student pilot felt a sharp pain in the right front sinus area. The pain was so severe that he was unable to continue to fly. The IP took the aircraft and leveled off. The pain subsided gradually and they continued descent. The pain recurred once more at 9,000' and the IP again leveled off until the student's pain eased. What would have happened if the pilot had been solo?



### Icing Problems

Three A-10's were engaged in a low altitude tactical navigation and air-to-ground range mission. The crews were VFR for the first part of the mission, but then snow showers moved into the area. The flight terminated the range mission and started home IFR, climbing to 11,000'.

Mixed icing was encountered in the climb and accumulated on wings, pylons, and slats as well as the horizontal and vertical stabilizers of all three aircraft.

Ice remained on the aircraft wings after landing. Although none of the pilots noticed any engine problems, the No. 3 aircraft had ice damage to the right engine. ■

■ A "buzz phrase" making the rounds in some staff agencies goes something like "If you can't stand the answer, don't ask the question." While not exactly words to live by, we've been tempted to use them when trying to evade answering the question "What *is* on course?" or "What *does* established on a segment of an approach mean?"

Consider the following scenario: You are being vectored to final for a TACAN approach, the controller turns you loose on a 30° intercept to the final approach course with 10° of bearing pointer and CDI travel to go. As the CDI begins to move toward the center of the case, you ask yourself "When am I 'established?'" The definition is suddenly important since your assigned altitude is above the final approach fix altitude and you'd like to descend.

AFM 51-37 neatly sidesteps the issue by ignoring it. Let's freeze the scene and discuss the dilemma. You need to descend for a landing while avoiding the dirt, rocks, trees, spiders, snakes, and broken glass. The approach procedure is designed to lead you both vertically and horizontally to a point from which a landing can be made. The problem becomes twofold: Obstacle clearance and course guidance. The obstacle clearance problem is solved by approach designers complying with AFM 55-9 (TERPS) procedures. Course guidance remains the pilot's job.

In an ideal situation, you are absolutely established on a segment when the aircraft's ground track exactly mirrors the heavy blue lines on the approach procedure. In the real world, the question remains: When can I consider myself "established" for descent purposes? To open a dialogue on this subject invites, at best, discussions concerning pilot technique, at worst, hate mail from the fringes of aeronautica.

While we realize a certain degree of emotionalism surrounds this subject, we offer the following for your comments: When using ground-based nav aids (VOR, TACAN, and ILS) you may consider yourself established on a segment of an approach when the aircraft position, as depicted on a Course Deviation Indicator, is within and will remain within half-scale deflection from centered with respect to the desired course.

**WARNING**

The above definition is for discussion only and will not be used to settle bar bets, start fist fights or otherwise irritate our friends in Stan/Eval.

For discussion purposes, we assumed the following circumstances in developing our proposed guidelines for a workable definition:

a. Some type of CDI is operational.

b. CDI scale is 10° either side of centered in TAC/VOR Mode and 2-12° in LOC/ILS Mode.

c. RMI only was not considered.

d. ADF was not considered.

We now need *you* — the operators, instructors, evaluators — to tell us if the proposed definition has merit or if we have overlooked a potentially dangerous situation? Written comments are preferred and should be sent to: HQ ATC/DOTO, Attn: OPR AFM 51-37, Randolph AFB TX 78150.

Our phones still work and if the written word is out, call Lt Col Jim Curran or Maj Bill Gibbons at AUTOVON 487-5834. Keep it "On Course!" ■

# MAIL CALL

EDITOR:
FLYING SAFETY MAGAZINE
AFISC (SEDF)
NORTON AFB, CA. 92409

## Tail Rotor Trickery

Referring to your article on "Tail Rotor Trickery" in *Flying Safety,* August 1982, I would like to put forward an additional flight situation in which a helicopter may run out of yaw control.

As mentioned in the article, many helicopter yaw control problems arise from the shed main rotor vortices entering a bottom aft rotating tail rotor. Apart from the flight situations that were described, viz. hovering with over 20 kts wind from 040 to 090 deg. starboard and hovering IGE with wind on the tail, to me there seems to be another flight situation in which loss of yaw control can also occur.

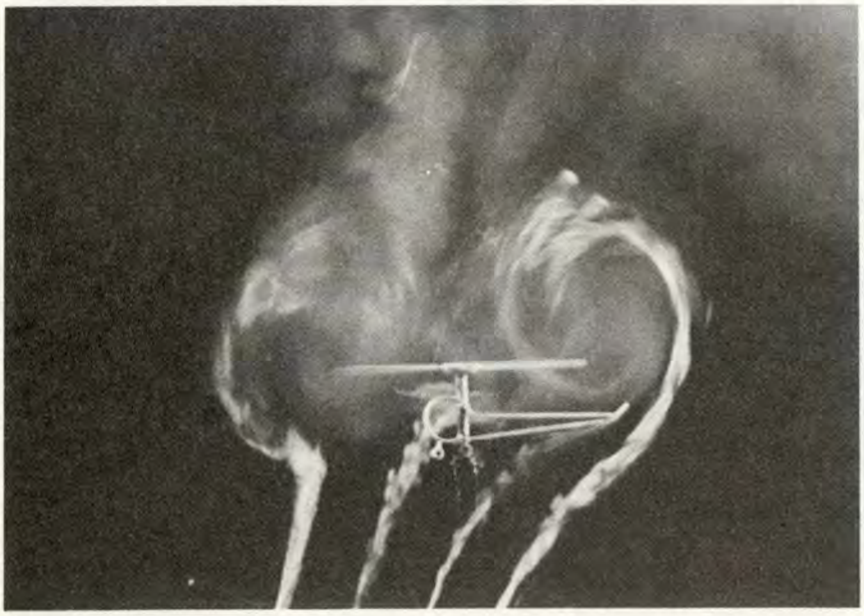
When the *main rotor* enters the vortex ring state especially at a low forward speed of the helicopter, a strong and irregular vortex pattern exists in the region of the tail rotor. This can be seen from this photograph of a wind tunnel smoke experiment carried out at our laboratory. As this vortex is at least as strong as the shed tip vortices which enter the tail rotor when hovering in the 20 kts starboard wind, the loss of tail rotor thrust is of the same magnitude at constant pedal travel. As the pedal deflection is already high in the main rotor vortex ring state, there may remain insufficient pedal margin to compensate for the relative reduction in velocity over the tail rotor and the helicopter starts spinning around the top axis.

So when a helicopter with a bottom aft rotating tail rotor enters the vortex ring state (settling with power) then the commonly known problems — large thrust variations, vibration, reduced control effectiveness and rapid loss of altitude — are aggravated by an additional problem of the helicopter running out of yaw control. To me it seems impossible then to stop the top spinning helicopter, unless one has enough height above the ground for recovery by building up forward speed in a spiral dive. It seems likely to me that such a situation as described may occur at the end of an approach to the hover, when a high pitch up flare is performed with inadequate collective input.

I would be very pleased with your comments on my theory and would be grateful if you could provide me with information on any such case reported to you.

***H.J.G.C. Vodegel***
***National Aerospace Laboratory***
***The Netherlands***

*If you have any comments on Mr. Vodegel's theory, we'd be happy to hear from you.*



## Thin Air

In reference to your Ops Topic ("Thin Air," July 1982) on the F-15 with lack of pressurization to FL 340, I feel that it would be useful to change the emphasis of the final conclusion from one of criticism to one of positive reinforcement. The incident is an excellent example of the necessity and value of physiologic training and periodic updating of that training. This episode demonstrates that knowledge of personal hypoxia symptoms is the best cross-check of cabin pressurization.

***Benjamin E. Wiseman***
***Captain, USAF, MC, FS***
***Kelly AFB TX***

*Criticism was not intended. Rather, the question should trigger crewmembers to review their own knowledge of procedures for pressurization problems.*



☆U.S. GOVERNMENT PRINTING OFFICE: 1983 — 683-026/2

UNITED STATES AIR FORCE

# Well Done Award

*Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.*

CAPTAIN
## Thomas E. Sawner

FIRST LIEUTENANT
## Paul H. Bonnier

**401st Tactical Fighter Wing**

■ On 22 December 1981, Captain Sawner and Lieutenant Bonnier were leading a flight of two F-4Ds on a local ground attack training mission. At 165 KIAS, just after nose wheel lift-off, Captain Sawner felt the stick drive full aft forcing the aircraft into a 20-25° nose-high attitude at a speed less than computed take off airspeed. He immediately countered the heavy back stick pressure, using both hands to force the nose down and prevent a stall. The aircraft continued a steep climb to 6,000 MSL and 200 KIAS before level flight was regained. The crew declared an emergency and accomplished all checklist procedures. All actions failed to reduce the severity of the back stick pressure. Captain Sawner performed a controllability check and found that he was unable to maintain attitude control without using both hands on the stick. He elected to have Lieutenant Bonnier fly the throttles for the straight-in emergency approach. Their coordinated actions enabled the crew to fly the aircraft to a controlled touchdown. By their immediate reactions, quick problem assessment, and excellent crew coordination, Captain Sawner and Lieutenant Bonnier saved a valuable aircraft. WELL DONE! ■

Now is the time for all good PILOTS to come to the aid of their Safety Offic

# NEW YEARS Resolutions


1. I will either:
   a. Hoot with the owls, or
   b. Soar with the eagles, but
   c. I won't do "a" the night before "b."
2. I will practice instruments and use the hood (Ugh!).
3. I'll spend an extra night in Las Vegas, San Francisco, Knob Knoster, or Portales rather than launch when only get-home-itis says it's a good idea.
4. I will try to read my Dash One cover-to-cover for the umpteenth time.
5. I will see the flight surgeon when I am sick; I will spend a week in bed if necessary (out of sight); I will not self-medicate.
6. All of my "war stories" will be truthful . . . or at least be based on fact . . . well, at the very least they will conform to the laws of nature, aerodynamics, and human physiology.
7. I will remove my rings before flight. If married, I will put my wedding ring back on at all cross-country bases.
8. If I lose sight of lead, I will admit to being human, and break out.
9. I will not be a prima donna (at least with most other pilots).
10. I will take myself off the schedule when I am too fatigued to fly.
11. I will eat breakfast before flying (candy bars and coffee don't count).
12. I will write up all aircraft problems. (See Resolution 3.)
13. I will always check my gear down before landing.
14. I will not raise the gear until I am definitely airborne.
15. In an emergency, I will maintain aircraft control above all else (except ejection).
16. I will not use foul language when talking about the !@##@$%#%$@!$* simulator.
17. I will refer to the check list.
18. I will say "I've got the aircraft" or "You've got the aircraft."
19. I will taxi with all due caution.
20. I will eject if necessary.

Courtesy Capt Edward G. Schofield,
Travis AFB CA