flying

SAFETY

FEBRUARY 1983

Surviving An Aircraft Crash

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What's A Good Leader?

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THERE I WAS

■ We've all heard the adage, "There are 'old pilots' and 'bold pilots' but no 'old, bold pilots'." We've also probably heard that there are some critical times in one's flying career where past experience has proved a large share of accidents occur. These times are around 2,000 hours and again around 6,000 hours, I think. Big deal, right? It won't happen to me — I'm too smart for that.

I'd like to share an incident with you that happened to me a while back. Nothing was broken, and the recovery was uneventful. But it wouldn't have taken much for things to have been a whole lot different. It was a typical CFIC sortie 5 profile with aerial refueling and pattern work scheduled. It was a beautiful day — calm winds, clear skies — the kind we all look forward to. The first few touch and goes went smoothly, and it promised to be a good day.

On the next touch and go, just after lift off, the master caution light illuminated and I noticed that the No. Five hydraulic pressure gauge went to zero. This was confirmed by the right forward and right aft landing gear remaining in the down and locked positions. Big deal, right? I was somewhat annoyed knowing the Dash One is fairly specific on just what type of training can be accomplished, and it didn't include what I had planned for the rest of the period.

We then spent the next few minutes deciding exactly what we could accomplish as well as planning for the full stop. We decided to accomplish a few low approaches while we burned down fuel, and then land. The next 30 minutes or so were busily spent deciding what gross weight would be best to avoid hot brakes and how to coordinate the landing. We discussed such items as which bypass valve needed to be opened and if that would take care of clearing the active. In short, we were well prepared for our eventual full stop landing. The command post was notified and maintenance was standing by as we made our base turn. The touchdown was smooth, the drag chute deployed, and the aircraft decelerated nicely.

After we stopped, maintenance was cleared in to ready the aircraft for taxi. You can imagine my surprise when the first words out of maintenance were "Get off the aircraft, you've got hot brakes." It was then I noticed something conspicuously missing — no crash equipment. Why? Because I had failed to do the obvious — I had not declared an emergency. I notified the tower that we had hot brakes and were shutting down and evacuating the aircraft. As we deplaned we were made even more aware of our predicament — hot brakes, hydraulic fluid everywhere, particularly in the forward wheel well area, and no crash equipment. Not an enviable situation to find yourself in.

Well, all is well that ends well, I suppose. The brakes weren't really hot, the crew chief mistook spraying hydraulic fluid for smoke, but I was certainly made keenly aware of my "error" in judgment. What could have been the consequences and why had I erred? I had jeopardized my crew, maintenance personnel, crash personnel, and the aircraft by not doing the obvious and declaring an emergency. Was I complacent? Possibly so. I certainly wasn't overly concerned with the emergency. I was more interested making sure my students clearly understood the problem. I know in the future I won't neglect that detail.

No matter how seemingly insignificant your problem is, think it through entirely. Is there a possibility that under the right set of circumstances things could get a lot worse in a hurry?

IP's and Flight Lead's, this is the kind of "no sweat" situation that can easily get you in trouble. It can *happen to you! Both you old and new heads might find it interesting that since 1977, 42 percent of our total Class A mishaps occurred with guys with over 2,000 total hours in the seat, and over 55 percent of these were ops-related. Even when you're sure you've got a handle on things, take the extra minute to think it through and make sure you've covered all the importan steps.* ■

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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Hit on his first pass, Four headed the wrong direction. The friendlies were behind him. If ever he needed a good leader, now was the time.

About The Flight Leader

■ You were diverted from your briefed mission this morning to get some trucks the FAC has cornered. When you call him he gives you a quick description of the target and his position. Then he tells you to stand by.

You know the area he describes. You've seen it many times in the nine months you've been in SEA. As you listen to the FAC working another flight, you can visualize the terrain. When the last man in the flight ahead calls off target you are just arriving in the area. You spot him, then the rest of the flight and the FAC in rapid order.

"Okay, Boomer Flight," the FAC calls you as the other flight leaves. "Give me an estimate of your position, you're next."

"I'm over you now," you reply, "orbiting left. I have you in sight."

"Bee-ootiful, Boomer, I've got about five trucks cornered in that patch of trees off my left wing . . . north of the road . . . against the karst."

Before the FAC marks the trucks he gives you a full description, their elevation, his estimate of the surface wind. When you've rogered that, he goes over defenses in the area . . . moderate automatic weapons fire, escape heading for immediate bailout, and location of the nearest friendlies . . . 15 miles west. You catch your thoughts wandering before he is finished . . . you've worked in this valley many times before. You know the bailout heading and the location of the friendlies.

"Okay, Boomer Lead," the FAC's voice changes. "Let's make passes west to east. Mix them up a little, but go toward that hillside . . . they're tucked in pretty tight against the karst."

Pulling back up for your second pass, you watch the flight roll in and deliver. They're varying their run-ins enough to keep the gunners off balance, but they're placing the ordnance right where the FAC wants it.

"You're getting ground fire from the top of the hill, Three," the FAC's voice is matter-of-fact. "Four, if you have time, move it 200 meters east to the top of the ridge . . . two guns up there firing now . . . Lead, roll in from your position to cover him . . . north to south . . . north to south. . . ."

"Lead's in with guns." You were rolling in when he called. "Move it around, Four; they're tracking you. . . ."

As Four releases and starts his pullout, you see something sparkling on his fuselage, aft of the cockpit.

"I . . . I think I'm hit. . . ." Four sounds completely surprised. He is jinking as he pulls off over the hill. The airplane looks intact, no smoke, no fire . . . and he seems to be under control.

You bend your airplane hard toward him as his voice calms down. "Compressor stalls, Lead. No power . . . control's OK, though . . . trying to climb."

Then you see that he is still heading east, toward the bad guys and away from the friendly ground troops.

"Bring it around to the west, Four . . . 180 to the left . . . head west! I'll catch you in the turn. Don't go any farther east!" You see him start the turn, then you ask, "How's the motor, Four? Is it gonna last till we cross the river?"

"Dunno." His answer is brief and curt. He's busy in the cockpit. It doesn't sound good. "How far is the river, Lead? I can't stay with this very long . . . smoke in the cockpit."

As you close on him you realize Four doesn't know the area. This is only his ninth or tenth mission. Nothing looks familiar to him yet. In fact, he doesn't really know where he is!

"Lead, I'm going to have to g[illegible] out. . ."

"Hold on, Four, hold on," you interrupt quickly when he releases the mike button. "Stay with it as long as you can. See that long ridge curving to the north? Beyond that is good guys . . . can you get that far?"

"EGT's pegged . . . getting hotter 'n hell in here . . . but I have control. I can fly the bird."

"Okay, good. It's your show, but stay with it as long as you can . . . get over that ridge." You hear the FAC on guard channel, calling the rescue forces. "The Jollys are on their way, Four."

He crosses the ridge with about 2,000 feet to spare. When he ejects, you estimate he is five miles into good guy country. His chute blossoms and then almost immediately disappears into the jungle. Without taking your eyes off the spot where the chute disappeared, you set up an orbit a[illegible] start to refine your estimate of his

About The Flight Leader

continued

position. The FAC is just arriving in the area when you hear Four come up on his radio. He is OK. You begin to relax.

Low fuel forces you to leave before Four is aboard the Jolly, but the situation is under control. On the way home you hear that Four is on the chopper and in good shape. Thank God, you think, he got that bird over the ridge and away from the hostile area.

Without you he probably would have continued heading east until he was forced to eject. Unfamiliar with the area, very busy in the cockpit the entire flight, and then hit on his first pass, Four was close to saturation. Escape to the west, which was automatic reaction to you, required that Four concentrate on the FAC's instructions and then recall them now that he was in trouble.

Four needed a flight leader. And he had a good one. The system worked as designed, and Four lived to fly another day.

The flight leader's position is one of grave responsibility, not just a position of authority and status. And this responsibility is much broader than merely leading his flight through the air to the target and back.

Unfortunately, not every pilot flying lead in a flight understands this responsibility. Take the following incident:

Shortly after takeoff, No. Two in a flight of F-100's found that his afterburner would light every time he moved the throttle to about 87 percent. Flight Lead decided to continue the mission, climbing in burner. After descending in the vicinity of their briefed target, they were diverted. Making another burner climb, and a gradual descent to the second target, they salvoed ordnance and started home. Climbout was in burner again.

Number Two, who had been doggedly hanging on all this time, found he was down to 2,400 pounds of fuel when they were 130 miles from the landing base. At 65 miles, he had 1,200 pounds and jettisoned tanks and pylons. At 8,500 feet, 25 miles from the field, he flamed out, showing 600 pounds in the forward tank. He managed to get the engine relit and flew another 15 miles before the engine flamed out again.

He ejected ten miles from the field.

The mishap board found supervision to be a factor. The flight leader continued the mission when his wingman had a known malfunction which affected safety of flight.

Too frequently, an inexperienced wingman, accustomed to following the direction of his superiors, will follow his leader into situations he probably would not enter if left to his own judgment.

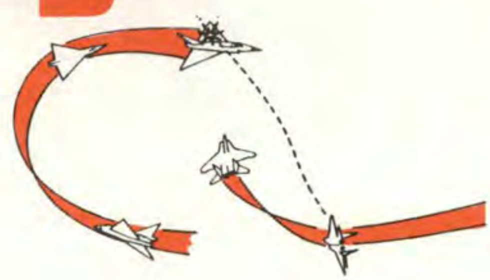
But a good wingman follows his leader anywhere! And a good wingman doesn't question his leader's judgment.

Now, about the good flight leader. . .

- He has broader, longer experience than his wingman. When problems arise he thinks of more and better alternatives. He chooses the best course of action and reaches a sound decision more rapidly than his wingman.
- He can safely take more imaginative action in a tight situation, because he has a better understanding of the variables involved. He's been there before, knows what's on the other side of the ridge. More at ease than his wingman in an unfamiliar environment, he observes more and understands more of what is going on around him.
- He can better evaluate all aircraft malfunctions because he knows the machine better than his wingman. Generator failure, TACAN failure, low fuel state, hung ordnance . . . he better understands the impact on mission accomplishment and safe recovery.
- With more knowledge of the mission, he can rapidly evaluate a tactical situation and arrive at an efficient tactical plan. Freed of much of the concentration on switchology and pattern flying that occupies his wingman, he rapidly relates terrain, defenses, weather and target to the mission objective. He plans tactics for the entire flight as the situation develops, or he evaluates and accepts or rejects the plan presented by the FAC, with his wingman's abilities always in mind.

In summary, a good flight leader accepts all the responsibility for successful completion of the mission, keeping in mind his wingman's proficiency, experience and knowledge. — Reprinted from *Aerospace Safety*, January 1970. ■

Down In Flames Through IFFC



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■ It was a bright, sunny, August day as the F-15C crew searched the sky for their target while they listened to the voice of the range controller on the radio.

Then the pilot spotted a bogie at 10 o'clock and about three miles. Once the bogie was confirmed as their target and they received clearance, the F-15 crew began the attack.

The target, a PQM-102, started a 4G right turn at 420 knots. The F-15, traveling at 400 knots rolled into a 3.3G turn and engaged the drone in a 130-degree aspect right frontal attack.

The pilot opened fire at 5,800 feet and ceased fire at 3,800 feet after a single two-second firing burst. The drone caught fire immediately, went out of control, and crashed onto the range.

Some things made this engagement different from the traditional air-to-air combat. First, the engagement occurred during a nearly head-on pass, and at a closure speed of 760 knots. Then the pilot began firing at almost a mile and ceased before even reaching conventional firing range.

The key to such unusual parameters for the engagement is a new Integrated Flight and Fire Control (IFFC) system. The heart of this system is an on-board high-speed digital computer which integrates the flight and fire control systems with the optical sensor/tracker pod and computes the trajectory of a target with speed and accuracy otherwise virtually impossible for a pilot in a combat situation.

As important as the IFFC is to improving tactics, it will also have some significant flight safety implications. The capability to fire and break off the attack at much longer range can reduce the midair potential.

The same computer which tracks a moving airborne target so accurately can also pinpoint a ground target and compute release points even in a turn. Such capability can greatly reduce the pilot's task loading and, hopefully, allow more time to concentrate on key safety-related matters like aircraft control and terrain avoidance. ■

Surviving An Aircraft Crash

MAJOR ARTHUR P. MEIKEL III
Directorate of Aerospace Safety

■ Few will dispute that fatalities caused by aircraft crashes are tragic. But to think that the victims had no chance of avoiding their fate is erroneous. In some cases, this has been true, but more often precautionary actions could have been taken, especially if the passengers had been aware of the impending crash. Are you prepared to survive an aircraft crash? Would you like to learn how to improve your chances of living?

My Air Force experience has shown me that crewmembers who are not at the flight controls are more concerned about surviving an aircraft crash than the pilots. The most concerned, i.e., those with the worst case of "flight nerves," are pilots who are passengers on an airline or military cargo aircraft. This is particularly true of the older evaluator whose opinion of the younger pilot's ability is somewhat tarnished. But even most of these people do not fully understand the hazards involved.

Perhaps it is the feeling of helplessness or the lack of control that worries passengers most. After all, their fate is in someone else's hands and they may feel that there is nothing they can do to save themselves. But, a recent NTSB special study on cabin safety in large transport aircraft indicates that you can often greatly increase your chances of surviving a crash. First, you must understand the perils and take actions to minimize risk.

Three factors determine survivability in an aircraft crash. It is important that:

- Deceleration forces not exceed the tolerance of the human body.
- The restraint system remains intact.
- The occupiable area remains relatively intact.

The NTSB study considered 234 crashes between 1970 and 1980. This study was limited to large transport aircraft carrying 30 or more passengers for hire — a sample group of 88 crashes. Of those crashes, 77 were found to be partially survivable. In other words, in over 80 percent of crashes of large aircraft some passengers live while others die. Why?

Passengers can do little to improve their chances of surviving in crashes with severe aircraft impact. Outside of assuming the best body position for the direction of impact, not much can be done to control decelerative forces. The NTSB study lists approximate G forces which the body can withstand.

Direction	Gs
Forward	20-25
Downward	15-20
Sideward	10-15
Upward	20

Note: Duration from 0.1 to 0.2 seconds and rate of onset 50G/second.

These G forces obviously exceed design criteria for seat and cabin furnishings. The limiting factor on chances for survival then becomes aircraft seats and furnishings. Let's take a closer look at them.

In 84 percent of the crashes, seat restraint systems failed. Seat legs or points of attachment failed, or the floor was damaged so severely that the seat tracks failed. It is likely that, as a passenger, you will be thrown from your seat or be hit by other dislodged passengers.

Are you prepared to survive an aircraft crash? If you understand the factors which determine survivability, you can greatly improve your chances.

In 78 percent of the crashes, cabin furnishings failed. Galley units (62%) and overhead racks often failed. This means danger to the passengers. Being struck by galley units is, of course, a hazard to those sitting nearby. If you are immediately under the overhead rack your risk increases. Window seats are also dangerous because a fallen overhead rack may act as a trap. During your egress, once you reach the aisle, the exits may be blocked by galley or overhead units.

Even though no seat is 100 percent safe, you can still enhance your survival by assuming a good body position. The normally hostile post-crash environment makes a protective posture even more important. During post-crash fires or water impact, your survival chances improve greatly if you are conscious and uninjured. You then have a better chance of freeing yourself, finding an exit, and egressing quickly. Fire is a major killer in the post-crash environment. Your chances of survival are greatly diminished within two to three minutes after a fire breaks out in your area of the aircraft fuselage.

Anyone who has seen the film "Crash Survival," knows a crash position is not a new concept. The 28-minute film describes a rigid, bent-over body position and lists the advantages of a secure seat belt and protective clothing. I recommend the film to any crewmember who hasn't seen it. Your Base Film Library should have a copy — the film number is 39457. It is also available in cassette form.

Surviving An Airplane Crash continued

The third factor determining passenger survival is whether or not the occupiable space remains intact. In approximate order of hazard, the most common impact perils were lights/stanchions, trees/poles, embankments, ditches, buildings, fences, and autos. Because of the forward direction of travel, and since most survivable crashes occur during takeoff and landing, many people consider the tail the area most likely to remain intact. The NTSB study does not address this point, and the penetration of occupiable space seems random. Those who sit aft in aircraft should realize a weak point exists in the tail section. A break there could cause you to be ejected from the aircraft and injured. But such a break could also provide an avenue of escape.

Some of the actions you can take to enhance survival have been mentioned previously. Suggestions include:

- Assume a bent-over, braced, crash position to minimize whiplash-type movement.
- Keep your head and upper neck aligned (ie., face down) to increase the tolerance to deceleration forces.
- Protect your face and head (to maintain consciousness) by placing some material between your knees and face that extends up over the top of your head, e.g., pillows, blanket, folded jacket.
- Know the location of several exits on the aircraft.
- Know how to open emergency exits in the dark or in smoke.
- Check your luggage rather than store it in an overhead rack.
- Select an aisle seat.
- Wear clothing that won't melt when heated, e.g., corduroy, wool.

A new problem relating to crash survival has recently come to our attention at the Safety Center. Many units are using reclaimed commercial airline seats in Air Force aircraft. These airline seats are installed so they'll face aft, according to Air Force specification. A seat designed to face forward may withstand as little as 3 Gs when facing aft. In aircraft equipped with a table and commercial airline seats on both sides, seats should be stressed to withstand at least 9 Gs. Seat design rather than regulations should dictate seat installation. In some cases, only the manufacturer has the answers.

Another grim statistic concerns seat position and seat belts. The familiar airline announcement recommending seat backs be in the full upright position, stowing of trays, wearing seat belts, etc., is for our own good. Landing with a reclined seat and a loose seat belt can mean death. Decelerative forces are completely absorbed by the neck as the occupant slides from under the seat belt and is caught by the belt under the chin. On military aircraft, seat and belt regulations must be followed strictly by crews and enforced for passengers.

A last thought on crash survivability concerns implementing your survival plan. When will you initiate your plan of action? When will you know you're in trouble? Will you be the first to open the overwing hatch and leave? Will you assume the crash position as soon as you feel turbulence on takeoff? Experience has shown that crew or flight attendant notification is not enough. You will have to implement your plan on your own regardless of the pressure from other panicking passengers.

When aircraft seats are installed, seat design rather than regulations should dictate seat installation.

Survivors have attributed their survival to assuming "the position" early. In one mishap a military aircraft aborted and ground looped after takeoff power was applied. During the ensuing confusion there was interphone, verbal, and alarm bell communication among crewmembers. Since there were no windows, the large crew left the aircraft via the normal crew exit. The crew did not know that one main landing gear had collapsed and the aircraft was off the runway experiencing a sizeable fuel leak. As a result, the crewmembers were "cool" and lucky.

In another case, the aborting aircraft stopped amid the landing lights on the departure end of the runway. The aircraft skin was punctured, but there was no fuel leak. Again, the crew waited for transportation to arrive before deplaning. No, they didn't check for a fuel leak right after the aircraft stopped. After a mishap the crew may be just as confused as you are. Amidst the chaos, you will probably be on your own.

The intent of this article is not to frighten aircraft passengers, but mishaps do occur and fatalities do result. Among these fatalities, there are those who "almost" survived. There is reason to believe that some of those who perished could have lived had they been aware of the hazards involved. You may someday be offered a chance to survive. Plan ahead, and take all possible actions to increase your chances. ■

Who's Sleepy?

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■ Have you ever heard the old wives tale that a warm glass of milk before bedtime can help you fall asleep sooner? As someone who makes their living in the flying business, you're usually more concerned with trying to stay awake than with trying to fall asleep. Aircrews continue to vote flying fatigue as one of their more important concerns and, as it turns out, what you're eating can play an indirect role in your state of mental alertness.

Whether you've ever tried the "warm milk before bedtime" remedy or would even want to, researchers in the past 20 years or so have determined that there may be something to it after all. That's right, there may be something in milk and certain other foods that can actually help us fall asleep. What the experts believe at this point is that one of the body's chemical compounds called serotonin (sara-tone-in) plays a part in helping us fall asleep normally.

What's interesting is that the body makes this "sleep-causing" compound directly from a nutrient substance found in milk and many other foods. This nutrient is one of the building blocks of protein, an essential amino acid called tryptophan (trip-toe-fan). Experiments have shown that when using purified, concentrated forms of this compound (tryptophan), people do experience a "sleep-causing" effect or drowsy sensation. This drowsy sensation was particularly noteworthy when the pure tryptophan was taken with a high "carbohydrate" meal. It seems that carbohydrate is what dramatizes the effect of the tryptophan.

Who's Sleepy? continued

Tryptophan has also been shown to markedly aid insomniacs in getting to sleep. Keep in mind that tryptophan is not a drug in the strictest sense. Rather, it's a nutrient substance that is available at most health food and drugstores across America. It's classified by the Food and Drug Administration (FDA) as a "generally recognized as safe" food substance. In England, interestingly enough, tryptophan is available for use in treating depression. At least some of the interest in tryptophan has its roots in the fact that it is about as "natural" as you can get as far as a sleeping aid. It also appears to promote normal, restful sleep unlike the distorted quality of sleep that comes with traditional sleep drugs.

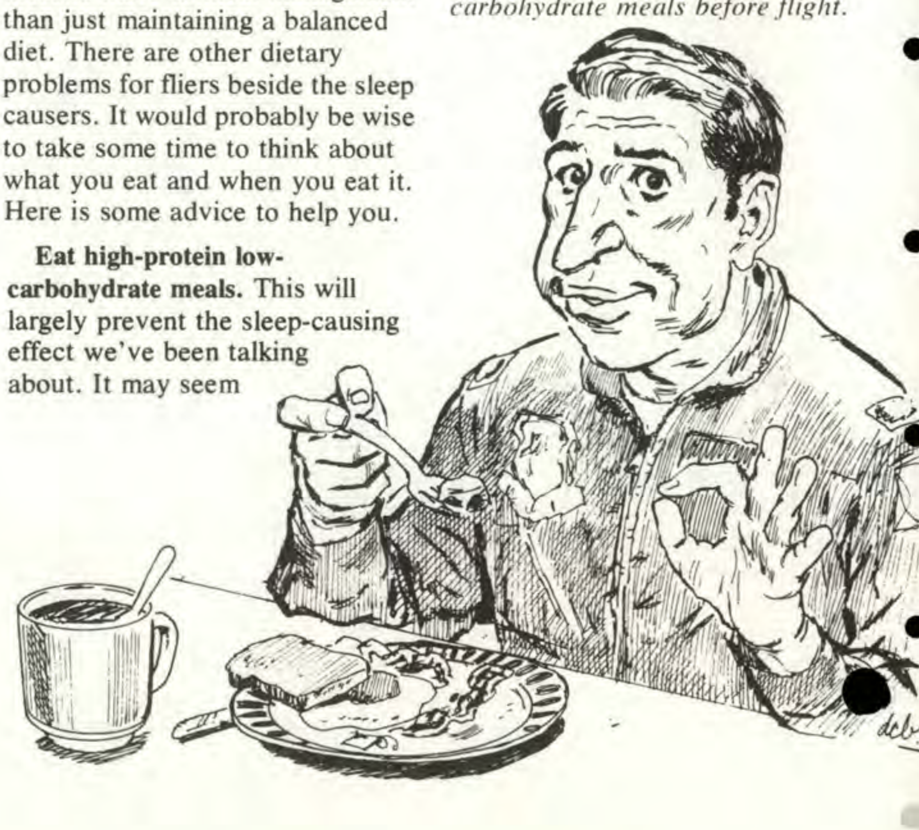
Some research physicians have reported that tryptophan is becoming more commonly used and recommended within the medical community as a sleeping aid for insomnia due to jet-lag or similar causes. Two-to-four gram doses seem to be around the average although a definite drowsiness is noted in adults with as little as a one gram dose. (Normal dietary intake of tryptophan is usually between ½-to-2 grams daily.)

When used as a sleeping aid, it usually takes 30-to-45 minutes before the first effects begin to occur. But the big question of whether a similar drowsy sensation actually occurs from the tryptophan present in natural foods (as opposed to concentrated tryptophan in the laboratory) has not been completely answered yet. The evidence thus far only suggests that there probably is such a thing as "sleep-causing food."

How strong a sleep-causing effect should we look for? Probably not a powerful one. Let's face it, we haven't really seen people nodding into deep sleep making embarrassing spectacles of themselves in restaurants around town. No, the effect is sneaky and gradual, like hypoxia. In that sense, low-grade drowsiness could be dangerous in flying operations. So, knowledge of sleep-causing foods may be of interest to a flier.

Unfortunately, the research on tryptophan and other sleep-causers is not finished. But, nonetheless, there is more to meal management than just maintaining a balanced diet. There are other dietary problems for fliers beside the sleep causers. It would probably be wise to take some time to think about what you eat and when you eat it. Here is some advice to help you.

Eat high-protein low-carbohydrate meals. This will largely prevent the sleep-causing effect we've been talking about. It may seem confusing that we're suggesting high protein foods when it is the protein foods which contained the sleep-causing food substance, tryptophan. But, as indicated earlier, it isn't so much the tryptophan-containing "protein" that is the problem, it's the carbohydrate taken with the protein. So, high-carbohydrate meals (with relatively less tryptophan present), probably have a stronger so-called "sleep-causing" effect than the high-protein meals which to have high total levels of tryptophan. Remember, this is because more insulin is released with high-carbohydrate meals and it is the insulin which dramatizes the effect of tryptophan. So, *avoid high-carbohydrate meals before flight.*



This advice is consistent with the recommendation of researchers at the Bioastronautics Laboratory who advocate "high-protein preflight meals in moderate proportions with a minimum of carbohydrates, animal fats, and gas-producing foods" to combat the onset of aircrew fatigue. For example, postpone the potatoes and gravy as part of your preflight breakfast and go with just the ham and eggs and a piece of toast. But there are some other basic guidelines you can follow as well.

Avoid overeating. You're probably going to feel drowsy anytime you overindulge. This is largely because digestion and absorption of food require vast amounts of blood. Thus, there is a redistribution of blood to the digestive tract that is directed by our "maintenance state" nervous network. Many of the activities under this "non-excitatory" branch of our nervous system are associated with states of semi-relaxation. And, when you think about it, that's reasonable since in order to digest food, it helps if we direct the body's energy to that task and relax the remaining body functions.

Eat balanced meals regularly. We've recognized for years that low blood sugar due to irregular habits (like those of fliers), plainly results in fatigue. You don't have to have a full-course meal everytime you eat either, but you *do* have to watch what you eat. This makes our next bit of advice important.

Avoid high-simple-sugar snacks. Lay off the candy bars. Instead, strive to eat lower carbohydrate snacks like a bag of nuts, for example. If you're going to eat a carbohydrate, then choose a snack with complex sugars in it like a dried grain cereal-bar or a piece of fruit. And, if you're stuck with what a vending machine may have to offer, you can hardly go wrong in the short term by opting for a package of those peanut butter crackers. They make a remarkably balanced snack. The cracker offers a little carbohydrate, and the peanut butter provides a nice combination of protein and fats.

Also remember that high-"simple-sugar" snacks like candy bars are not a food source for people who have missed their usual meals. The resulting low blood sugar makes matters particularly difficult for the brain since blood sugar is the brain's only source of energy. Following a period of fasting, a sudden intake of a high-simple-sugar food like candy, donuts, ice cream, etc., may, in some individuals, cause a sudden release of extra insulin. The insulin is released to carry the sugar into the cells for use as energy. This is normal, but if too much sugar is hauled into skeletal muscle cells at one time, then the amount left in the bloodstream for the brain to use may be severely reduced. This is sometimes loosely referred to as "sugar-shock."

The effect can be to cause feelings and sensations very similar to those of hypoxia; mental confusion, nausea, numbness and tingling, headaches, disturbances in speech and vision, a collapsing sense of fatigue, light headedness, muscle incoordination, and sometimes even fainting spells. Obviously, none of these symptoms are tolerable in a flying crew member. The time from intake of the high-sugar food to the onset of symptoms can be as little as 20 minutes or as long as two to four hours. Some people even suffer similar effects when they miss meals. Either way, it's pretty easy to prevent — eat balanced meals regularly and when you don't, avoid simple-sugar snacks as the solutions to your hunger.

So, now that you know something about these potentially "sleep-causing" foods and other problems, examine your own diet and eating habits. See what you think. Are there any foods or combinations of foods in your diet that leave you drowsy even when taken in moderate portions? If there are, then maybe you'll want to do a little more accurate preflight meal planning. Of course, you've got to maintain a balanced diet so don't overreact to what's being said here and reject your inflight lunch because you think your milk may be too warm!

Whatever the effect of tryptophan may turn out to be, our aim is to let you know about it as the research develops. Meanwhile, until the final word's in, give it all some thought. Who knows? Maybe this information, properly applied, will assist you, the flier, in flying safer and more enjoyably. ■

IT HAD TO BE THE . . .
ENGINE

■ When I first heard about the accident, I knew it had to be the engine. The pilot was the chief instructor pilot for our Aero Club and had over 4,000 hours in the Cessna 150. It was obvious that he couldn't have been lost since the weather was VFR. It was clearly engine failure.

I thought about the accident as we flew out to the scene in a helicopter. The Civil Air Patrol said it was in the bottom of a ravine and both occupants appeared to be dead. Perhaps they were trying to make it to the ranch airstrip just a few hundred yards away. If only that engine would have lasted a few more seconds. . .

Jim used to conduct the monthly safety meetings for the instructor pilots so we knew he wouldn't take any chances around those mountains. True, he had been involved in an accident with a student pilot 20 months before, but his abilities must have been recognized because he became chief instructor pilot two months after that mishap.

When we reached the aircraft, both bodies had already been removed by Coast Guard and FAA personnel. Wonder what caused that engine to quit? Maintenance had been rated outstanding in the last two safety surveys.

When I asked the ranch manager if he had seen the aircraft make an approach to the field, he replied, "Yes, but I saw only the approach to the strip. I didn't see the crash beyond the runway."

"What were the winds like yesterday?" I asked.

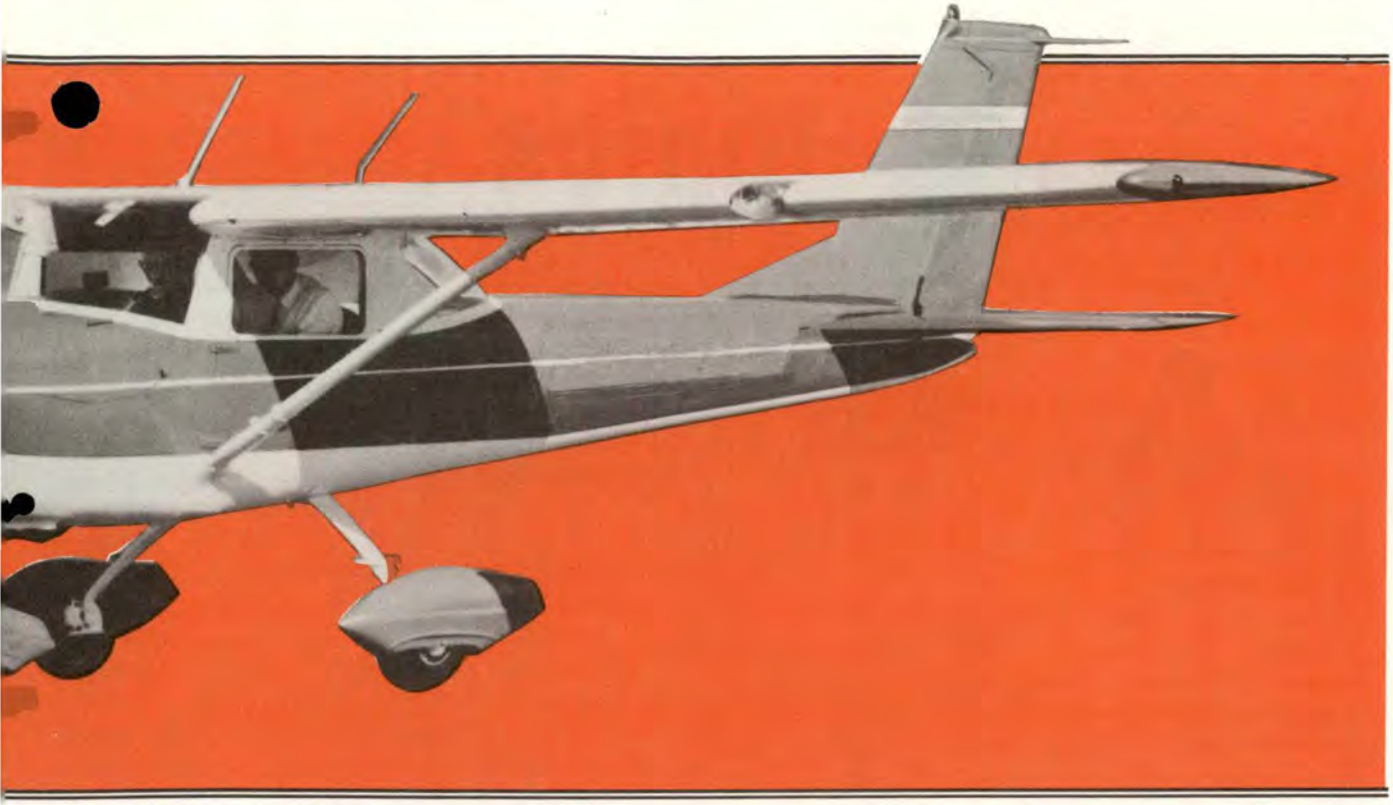
"Just like today," he replied. "Coming down the mountain rather than the usual northeast wind. It gets a little turbulent when the wind blows this way," he added.

Jim knew about turbulence near the lee side of these mountains. He had been flying around them for years. Landing at the ranch in the prevailing wind would usually be a piece of cake, but landing in this wind could be a little tricky.

The wreckage was located on the mountain side of the runway. Why would he let the student turn uphill after a low approach. . .or was it a touch-and-go? Nobody witnessed the latter part of the approach.

We used a sling and a Huey helicopter to get the engine out. Our on-site investigation revealed no flight control malfunction. We wanted to get that engine back to the base to find out what went wrong.

On the trip home, I kept thinking about the 60' tree approximately 50 feet behind the wreckage. It hadn't been touched by the airplane. He must have stalled or spun to miss that tree. Jim would have taken control before it entered a spin. He



wouldn't let the student go so far as to put both of their lives in jeopardy before he reacted. Didn't he have 4,000 hours in that bird? Yet if the aircraft ran into turbulence when it flew over the gulch and if it went into a spin while the student was trying to turn towards the upsloping terrain, the aircraft would be below the edge of the gulch in one turn if the spin started less than 670 feet above the ground. Then it would be too late for even Jim to make a recovery.

We took the engine directly to the reciprocal shop. Since it was late, we decided to start the teardown first thing in the morning. On the way back to the office, my supervisor and I talked about Jim's previous mishap. I dug out the old report and took it home to read.

"Cross-country flight. . .several touch-and-go landings, and a full stop landing. Following this, the instructor requested the student to execute a maximum performance takeoff. While in this maneuver, the instructor administered a simulated engine failure and during the recovery, the aircraft struck the runway and sustained major damage.

". . .the student had a total of 29 hours at the time of the accident. . . .When the instructor pulled the throttle to idle at 150' in the air, the student — a large burly marine — pushed the control wheel full forward. The instructor got on the controls when the student didn't recover quickly enough and the aircraft struck the ground with considerable force with both student and instructor on the controls.

". . .the aircraft's engine was performing satisfactorily and continued to run at idle power throughout the impact with the runway.

"CONCLUSION. . .the instructor required the student to perform a maneuver for which the student lacked the necessary skill or judgment." THE MANEUVER WAS PERFORMED VERY NEAR THE GROUND AT A HIGH ANGLE OF ATTACK AT AN AIRSPEED VERY NEAR THE STALLING SPEED. . .

". . .the instructor did not brief the student. . . .

". . .the instructor did not demonstrate the desired procedures to be followed. . . ."

The conclusion was obvious. Jim was overzealous in pushing his student into a maneuver for which he was ill prepared and not briefed or knowledgeable on the proper recovery procedure.

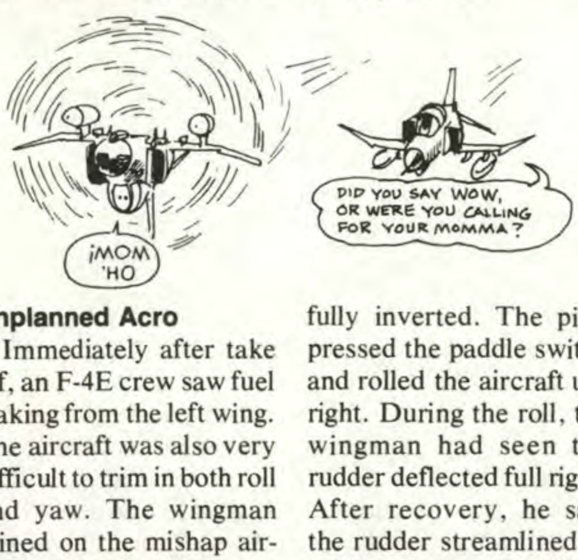
I went to sleep thinking about those 4,000 hours, and an engine teardown, and the possibility that maybe it didn't have to be the engine after all. — Reprinted from *Aerospace Safety*, July 1971. ■

OPS topics

Seat Pins Removed? Canopy Locked?

On take off, the F-4 back seater felt air flow near his left elbow. Looking at the canopy sills he saw that the left side of the canopy was up about 1/2-inch and that the pin bag was caught between the canopy rail and the sill about two-thirds of the way to the rear. The pilot was able to make an uneventful recovery.

After landing, egress investigators found two of the cockpit seat pins still installed. The pin bag had not been stowed either by the aircrew member or the crew chief who helped him strap in. Wonder who did the cockpit preflight and the before take off canopy checks?



Unplanned Acro

Immediately after take off, an F-4E crew saw fuel leaking from the left wing. The aircraft was also very difficult to trim in both roll and yaw. The wingman joined on the mishap aircraft, and the flight entered holding at 7,000 feet (about 4,000 feet AGL).

After 35 minutes in holding while in a left bank the aircraft suddenly yawed right and rolled fully inverted. The pilot pressed the paddle switch and rolled the aircraft upright. During the roll, the wingman had seen the rudder deflected full right. After recovery, he saw the rudder streamlined.

The pilot turned off the yaw and roll augmentation and made a successful approach and landing. After landing, maintenance replaced the malfunctioning yaw rate gyro.

RCR Readings — An Update

New Tapley system decelerometers have been procured to replace the James Brake decelerometers. With a fair number of Tapleys in the field, some differences and potential problems have been discovered. The major problem which was addressed in AL-SAFECOM 006 (1982), is that Tapley readings result in higher reported RCR's than past James Brake decelerometer readings. Tapley RCR's are roughly 3 higher than the James RCRs we are accustomed to. For example, for the same runway condition, a James Brake reading of 4 would read as 7 on the Tapley decelerometer.

The proper operating instructions for the Tapley meter have been distributed, and those responsible for using the meter should be familiar with them. In addition, until calibration standards for decelerometers have been resolved, the following rules apply.

- Tapley decelerometer, reduce RCR values by 3.
- James Brake decelerometer calibrated IAW TO 33K6-4-1-2, Sec 19, draft change 4, reduce RCR values by 3.
- James brake decelerometers calibrated by current standards. No correction required.

Some Extra Pull

An AT-38 student was making a full stop landing. He pulled the stick aft to aerobrake too rapidly. The aircraft became airborne and began drifting rapidly left toward the edge of the runway. The IP took control and began a full AB go-around. At the same time, the IP used right rudder and aileron to keep the aircraft on the runway. During the go-around the right wing dropped and allowed the wing tip to scrape the runway.

The aircraft completed the go-around, and the IP was able to make an uneventful full stop on the next attempt.

Foreign Objects

An F-15 had deployed to a forward operating location in West Germany. After a mission, the number two engine was found to have been damaged by a metal object.

FOD prevention at this base was especially difficult since the area had been previously used by the Army as a staging area for armored personnel carriers and tanks.

Scraped Tail

An F-16B was flown to a planned touchdown in the first 200 feet of the run way. A BAK-13 was installed 1,900 feet from the threshold because of mixed F-4/F-16 traffic.

The pilot elected to delay full aerobraking until past the cable, then increased the pitch attitude to 12-14 degrees.

Although the pilot noticed nothing unusual, tower personnel noticed sparks trailing the aircraft during the initial portion of the aerobraking.

Needle and Ball, But No Airspeed

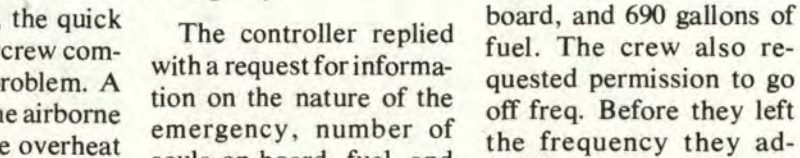
As an F-111 passed 11,000' in an instrument climb at 350 KIAS, 2,000 fpm rate of climb and 8 degrees nose up attitude, the pilot selected two stages of afterburner. The airspeed began to decrease, dropping to 320 knots, and the rate of climb dropped to 1,000 fpm despite a constant attitude indication.

The pilot selected full AB but airspeed and VVI continued to decrease to 280 knots and 500 fmp. The aircraft stick control became sluggish, and the pilot leveled off. There was no increase in airspeed, so the pilot began a slight descent to gain speed. In the descent, the airspeed built slowly to 350 knots. This increase led the crew to discount a pitot static malfunction.

The crew continued descent, leveled at 15,000 feet, and proceeded to the initial approach fix for home base. Another F-111 attempted to rejoin, and the mishap aircraft climbed to 17,000' to ease the rejoin. The chase aircraft was not able to find the mishap bird even with vectors from ATC. Finally, they were able to achieve a radar lock-on and make the rejoin.

It was then that they found that instead of 17,000 feet and 220 knots as indicated, the aircraft was actually at FL 230 and 350 knots. The IFF altitude readout indicated 17,000' which confirmed a pitot static malfunction. The crew completed the emergency procedure and made a wing formation approach. Throughout the flight, all primary and standby altitude and airspeed indicators agreed. There were no off flags or caution lights visible.

After landing, investigators found a crack and leak in the static pressure line to the standby airspeed indicator.



Get (Give) The Whole Story

Airborne emergencies often require quick, decisive action. Unfortunately, in this case, the quick action of the aircrew complicated their problem. A T-33 had become airborne when the engine overheat light came on. The crew performed the emergency procedures and notified the departure controller they were declaring an emergency.

The controller replied with a request for information on the nature of the emergency, number of souls on board, fuel, and intentions.

The T-Bird crew responded that the emergency was an engine overheat, two souls on board, and 690 gallons of fuel. The crew also requested permission to go off freq. Before they left the frequency they advised that they wanted a full stop and had the field in sight.

continued

OPS topics

Get (Give) The Whole Story continued

Departure control cleared them off freq and advised them to return to Tower. The controller then contacted Tower and advised that the T-Bird had declared an emergency which the controller believed to be a low fuel light, and that the aircraft had 60,000 pounds of fuel on board. The tower controller questioned the fuel and over the crash net reported the amount as 600 gallons. When the T-Bird came up on tower frequency, the tower asked for fuel on board but did not question the nature of the emergency. Nor, due to poor radio reception, did they hear the T-Bird pilot state that they would be egressing at the end of the runway.

The fire department responded to what they believed was a low fuel state emergency, and when the T-Bird was safely on the ground the senior fire official, in violation of standard procedure, terminated the emergency.

The T-Bird completed the roll out, turned off the runway, and shut down. The crew climbed out, pinned the aircraft, and waited for the fire department. When they did not arrive, the pilot climbed back into the cockpit and radioed ground control to confirm that they had the T-Bird as an emergency landing.

When ground control advised that the emergency had been terminated, the pilot informed tower of the true nature of the emergency and that the fire department was still required. The fire department responded, examined the aircraft and then, once again, terminated the emergency.

Which Switch

An A-10 was egressing from the target. The pilot was looking for a helicopter at 5 o'clock when he felt a sudden pitch-down. He immediately rolled out, hit the emergency disconnect, and started a climb. In the climb, the pilot saw both hydraulic pressure lights on and both hydraulic pressure gauges reading zero.

The pilot hit the flight control mode switch with his hand then, at 6,000 feet, he decided that he could not have moved the switch since he had not lifted it first; therefore, the switch must have already been in manual reversion. This was confirmed when, after the pilot returned the switch to normal, all flight controls and hydraulic pressures returned to normal.

The investigation of this mishap centered around how the switch could have been moved to manual. The most likely answer is that while attempting to turn off the VTR during egress, the pilot mistakenly switched the flight controls to manual reversion. The switches are similar, close together, and not readily visible.

Birdstrike

The pilot of a T-38 was on radar downwind at a strange field. The aircraft was at 3,100 MSL and 290 KTAS with the student pilot flying under the hood in the back seat. Prior to the impact, the IP had seen several large birds between 3 and 12 o'clock.

When the bird struck the aircraft, it hit the canopy bow about 8 inches above the canopy rail causing the front canopy to implode. The bird struck the IP on the left shoulder and left side of the helmet then lodged behind the front seat. The IP's vision was not obscured because he had his helmet visors down, however, the visor housing and head shell were cracked and the communication cord partially severed.

The student was unsure of what had happened when bits of bird remains entered the rear cockpit through the instrument panel. However, he initiated a climb, pulled back the instrument hood, and declared an emergency. He then reestablished communications with the IP.

The crew were able to make a successful landing without much further excitement.

LOOKS CAN BE DECEIVING!

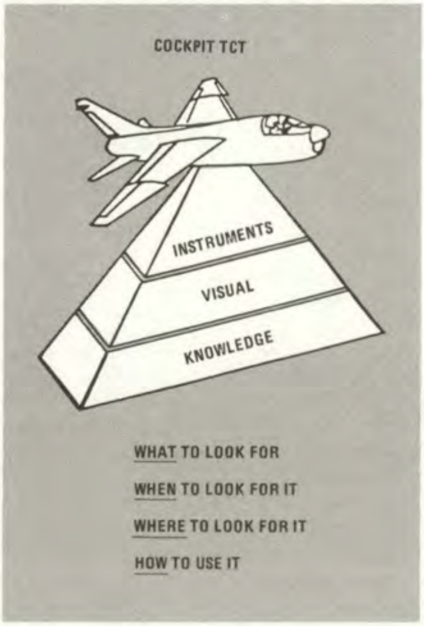
("How Low Can a Pilot Get," Part II)

CECILIA PREBLE
Assistant Editor

■ In the January issue, Captain Milt Miller of the Tucson Air National Guard discussed the first two parts of his low altitude training program — task sequencing and timing and low altitude physics. In this article he discusses the third factor — the visual environment — and how it fits into the overall plan. The objective of this exercise is to determine how low we can fly and maintain our effectiveness.

The number one all-the-time task for a pilot in the low altitude regime is terrain clearance. No matter what the mission task — straight and level navigation point-to-point, 30° dive to weapon release, or high-G turns to defeat a threat, the pilot must control all factors necessary to avoid the ground. In most cases this boils down to recognizing and controlling the low altitude physics.

Despite the rapid advances in terrain following radar, ground proximity warning systems, and other sensors, the ultimate and most reliable sensors for most aircraft and environments are still the pilot's eyes and brain. The pilot must be able to take the available information and use it to control the physics of flight and avoid the terrain.



But as we've all heard again and again, the eye can be deceived. Visual illusions are a common hazard. Captain Miller puts these visual shortcomings in perspective and suggests ways to compensate for them. "You have to accept the fact that the visual environment is highly dynamic, variable, and sometimes insufficient to support parts of the visual terrain clearance tasks."

The first step in overcoming confusing visual clues is a clear understanding of the environment. Miller uses five factors to rate the quality of the flight visual environment: density, known size, texture detail, terrain gradient, and unacquired vertical obstructions.

continued

Density refers to the number of things registering on your eye as you fly past. Across the desert, you may see many bushes, cacti, fence posts, and telephone poles whizzing by. You get certain information from these things. Over a dry lake bed or over water and in the clouds, the number of density items decreases — often drastically. As this density decreases, the available visual information does, too.

"If you could see air molecules, you'd see them smashing on the windshield, giving you a continuous visual indication of motion and speed. Unfortunately, our visual system is not that sensitive, and in low density environments there just aren't enough objects of sufficient size and contrast to tell you the true physics of what's there. You have to have a knowledge perceptual base that takes what little bit of visual information you have, adds to it and says — 'I'm at FL 390, things aren't moving very fast, I am, therefore, safe.' That's density. High density is good because you're receiving a great deal of information. Low density is bad because you may not have enough visual information to see, predict, and control the physics."

Known size is a simple concept. You know that the average man is not 15 feet tall. A horse is not an inch and a half long.

"I have a known body of knowledge about what I've dealt with all my life. Vision psychologists tell us that if there is something of known size in the visual field, the mind will subconsciously lock onto it and use that to range distance and height almost automatically. If it's right, terrific. But if it's not, then there can be trouble."

Texture detail works along with known size to validate your size reference. If you're looking at a tree, you'll find it difficult to assess its true size without some other reference. It could be a big tree far away or a small tree close up. But if you can see the leaves or limbs or the sharpness of the shape, then you can easily estimate relative size.

"Herein lies the problem of rejoins at night on lights. There is no texture detail until you get in close enough to resolve the lower intensity formation lights or the angles and shape of the airplane. The same problem exists in low light, low vis, or even a dry lake bed or open water. Without detail, you have insufficient information to help estimate distance by correcting or validating your impression of known size."

Terrain Gradient affects your perception and your available processing time. Is the terrain rolling or flat? Flat is usually better because you can easily predict changes in terrain while you're busy doing something else. In a rugged area the terrain changes are unpredictable and so require much

VISUAL ENVIRONMENT RATING FACTORS

	GOOD → BAD				
	1	2	3	4	5
DENSITY	HIGH				LOW
KNOWN SIZE	MANY				FEW
TEXTURE DETAIL	HIGH				LOW
TERRAIN GRADIENT	FLAT				ROUGH
UNACQUIRED VERTICAL OBSTRUCTIONS	FEW				MANY

more time to assess. The whole visual field is in constant motion because of the terrain gradient and it doesn't change in unison with aircraft movement.

Unacquired Vertical Obstructions — Towers, cables, etc, also require special attention. In environments where you know there are few or no unacquired vertical obstructions, you can devote less time to terrain clearance. You don't have to keep scanning for the low-contrast object sticking up above the very obvious terrain.

"With these dive definitions in mind, let's evaluate some typical flight environments for visual factors. How about a controlled range such as Gila Bend or Nellis?

- Density — very dense, lots of bushes, excellent.
- Known Size — plenty of items of known size, range towers, roads, trucks, excellent.
- Texture Detail — plenty, good.
- Terrain Gradient — flat, good.
- Unacquired Vertical Obstructions — few, good.

Our training environment looks very nice. Now let's progress to a typical tactics range, just a few miles up the road.

- Density — about the same as before, good.
- Known Size — here is the first big change. In many places you can't rely on anything for known size. The bushes vary from knee high to 15 or 20 feet high. They've even reduced the size of the simulated tanks on the range so you're likely to get the wrong information there, not so good.
- Texture Detail — depending on where you are, it's about the same as the controlled range although there are areas where there is no texture detail, fair.
- Terrain Gradient — depending on where you are, the whole spectrum from flat to rough is covered, fair.
- Unacquired Vertical Obstructions — none, good.

"We now begin to see that the environment is changing and that we have progressed from a very optimal environment to something good but not perfect. Let's try flying across the ocean."

- Density — poor.
- Known Size — poor.
- Texture Detail — poor.
- Terrain Gradient — excellent.
- Unacquired Vertical Obstructions — excellent.

continued

LOOKS CAN BE DECEIVING!

continued

"So you have an unusual situation here. Part of your environment is perfect, and the other part is bad. The secret is knowing what to do with it."

These five aspects of flight environment can change, not only as you fly across different areas, but as the sky conditions change.

"In other words, we can take a very good environment, provide enough known size and texture detail to make it a piece of cake to fly over, but deny the pilot visibility or provide poor light intensity (like dusk or dawn) and we have changed the environment into one of no known size or texture detail. It doesn't have to be the inherent properties of the surface itself, it can be the sky that produces the same thing."

As the light intensity drops, so does perceivable density. Many of the things you could have seen at noon, are gone at dusk. If you only see some of them, what perception will you have? If you don't compensate, you'll perceive yourself as either farther (or higher) from the surface, or as flying more slowly.

A pilot should forecast what is going to happen to his terrain clearance tasking as the environment and sky change. You can't take the attitude, "I think I'll see what it looks like when I get there and if I don't like it, I'll consider myself uncomfortable and raise my altitude," because you may not have that option. You may have to temporarily maintain a specific altitude for weapons delivery or other mission requirements, however, as always, the number one all-the-time task for a pilot in the low altitude regime is terrain clearance. Relying on altitude to solve all your problems is not always possible, if you're going to do your job. If you can't predict the visual environment or its effects on terrain clearance tasking, you're very likely to overtask yourself as the visual environment gets worse. What was perfectly feasible and valid tasking in one visual environment can quickly become unacceptable just because of changes in the environment.

So far we've discussed fairly static things — what is attached to the ground, how the sky affects it, and how your visual system may use it to control AGL, for example.

"Now let's put the time vector in, because that creates some very unique bits of visual information. It's called speed rush, otherwise known as 'boy, I'm really moving fast, or no, I'm not anymore.' "

You may not know if your altitude just changed or your speed, or if it was your environment. Here is where flow patterns come in. As your eyes take in the number of things out there (density) and as you move through them, they all move past you at a relative physical rate.

The closer you are, the faster they move, and vice versa. So, at 50 feet and 400 knots, things are moving twice as fast as at 100 feet, with the same velocity.

Flow rate is a function of three elements: what is inherently in the environment in terms of density; your velocity; and your altitude. You can have the same flow rate at 100 feet as you do at 50 feet by doubling your velocity at 100 feet. You can also have the same flow rate at 50 feet with the same airspeed by halving the density in the environment.

"Determining velocity visually can sometimes be tricky. If you look right through your velocity vector at something, you can't tell much because your only clue is how fast it gets bigger. On the other hand, angle rate of change can provide a dramatic indication of your velocity.

"As your airplane moves through space, you look at the density items below and ahead of you. If you select one and look at it from a certain angle down and watch it, given a height and airspeed, it will move from one angle position to another in a known, mathematically perfect pattern, as it passes under

continued

VISUAL ENVIRONMENT: GROUND	SKY: HORIZ CEILING	SKY: VISIBILITY	SKY: LIGHT INTENSITY	VISUAL EFFECT
KNOWN SIZE		●	●	DISTANCE ESTIMATION
TEXTURE / DETAIL		●	●	
DENSITY		●	●	FLOW PATTERNS
TERRAIN GRADIENT	●	●	●	
VERTICAL OBSTRUCTIONS				PROCESSING SPEED
TERRAIN GRADIENT	●	●	●	

NON-VISUAL SUBSTITUTES		TERRAIN CLEARANCE TASKS
+ • RADAR ALTIMETER • KNOWN POSITION PROJECTION	=	AGL CONTROL
+ • HUD VELOCITY VECTOR • KNOWN MANEUVER • VVI/ALTIMETER	=	VECTOR CONTROL
+ • DEDUCTION • PRE-FLT PLANNING • KNOWN POSITION • ASSOCIATION	=	TIME CONTROL

the nose or down the side of the aircraft.

"From that, if we knew the airspeed and the time it took the object to cover an angle, we could absolutely calculate our altitude.

"The good thing about the angle rate of change is you just need to have one object to watch. You don't care what the density is, as long as there's something there to see. It's an arbitrary, consciously controlled estimate of height from the visual system."

There are indications that perceptually we are very good at this. People can be trained to use what they see to make use of these angles. To do that you must track the object. You can't stare out into oblivion and let the blur zone or the subconscious perception of speed rush take care of it.

"That won't do it. You've got to periodically look at something. Angle rate of change tends to work well in low-density environments if you push yourself to look at objects periodically."

How can you make the most of angle rate of change? You could practice periodically tracking an object, watching it and relating it to your height and observe how it changes, given your typical maneuvering speeds. When you go from a high density environment to a dry lake bed, although the tendency is to feel as though you've climbed (because there aren't as many density items whizzing past, speed rush appears less) you will compensate by making the most of the few items you do see by tracking them. Angle rate tracking is not intended to substitute for a 5 percent precision radar altimeter, but to control the subconscious effect of speed rush changes caused by changing densities. View it as you would closure on a rejoin. You can't state what your closure is in feet per second but you can sure say it's too fast, too slow, or about right. The same can be said for angle rate tracking. You will feel high over a low density area but the few items you do look at are moving under the nose very quickly.

Miller warns against the subconscious level of speed rush, which he calls speed rush base line.

"It has some very bad attributes. First of all, it's very short term. You put a guy at 50 or 100 feet, hold him there for a minute or two, pop him up to 200 feet and he's ready to pull out his box lunch. Although the rate of movement only changes linearly with height, he'll swear that it changes exponentially.

"Speed rush base line, the

subconscious aspect of angle rate of change, is very dependent upon density and it varies as a function of light intensity, visibility, and the terrain over which you are flying. If you are controlling your height based on speed rush base line, you may very well get into trouble. A dry lake bed or water are classic examples.

"Nothing moves very fast out there until a log goes whizzing by. If you're an angle rate tracker, you can at least lock on to something and follow it for a while. You need to be aware of the fact that your speed rush base line is very plastic and changes quickly. It explains why there is an overpowering urge to roll in early on a pop-up after a sustained low altitude run-in."

Now that you're armed with information about density, known size, texture detail, terrain gradient, unacquired vertical objects, speed rush and angle rate of change, how are you going to use all this information?

A combination of known size and texture detail will give you a distance for AGL estimation. And you know if you lose visibility and light intensity, you'll have difficulty visually estimating distance. Also, known size without texture detail can be misleading.

Density combined with terrain

gradient will give you flow patterns. A flow pattern is very predictable over flat terrain. Everything moves relative to the movement of the airplane. In rolling terrain, you have the problem of predicting what the terrain gradient is, as well as sorting out the flow pattern changes, which are moving more because of terrain gradient than aircraft movment.

Vertical obstructions and terrain gradient directly affect processing speed. If there are many vertical obstructions out there and the terrain gradient is rough, you're going to spend more time looking for them, time which you won't be able to spend on processing or other tasks. You can now predict and anticipate the changes in terrain clearance tasking demands by the changes in visual environment.

What substitutes can you look for to back up your visual system? In distance estimation, you can rely on your radar altimeter and known position projection (known maneuvers or time in the climb/dive).

"Angle rate tracking does tend to help but I'm not so sure that guys can do that consistently well. I think until more research is done, it should be treated more as a throttle for the subconscious effect of speed rush."

For flow patterns, nonvisual substitutes include your HUD velocity vector, known maneuvers, VVI and altimeter.

Relative to processing speed, substitutes include deduction, preflight planning, known position and association. Deduction comes into play when I know what I'm doing with the airplane and I didn't pull back on the stick so I can't possibly be getting this visual climb response. The density must be changing. Association is knowing that a line of square patches across the desert floor is a row of power lines.

"Visual information is the way we get what we use to accomplish our main task — terrain avoidance, and controlling the physics. But visual analysis is more art than science. There are many unknowns as we smoke along over the ground. Because of these unknowns, our analysis of actual AGL position is soft. So, there has to be a warning bell in the pilot's brain. You have to take all those rating factors and evaluate your environment. If you feel that the information you are receiving is inadequate, reduce your terrain clearance loading *now*! If you like what you see, you have good visual clues. Fine, but don't relax too much. Keep checking, things can change very quickly.

"What we have in the final analysis is a different way of looking at how to get our job done — that's putting the weapon on the target. As I said in the beginning, I'm not pretending this is the ultimate solution to all our problems, but I do think that if you seriously and honestly try to organize your low altitude operations around a task-loading decision model, you will improve your performance and increase your survivability.

"The three areas: controlling your task sequences and timing, controlling the low altitude physics, and controlling the visual analysis are the basis for this low level program. By being aware of the factors involved and the problems, you are much better able to know *what* to look for, *when* to look for it, *where* to look for it and, finally *how* to use it. If you've trained properly, you will *not:*

- rely on unavailable visual inputs.
- select incorrect inputs
- incorrectly use the inputs
- attempt too many tasks for the available time
- attempt the wrong task at the wrong time
- attempt a physically impossible maneuver
- bet your life on unrealistic maneuver tolerances.

That's what this is all about." ■

IT HAPPENED!

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This article is the third in a series dealing with cold weather survival. It concerns cold, dry, arctic or arctic-like conditions and provides some answers to questions posed in the first article, "You're Next."

■ Arctic or arctic-like areas are more feared by aircrew members than any other environment. This is based upon a 1980 environmental opinion poll of 124 Red Flag search and rescue exercise participants. Their responses clearly indicated that they were more confident of surviving as a captive than in an arctic environment.

This article may not appreciably increase your confidence or knowledge of arctic survival but, hopefully, will inspire you to further research the subject.

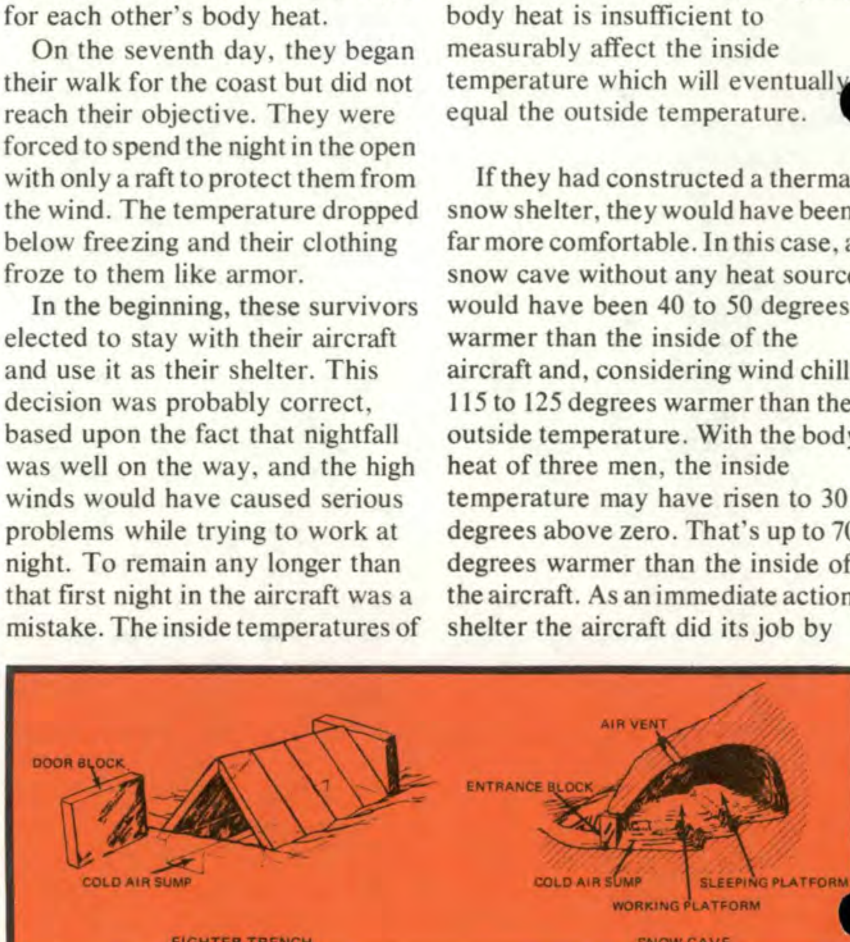
The first article "You're Next," included the story of three men that crash-landed on the Greenland ice cap. As you may recall, they elected to use the aircraft as their shelter. Temperatures were as low as 40 degrees below zero with 60-mph winds — that's a wind-chill factor of more than 115 degrees below zero!

Three days passed before the winds let up. They attempted to travel until the winds resumed and forced them back into their shelter where they remained for another three days. During their stay in the aircraft, they consumed water by sucking on ice, ate only biscuits, and had no external warmth except for each other's body heat.

On the seventh day, they began their walk for the coast but did not reach their objective. They were forced to spend the night in the open with only a raft to protect them from the wind. The temperature dropped below freezing and their clothing froze to them like armor.

In the beginning, these survivors elected to stay with their aircraft and use it as their shelter. This decision was probably correct, based upon the fact that nightfall was well on the way, and the high winds would have caused serious problems while trying to work at night. To remain any longer than that first night in the aircraft was a mistake. The inside temperatures of the aircraft will be no different than the outside ambient temperature, in this case 40 degrees below zero. Body heat alone will not affect the cold within those metal walls. Today's insulated aircraft would be easier to warm and stay warmer for a longer period of time if it could be artificially heated. But here again, body heat is insufficient to measurably affect the inside temperature which will eventually equal the outside temperature.

If they had constructed a thermal snow shelter, they would have been far more comfortable. In this case, a snow cave without any heat source would have been 40 to 50 degrees warmer than the inside of the aircraft and, considering wind chill, 115 to 125 degrees warmer than the outside temperature. With the body heat of three men, the inside temperature may have risen to 30 degrees above zero. That's up to 70 degrees warmer than the inside of the aircraft. As an immediate action shelter the aircraft did its job by



protecting them from the wind. As a long-term shelter, it does not provide adequate protection. Even living in the aircraft, these men did not have to endure some of the hardships they did. There was fuel in the tanks that if drained would have given them a source of heat for melting snow, cooking, and helping to prevent cold injuries. There were also wooden crates aboard that could have been used for fires.

Travel should be undertaken only when there is a definite, attainable goal that will aid in recovery or survival. Travel on the ice cap is difficult as well as dangerous, even when properly equipped. The survivors could see prior to landing that crevasses were scattered over the ice. These large, deep cracks in the snow's surface are one of the most dangerous hazards on the ice cap. They are often bridged with a snow crust and, except to the trained eye, are nearly impossible to detect.

Despite this, the party decided to travel to the coast which was based upon the fact that they were 110 miles off their map and even farther off their plotted course. They felt that rescue would not look for them that far off course. The fact that they wanted to paddle their dinghy the remaining 11 miles in the North Atlantic Ocean during the winter months is absurd!

One must always remember that the aircraft intact will provide the ultimate signal if kept clean. In this instance, it would have provided them with a signal by keeping it clean and by burning its fuel, tires, and other combustible parts. Burning these items would have provided them with a desperately needed source of heat as well.

They had already made up their minds to travel and all they had to do was wait for the weather to break. Knowing deep snow would be a problem, they improvised snowshoes from the plywood crates and seat cushions. On the seventh day, the weather broke. The temperature shot up to 54 degrees and it began to rain. Even with these conditions, they began their walk. Their provisions consisted of a raft, compass, Very pistol with three flares, and a box of biscuits. By evening they had not reached their objective, and their clothing was soaked.

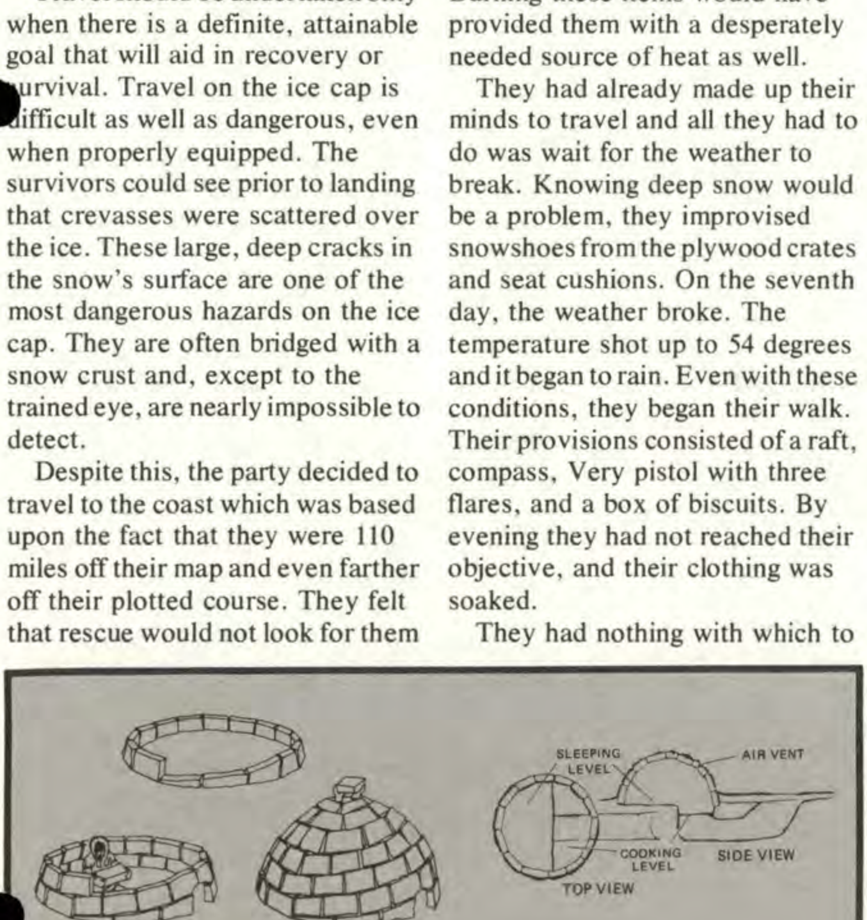
They had nothing with which to start a fire, the temperature was dropping, and the winds were beginning to pick up. They propped up the raft with oars and used it as a windbreak. Their clothing and boots froze to them. Death from hypothermia was a very real threat. Miraculously, they endured 17 hours of bitter cold and had the strength to continue the following morning.

Later that morning, an aircraft flew overhead. Only one flare operated, which is all that was needed. The aircraft circled overhead and later dropped a supply bundle. It was a rescue aircraft that had been searching for them. Even after being found, it still required another five days of surviving and travel before they were recovered. They were picked up the 14th day by a landing party from a small US Coast Guard patrol vessel.

These men survived more on luck, companionship, and the will to live than they did on knowledge and skill. During this era there were no survival schools — no way for them to gain the knowledge so abundant and accessible to today's airmen.

When asked what they thought had kept them going, there was no immediate answer. Then, Arthur replied, "Dave had his wife and baby daughter. Al was worried about his mother alone in Winnipeg, and I had my wife. Do you see what I mean? We had something to live for."

Next month, "But It's Not That Cold." ■



NEWS FOR CREWS

Career information and tips from the folks at Air Force Manpower and Personnel Center, Randolph AFB, TX.

The Rated Supplement — Where We've Been, Where We're Going

LT COL DON VANN
Chief, Rated Supplement Management Section

■ Over the past 20 years, the "Rated Supplement" has expanded and contracted in response to force structure and the number of rated officers in the active force. How large a rated supplement does the Air Force need? In 1979, the existence of the supplement was threatened by an exceptionally low rated officer inventory. This article looks at the supplement, its history, and recent development to shed light on its future.

Some people are confused about the purpose and composition of the rated supplement. Many believe that any rated officer who is not flying is in the rated supplement while others believe that anyone wearing wings and working in a support job is a rated supplement officer. To clarify — the rated supplement consists of pilots and navigators, lieutenant colonel and below, who are medically qualified to fly and are performing in a nonrated Air Force specialty.

The basis of the supplement is our wartime need for rated assets — we need more rated officers in wartime than in peacetime. From a wartime perspective, the supplement provides a pool of readily available rated officers to meet contingency needs; i.e., officers assigned to support duties who can be returned to flying duties (cockpit or rated staff) should operational requirements dictate.

In peacetime, the supplement provides rated officers a core of experience important to their career development. A rated officer who is assigned to nonrated duties in maintenance, engineering, logistics or in any other support career fields (see Figure 1), will gain a broader perspective of what it takes to support the flying mission. The officer can then share experiences with peers and be better prepared to serve in subsequent leadership positions. This development helps prepare leaders (and managers) for both peacetime and wartime requirements.

CAREER FIELD	AFSC
Organization Cmdr	0026
Dir of Logistics	0046
Plans & Program	0076
Resource Mgr	0096
Intl Pol Mil Affairs	0216
Disaster Preparedness	0515
Air Off Cmdg	0900
Air Attache	0910
Recruiting Off	0920
Historical Off	0930
Instructor	0940
Training Cmdr	0950
Air Traffic Contl	16XX
Air Weapons Dir	17XX
Missile Operations	18XX
Space Systems Ops	20XX
Audio-Visual	23XX
Weather	25XX
Scientific	26XX
Acquisition Prgm Mgr	27XX
Development Engr	28XX
Program Mgr	29XX
CAREER FIELD	**AFSC**
Comm-Electronics	30XX
Missile Maint	31XX
Aircraft Maint	40XX
Computer Tech	51X/096
Civil Engineering	55XX
Carto-Geodetic	57XX
Transportation	60XX
Services	62XX
Supply Mgmt	64XX
Procurement	65XX
Log Plans & Prgms	66XX
Comptroller	67X/69X 0056
Administration	70XX
Personnel Mgmt	731/2X 0016
Social Actions	736/7X
Manpower Mgmt	74XX
Education & Tng	75XX
Public Affairs	79XX
Intelligence	80XX
Security Police	81XX

Figure 1

The supplement also provides two types of "rated presence" in the Air Force. Performing key jobs at the Air Force Academy, Officer Training Corps Detachments, and serving in Recruiting Service, rated officers encourage cadets and prospective Air Force officers to pursue careers as pilots and navigators. These precommissioning "role models" bring the realities of an Air Force flying career to cadets who need information about what it's really like to be a rated officer. Secondly, rated supplement officers can provide "rated presence" in support jobs which capitalize on their operational backgrounds. Rated scientists and engineers apply their rated knowledge to all phases of weapon system research, development, procurement and logistical/maintenance support.

Rated presence and career development today will have positive payoffs in our long-term wartime effectiveness. For example, operational flying experience and scientific or engineering expertise can be a strong plus in our research and development (R&D) efforts. "Hands-on" experience brings an invaluable added dimension to R&D efforts. Likewise, in procurement, support plans, and programming efforts, rated expertise provides an added perspective upon which the Air Force can capitalize. Additionally, because of their educational backgrounds or operational expertise, rated officers have filled positions in support officer manning which would otherwise have gone vacant. Supplement officers do not, however, displace support officers. While isolated cases may exist, the relatively small size and highly selective placement of supplement officers into specific career fields and often into jobs requiring highly specialized rated expertise should dispel the concerns of critics of the rated supplement concept. Let's see why.

Back in the 60's, the Air Force had close to 20,000 rated officers working in support jobs. Since the Vietnam drawdown, the supplement size has fluctuated in relation to the overall size of the rated force and the number of rated requirements (see Figure 2). During this period, the size of the rated supplement peaked and began a rather dramatic drawdown. Without going into all the details of "why," rated requirements grew while the rated inventory declined rapidly during 1976-1979.

The rated supplement decreased dramatically as pilots and navigators were drawn out of support duties to return to line flying or rated staff duties to assure operational readiness. The swiftness of the drawdown made it apparent that if the trend continued, there would be no rated supplement in a few years. In April 1979, 13 generals from major commands met to determine the rated supplement's future. The result was a minimum peacetime requirement of 2951 rated officers in support duties. In October 1979, the Rated Prioritization Conference specified 100 percent manning of crew force need, 100 percent rated manning of certain organizations and specified the rated manning level at the Air Force Academy. They recognized the MAJCOM staffs and the rated supplement would absorb the shortages created by these criteria and directed the personnel community to convene another conference to review the situation should it become necessary to reduce the supplement below 2,000.

The rated supplement dropped to its lowest level in recent history during FY81. However, improved retention and increased UFT production have allowed us to manage an increase in the rated supplement during FY82 with similar projections for the next several years. It is encouraging that we are projecting increases over the next few years. Our Air Force can benefit through a strong supplement — it provides the benefits of rated presence to selected support positions, simultaneously augments the support force in key areas which are in need of augmentation, and increases career broadening opportunities for rated officers. ■

About The Author

Lieutenant Colonel Vann is a 1966 University of Evansville graduate and was commissioned through ROTC. He has served as a navigator in the B-52 and FB-111 aircraft. After graduation from Air Command and Staff College in 1979, Colonel Vann was assigned to Headquarters Air Force Manpower and Personnel Center as Chief, Bomber Assignments before his present duty as Chief, Rated Supplement Management Section.

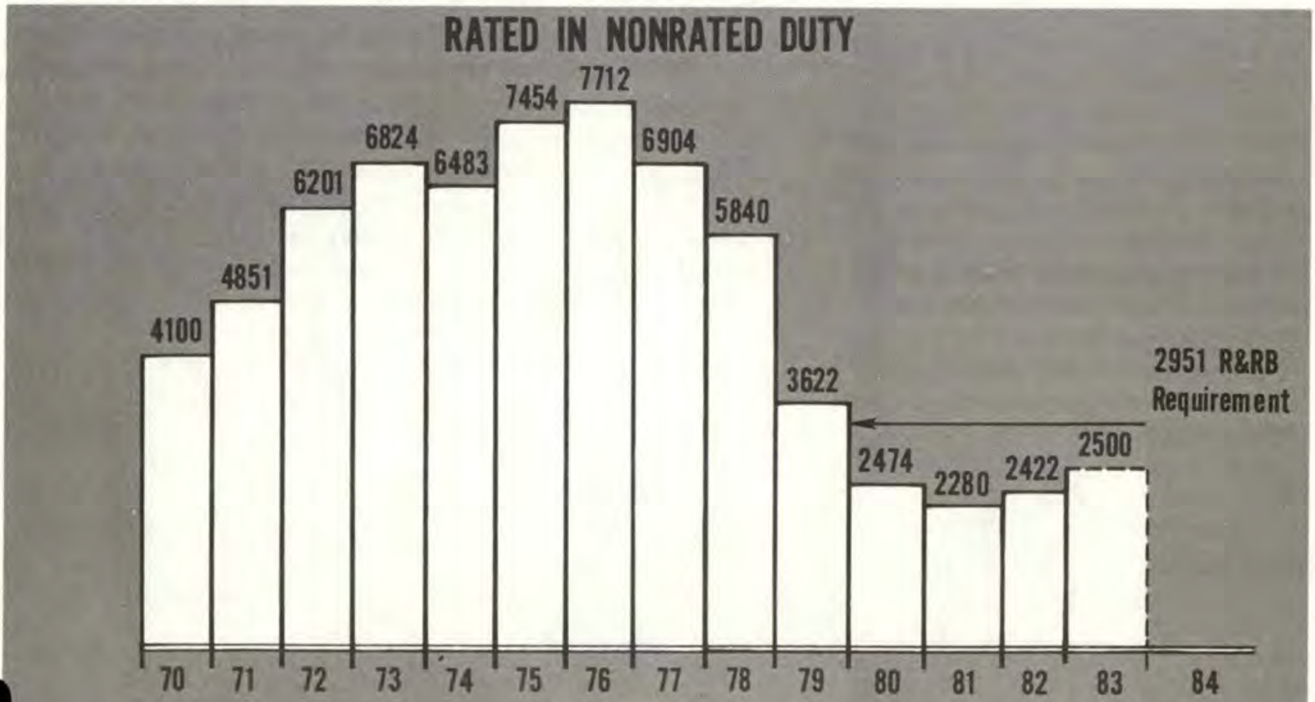


Figure 2

MAJOR

Phillip G. Anderson

58th Tactical Training Wing
Luke Air Force Base, Arizona

■ On 26 February 1982, Major Anderson was flying a functional check flight (FCF) in an F-104G. His aircraft was configured for a normal FCF profile: 5,800 pounds internal fuel, no stores or tanks. The mission profile started with an afterburner climb to 41,000 feet. Approaching this altitude, Major Anderson attempted to reduce power for level off; however, the throttle could not be retarded below afterburner range. He extended the speedbrakes and maneuver flaps for drag while declaring an emergency. Using a high-G spiral, he descended to 5,000 feet AGL while slowing to gear and flap lowering speed. He was now 15 miles west of Luke AFB with the afterburner still at full max and only 2,500 pounds of fuel remaining. Using Gs and a shallow descent to stay below the maximum flap speed of 240 knots, he set up for a 7-mile straight in from an altitude of approximately 500 feet of AGL. He was now on a one-degree glideslope, gear and flaps down, full afterburner and 240 knots with less than 3 minutes of fuel left. After mentally reviewing the emergency procedures one more time, he carefully raised the red guarded cover on the fuel shut off switch. One thousand feet prior to the overrun, Major Anderson shut down the engine using the electrical fuel shut off switch. The engine flamed out in 2 seconds. Touchdown was 1,000 feet down the runway at 200 KIAS. The drag chute was deployed, and only light braking was required on the standby brakes to stop with 2,000 feet of runway remaining. The time from take off to landing was 10 minutes and fuel remaining after landing was 1,200 pounds. Investigation revealed that at some time during the climb to 41,000 feet a broken rivet head from an unknown source jammed in the throttle cable pulley. The superior airmanship and situational awareness demonstrated by Major Anderson in executing this difficult recovery prevented the loss of a valuable aircraft and possible loss of life. WELL DONE! ■

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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.

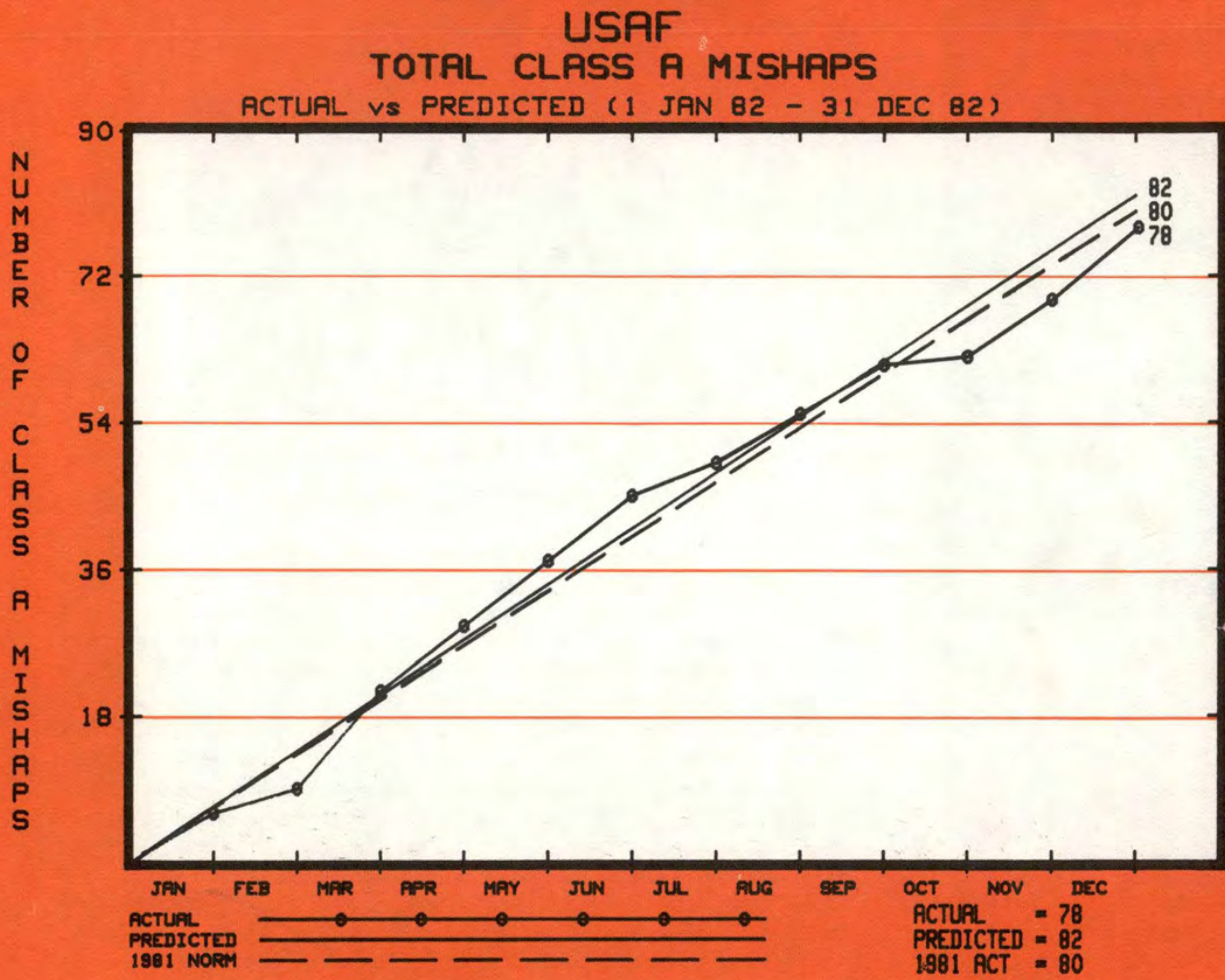
FIRST LIEUTENANT

Fredric G. Wilson

124th Tactical Reconnaissance Group
Boise, Idaho

■ On 8 April 1982, Lieutenant Wilson was flying as weapon systems officer of an RF-4C on a night terrain following mission at 1,000' and 480 knots. Without warning, the left front windscreen was shattered by a 20-pound swan, gravely injuring the aircraft commander. Lieutenant Wilson took control of the aircraft and started a climbing turn towards Boise, Idaho, 115 miles to the east. He was unable to establish communication with the aircraft commander; however, as the aircraft slowed below 250 knots, the injured pilot was able to lower the gear and flaps. Repeated mayday calls by Lieutenant Wilson on Guard, Salt Lake City Center, and Boise Approach were finally acknowledged by Boise Approach approximately 70 miles west of Boise. In the meantime, Salt Lake City Center was vectoring a second unit aircraft to join up and assist the disabled aircraft. After joining up, the assisting aircraft assumed the lead, and Lieutenant Wilson explained the situation. He was still unable to talk to the aircraft commander and was unsure of his status, especially since he wasn't making any attempts to fly the aircraft. Lieutenant Wilson could see the front cockpit parachute pack was damaged and believed further ejection seat damage was very likely. His visibility from the rear cockpit was poor due to bird remains on both canopies. Lieutenant Wilson agreed to attempt a night formation landing on the wing, and the lead aircraft proceeded to nearby Mountain Home AFB. On the way, the severely injured pilot lowered the arresting hook. An approach end arrestment was planned with the lead aircraft to execute a touch and go. Lieutenant Wilson flew a 13-mile final straight in approach in close formation and landed with a successful approach end arrestment. The superior airmanship and courage displayed by Lieutenant Wilson saved a valuable aircraft and possibly the life of his aircraft commander. WELL DONE! ■

Class A Mishap Rate For 1982



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