flying SAFETY

MAY 1988

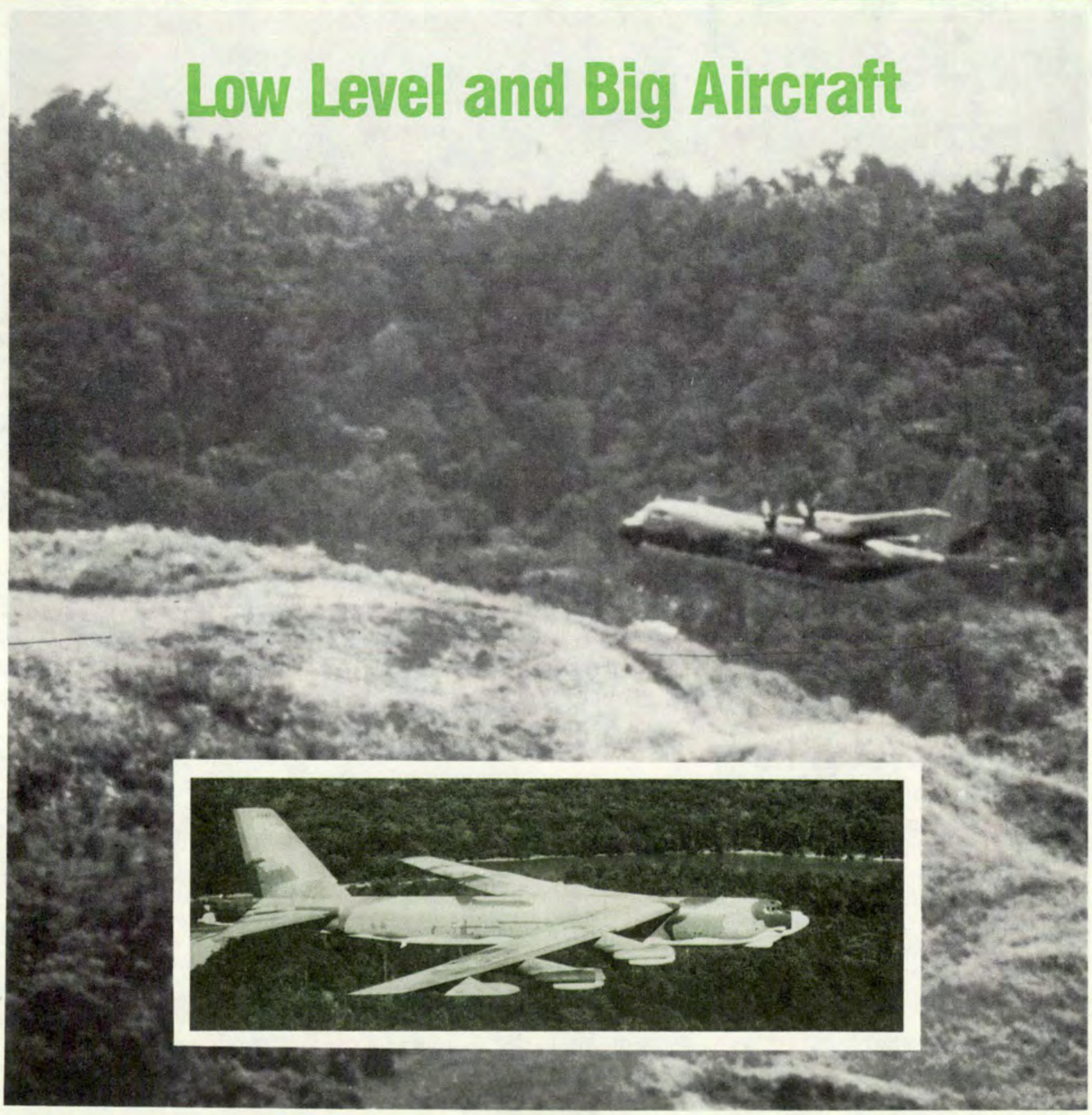
A Bolt From Out of the Blue

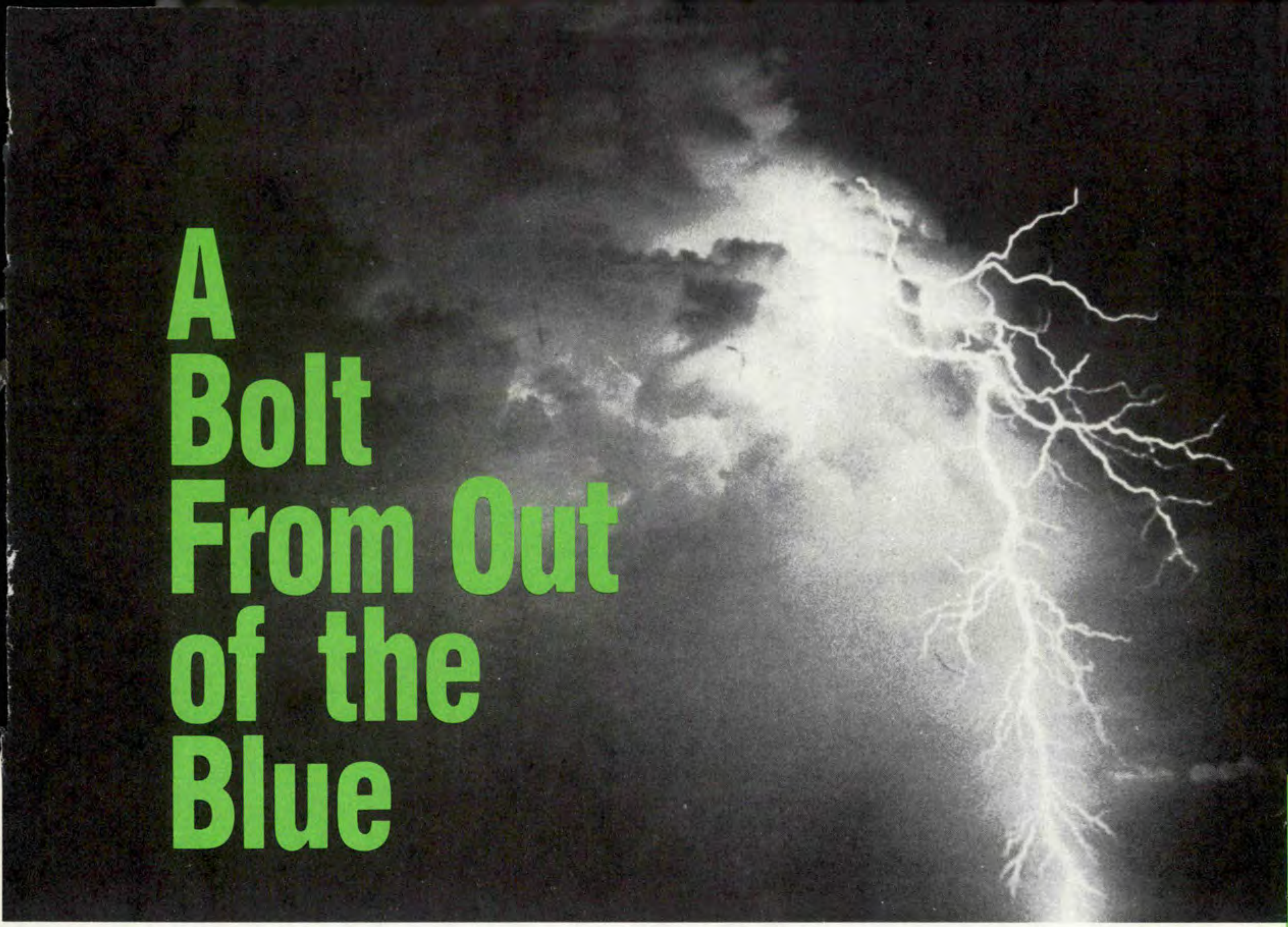
Off Time

Training To Be Best

Human Factors in F-16 Mishaps

Low Level and Big Aircraft





A Bolt From Out of the Blue

PEGGY E. HODGE
Assistant Editor

■ Worldwide, there are as many as 1,800 thunderstorms at any one time producing up to 150 lightning strikes each second . . .

■ In the United States, there are 90 million cloud-to-earth lightning strikes a year.

■ With these figures, it's no wonder that lightning strikes are a leading cause of weather-related aircraft mishaps. A review of recent lightning mishaps shows us *all* aircraft are susceptible to lightning strikes. They occur at a variety of altitudes, phases of flight, and in variable weather patterns.

Research reports spring, summer, and fall are potential seasons for lightning strikes. As spring is here with summer and fall right behind, it is an excellent time to review the basics, exceptions to the rules, aircraft damage and aircrew injury, and finally, some thoughts on what to do about it all.

A Review of the Basics

Where Lightning Occurs Lightning occurs at all levels in a thunderstorm, but lightning strikes are most probable above 28,000 feet at temperatures colder than -32 degrees celsius. The majority of lightning discharges never strike the ground but occur between clouds or within the same cloud. It is just as likely that an aircraft will be struck by lightning in the vicinity of a cirrus or stratus cloud formation as in the vicinity of a cumulus or cumulonimbus formation.

Most lightning strikes to aircraft occur between 4,000 and 15,000 feet MSL. Our review of recent mishaps shows this to be true with one mishap occurring at 41,000 feet.

When Lightning Occurs *Most* lightning strikes not associated with thunderstorms occur when aircraft are operating in one or more of the following conditions:

- Within ±8 degrees celsius of the freezing level.
- Within approximately 5,000 feet of the freezing level.
- In precipitation, including snow.
- In clouds.
- In some turbulence.

In concise terms, turbulence and clouds *may* equal the potential for an aircraft lightning strike. The probability of lightning strikes is greater in precipitation, but precipitation and turbulence are not reliable indicators of impending strikes.

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SPECIAL FEATURES

REGULAR FEATURES

Answers to FOD SEARCH (See Back Cover)

There are 189 examples of FOD *in* the FOD SEARCH puzzle. However, there are also five other FODs in the title and instructions where you were asked to find *all the FODs on the page.* These should be included for a correct total of 194. With this puzzle, as in life, you have to be sure you've found all the FOD. Tricky, aren't we?

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, OSAF

PURPOSE — *Flying Safety* is published monthly to promote aircraft mishap prevention. Use of funds for printing the publication has been approved by Headquarters, United States Air Force, Department of Defense, Washington, D.C. Facts, testimony, and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in mishap stories are fictitious. The contents of this magazine are nondirective and should not be construed as regulations, technical orders, or directives unless so stated. **SUBSCRIPTIONS** — For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished. **REPRINTS** — Air Force organizations may reprint articles from *Flying Safety* without further authorization. Non-Air Force organizations must advise the Editor of the intended use of the material prior to reprinting. Such action will ensure complete accuracy of material amended in light of most recent developments. **DISTRIBUTION** — 1 copy for every 12 aircrew, aircrew support, and maintenance personnel. Air Force units must contact their base PDO to establish or change requirements. AFSP 127-2 is entered as a publication at the Second-Class rate (USPS No. 586-410) at San Bernardino Postal Service, 1331 South E Street, San Bernardino, CA 92403 and additional entries.

A lightning flash is a very long electrical spark, which extends from one center of electrical charge in a cloud to another center of opposite polarity charge in the ground, another cloud, or sometimes even the same cloud.

A Bolt From Out of the Blue

continued

It is important to note that all conditions do not have to occur for lightning to strike.

Detecting Lightning Another basic we need to review concerns detecting lightning. Researchers tell us that lightning production phenomena do not appear to be easily identifiable by either current flight or ground radar systems. Therefore, present ground or airborne radar systems cannot be relied upon to avoid lightning strike incidents.

Also, visual observations of lightning or St. Elmo's Fire, or auditory observations or radio static do not provide reliable warnings of increased lightning strike probability.

Exceptions to the Rules

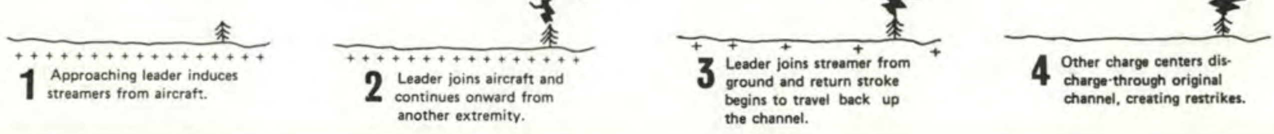
Lightning is not limited to the vicinity of severe thunderstorm cells. As mentioned earlier in our basics review, the majority of lightning strikes occur between clouds or within the same cloud. However, aircrews flying several miles from a thunderstorm can still be struck by the proverbial "bolt out of the blue."

Electrical activity generated by a thunderstorm may also continue to exist even after the thunderstorm itself has decayed. This electrical activity may drift downstream and is usually found within the cirrus deck that at one time was connected to the thunderstorm cell.

Some Aeronautical Systems Division's (Wright Patterson AFB, Ohio) research on lightning activity lends credence to the fact that lightning can strike "from out of the blue." Their findings indicate:

- Lightning strikes are not associated only with thunderstorm cells or other areas of intense precipitation. Reliable reports of lightning strikes were noted 25 nautical miles or more from the nearest storm cell sighted on aircraft or ground radar.
- Proximity to a thunderstorm may lead to a higher incidence of a lightning strike, but maintaining a reasonable distance from the cell will not guarantee a strike will not occur.

Figure 1. Sequence of Aircraft Lightning Strike. Since there is not room for very much charge to remain on an aircraft, it will "overflow" as intense streamers from other extremities and enable the leader to progress onward, as shown in the sequence below.



Lightning is a real threat to you and your aircraft. NASA lightning studies between 1980 and 1984 reported the majority of strikes(>90 percent) were triggered by the aircraft itself, and the probability of triggering a lightning discharge in a thunderstorm increased with altitude. The highest probability occurred above 28,000 feet at temperatures below −32 degrees celsius.

The Damage

When we talk about lightning, we talk about a hazard that can damage our aircraft and harm our aircrews.

Aircraft Damage Most military aircraft have metallic skins and structures that protect instrumentation and crewmembers from the effects of lightning strikes. However, many of the new lightweight, nonmetallic structural materials provide less protection for internal contents. Also, advanced aircraft have sophisticated electronic and electrical subsystems which are more prone to lightning damage.

Aircraft damage from lightning strikes is usually limited to burned or punctured wing tips or tail surfaces, or damaged radomes. Damage to aircraft electrical systems, instruments, avionics, and radar is also possible. Transient voltages and currents induced in the aircraft electrical systems, as well as direct lightning strikes, have caused bomb doors to open, activated wing folding motors, and made the accuracy of electronic flight control and navigational systems questionable.

NOTE: After a lightning strike, you should consider all instrument indications invalid until you can verify proper operation.

Under certain conditions, catastrophic fuel ignition can occur. The space above the fuel in most aircraft fuel tanks is filled with a mixture of vaporized fuel and air. The proper ratio of fuel vapor to air forms a highly explosive mixture. Figure 2 shows the approximate temperature-altitude range in which three standard fuels result in an explosive mixture.

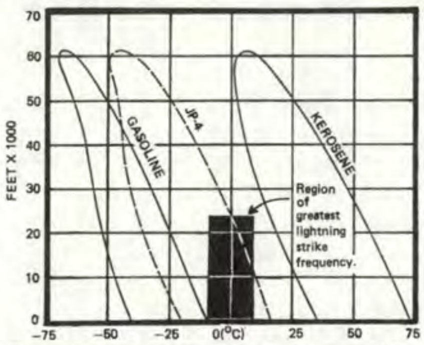


Figure 2. Temperature-Altitude Ranges of Explosive Fuel Mixtures.

As noted earlier, the majority of lightning strikes to aircraft have occurred between +8 and −8 degrees celsius shown as the solid bar in Figure 2. JP-4 vapor forms a nearly ideal explosive mixture.

Aircrew Injury Aircrews are not immune to the effects of lightning strikes. Flash blindness can last up to 30 seconds, and the shock wave can cause some temporary hearing loss if headphones or some form of hearing-loss protection gear is not worn. Some aircrews have even experienced a mild electric shock and minor burns.

As aircrew, we need to be aware of the problem as well as what we can do to help avoid a lightning strike.

What Can We Do?

There are no hard and fast rules which govern all flights influenced by thunderstorms and lightning. But the following will help as you plan and execute your missions:

- Find out if any part of your trip will be in the clouds or in precipitation. Try to arrange it so as few of these "ingredients" as possible are present.
- Check again just before you leave to see if there are any last-minute changes.
- Check frequently en route and listen to weather broadcasts. This "checking" will keep you continuously aware of the location of potential threat areas with respect to your flight plan.
- Avoid areas of reported thunderstorm and lightning activity when possible.
- Avoid penetrating the thicker regions of cirrus decks that were once associated with thunderstorms. Remember, electrical activity generated by a thunderstorm may exist *after* the thunderstorm cell has decayed.
- Avoid prolonged flight in precipitation or clouds.
- Do not loiter near the freezing level, especially during climb and descent, since most lightning strikes occur within 8 degrees celsius of the freezing level.
- Fly single ship or radar trail during formation flights in areas where lightning strike potential is high. Lightning has been known to strike several formation aircraft simultaneously.
- Know your aircraft's limitations.

The Best Means

There is no way to absolutely avoid lightning. The best means are education and awareness of what our experience and research tell us.

Lightning invades our lives almost the entire year. It is a problem that can damage our aircraft and harm our aircrews. It is a problem we have highlighted here hoping to preclude a "bolt out of the blue." ■

LOW LEVEL AND BIG AIRCRAFT

JOSEPH F. TILSON
Directorate of Aerospace Safety

■ Today, we find a need to operate our large (C-130, C-141, C-5, KC-135) aircraft on mission profiles which were not considered during their original structural design. It is becoming very important that the operators of these aircraft understand what these differences mean in terms of safety and what can be done to reduce the increased risk attendant with these new missions.

A False Sense of Security

We have been operating aircraft such as the C-130 down in the nap-of-the-earth for so long now that we begin to think it has some special design qualities which allow us to yank and bank in almost any manner we choose and "that ole baby will hang in there." Many of us tend to think in terms of the aircraft's age rather than its design capability. We point to the B-52 and remark how such an old aircraft can handle this severe use. We take a C-130 to Red Flag and are greatly impressed at its performance. This line of thinking needs a little broader perspective, lest we step over the line and experience a structural catastrophe.

The B-52s which are flying today bear little structural resemblance to those which rolled off the original production line 25 years ago. Almost all of the load-carrying structure has been replaced or reinforced as the result of several aircraft losses which occurred when we brought the aircraft down into the low-level environment. The B-52 System Program Manager at Oklahoma City expended several hundreds of millions of dollars to make the aircraft safe on these new missions. The Air Force film "Flight Without a Fin" will water your eyes as it explains only one small portion of the problem.

The C-130 has frequently been maneuvered down in the weeds at and beyond its handbook limits. This tends to cultivate a false sense of security about the risks of the operation. The new missions which emphasize weapons avoidance may tend to mask other serious threats such as local turbulence or asymmetric maneuvering. Contrary to popular belief, none of these aircraft were designed with any special maneuvering load capability beyond that of a garden variety commercial airliner.

Key Elements of Design

Gust is a key element in the large aircraft design. The structural designer assumes that the aircraft will occasionally encounter a vertical gust of 55 feet per second (32 kts). Certain gross weights and maneuvering loads are assumed, and the designer arrives at a decision about how much strength is required. This is what is called the *design limit load* (DLL). The pilot can relate this to the *maximum allowable "G"* (load factor) contained in the operator's handbook.

The designer is aware that there are a great many variables in manufacture, maintenance, and operation of each aircraft. To assure that the pilot can depend upon the handbook allowables, the designer adds 50-percent load to the DLL and arrives at a load called *ultimate load*. While this is a theoretical strength beyond which the structure is expected to fail catastrophically, it is not a guaranteed capability for every aircraft.

There are a great many operators who erroneously think that the structure is 50-percent stronger than the handbook-allowable load factors. Yes, the designer did add a 50-percent margin for ultimate strength, but that was done for a great many reasons, none of which were to accommodate an overaggressive operator.

The B-52s that rolled off the assembly line 25 years ago were designed for high altitude bombing missions. To enable them to withstand the severe stresses imposed in low altitude operations, almost all of their load-carrying structure has been replaced or reinforced.

That Extra 50 Percent

Let's discuss some of the reasons for that extra 50 percent and why it may not be there for you to trade upon. Figure 1 depicts two normal distribution curves around points A and B. Point A is the maximum load factor which the handbook allows. We know that some pilots will occasionally exceed this value, so instead of all maneuvering loads going right up to the A value and stopping, we see some actually going over onto the over-G side.

However, knowing that this and many other things were going to happen, the designer engineered it to a strength at point B (ultimate strength). Since all aircraft are not built to the design ultimate strength, we see a normal distribution curve about point B. Ultimate strength is a theoretical number, not a guaranteed value.

Figure 2 depicts those same two curves in the real world. Note that both curves have shifted toward each other. The curve that was at point A has moved to the right, indicating that the operators are imposing more load than is approved in the pilot's handbook. This occurs when the aircraft is operated overaggressively or experiences turbulence while maneuvering in a heavyweight configuration. The curve that was originally at point B has moved to the left. This movement can be caused by several things, many of which are beyond reasonable control.

The main reasons this curve may shift to the left are:

- *Repeated overstressing* which loosens fasteners.
- *Defective drilling* during manufacture which causes severe stress concentration.
- *Corrosion* which causes severe stress concentrations and crack initiation.
- *Structural damage* induced by maintenance or the flight crew.
- *Improper repairs* performed at field and depot level.
- *Defective material* properties in original or subsequent manufacturing.
- *Optimistic design assumptions* regarding the actual usage loads environment.

Note that figure 2 shows a shaded area where the two curves overlap. This means that those aircraft which are short on design strength are being subjected to a greater-than-allowed flight load and are destined to fail. The system manager spends hundreds of millions of dollars trying to keep the design stress curve at point B, but if you study the preceding list of reasons for its movement, you'll see many of these things are out of the manager's hands. The other way to reduce failures is to educate the operators so they reduce the tendency to move the operational curve to the right of point A.

Your Questions

Let's address the following ques-

continued

Figure 1

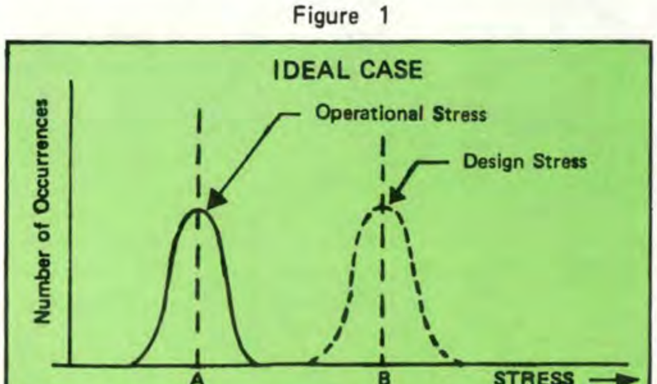
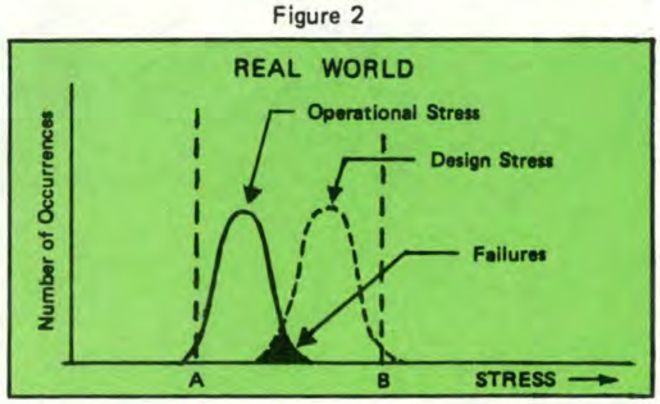
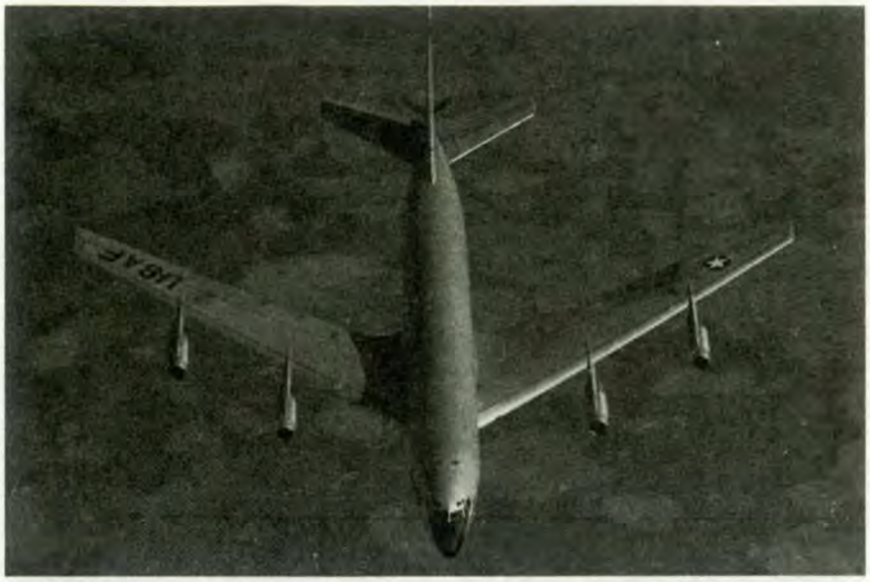


Figure 2





LOW LEVEL AND BIG AIRCRAFT continued

tions which invariably arise during discussions of this subject.

■ I know a guy who exceeded the handbook maneuvering limits and an over-G inspection showed no damage. Why?

Answer: The aircraft was probably at a very light gross weight at the time, and if not, it probably was free of structural defects. Very likely it came off the production line as one of the aircraft actually built with point B (or better) strength.

■ Don't they test the aircraft during initial design to prove it has the full 150-percent ultimate strength?

Answer: Yes, they do, but they test only one aircraft and are satisfied if it is at (or near) the 150-percent point. The normal rules of probability say that some aircraft will actually be built with strength below 150 percent. However, if you were the contractor, wouldn't you do everything in your power to assure that the test aircraft was flawless?

■ Then why don't we provide a bigger structural margin such as 160 percent or 170 percent?

Answer: This extra strength would add enormous weight to the aircraft. If the user operates the aircraft as originally agreed upon (point A), then the 150 percent is adequate. The extra weight would reduce range and performance. Any structural engineer who designs this way finds his or her career detoured into designing things that don't fly, such as plastic models or highway bridges.

■ Well, what do we do now that we have these new missions which were not in the original planning?

Answer: Assist the system program managers in identifying the new missions, and support their needs to measure loads, design modifications, and fund new work to bring the aircraft up to the new operational requirements. Above all, know your operational limits and fly smart until the program managers can get your aircraft modified. Remember, the day you are trying to be at the top of the class in threat avoidance, you may be flying an aircraft that is at the bottom of the class in structural strength.

Keep in mind there is something else out there that wants a part of your operating curve, and you don't get to vote on its right to share. That is the unseen vertical gust which appears in the form of turbulence. If you are using all of the capability of the aircraft and encounter a vertical gust in excess of the rather modest 55 feet per second (32 kts) assumed by the designer (who wasn't told about nap-of-the-earth), you had better hope your aircraft is not at the bottom of the class. A gust greater than 55 feet per second is many orders of magnitude more likely to occur at 3,000 feet than at 20,000 feet.

Operational Flight Restrictions

Some of today's aircraft are known to have questionable structure and are appropriately being allowed to operate only under certain flight restrictions. These restrictions have been imposed to assure safe operation of the aircraft until the suspect structure can be properly inspected, modified, or replaced. The user would be very wise to respect the restrictions imposed on the aircraft. If we keep the curve at point A from crossing the curve at point B, you will arrive home safely and get another chance to do it all over again. ■

The C-141 was not designed with any special maneuvering load capability to withstand the rigors of low level missions incorporating threat avoidance. But, it can be operated safely in this environment with the latest design changes to the vertical fin if you, the fliers, understand the design parameters and the load applied, and remain within the handbook limits.

Off Time

LTJG DANIEL B. ABEL, USCG
Coast Guard Air Station
Opa-locka Airport
Opa-locka, Florida

■ Lt Chris Johnson sprawled out on the well-worn couch in the pilot's lounge. Although his eyes were aimed toward the TV screen, they never really saw what was on. His thoughts were of the morning's activities. He really got a lot knocked out around the house. The Coast Guard gives their pilots the morning off before they assume 24 hours of ready duty. As such, Chris had time to hack away at the chores on the "home front."

He was up early and in the yard by 0730. He spent most of the time pruning the numerous bushes that had somehow taken over the back yard while he was gone on deployment. Cutting, clearing, and hauling it away to the dump was a big task, but he got it done just in time to shower, catch a quick lunch, and head for the base. Chris looked down at his hands. The calluses and blisters were a testimony to how hard he had slaved away.

As he sat there consumed in thought, LTJG Ken McWillan walked in and sat down. Ken was a nugget fresh out of flight school. His enthusiasm for flying was boosted even more by weeks of the transition course to the HH65A "Dolphin." The end result of the Pensacola grind and the transition hours was a hard charging copilot who ached for chances to fly the new helo.

"You really watching this old movie?" Ken asked, interrupting Chris' thoughts.

"Huh? Oh, go ahead and watch whatever," Chris responded as he tossed him the remote control.

They sat and ran through the stations, finding a few old movies and a rerun or two. "Late on a Tuesday night must not exactly be prime time," Chris thought. Within a half hour both had shuffled down the hall and crashed into bed.

Scramble

Chris' sound sleep was shattered by the light of the open door to his room. It was the Senior Duty Officer. Chris squinted into the bright hallway light flooding in and raised his head.

"Gotta case, there's a boat on fire with people going in the water off Kendall Key."

Chris sat up in bed and turned his eyes to the red numbers of the clock radio. Focusing closer, he read 3:17. He slowly turned and dropped his feet to the floor. His head felt about 20 pounds too heavy — with all sorts of pressure behind his half-open eyes. Every muscle in his body ached. His hands hurt to move as he reached for his watch. "I guess I must be getting too old or too outa shape for the stuff I did in the yard," Chris thought. Within a few moments, he was forcing his stiff body to jog out to the "ready" helo.

As Ken did a quick "walk-around," Chris strapped in and started slushing his way through the pre-start checks. Out of the corner of his eye, Chris saw his copilot climbing in. Ken's face beamed with the chance to fly some "real SAR." With a flip of the battery relays, the instrument panel vertical scales lit up like a Christmas tree in the low evening light. Chris lit up the inter-

continued

com to ask Ken to plot the exact location for the distressed vessel. He heard nothing — no crackle, no side tone, nothing. "Great," Chris thought, "I've got a broken 'ready' airplane."

Chris tapped on Ken's shoulder and then tapped his own helmet's earpiece. They both sat there talking, with neither one hearing the other. Chris leaned forward with the grimes light to check for any popped circuit breakers. His leaning over was interrupted by a tap on his arm. It was his copilot holding the helmet end of Chris' intercom cord. As he slipped it into the connector, Chris thought to himself, "Great! I've got a nugget doing my thinking for me!"

Chris got the two engines started and taxied toward the "duty." After a smooth liftoff, Coast Guard Rescue 6405 was racing toward the coast. It was a real dark night. An overcast layer at about a thousand feet hid whatever light the moon had to offer. The twinkling lights of the city, though, added enough light to make up the difference until we reached the coastline. Then it was black!

The position given for the burning boat was marked by absolutely nothing. Apparently, it had burned to the waterline, then put itself out. The position was far enough offshore that the lights of the city were of no help. The datum for the search that was to follow was ominously black. Chris decided to enter a quick sector search while he told Ken to break out the night vision goggles.

Even during the preflight, the pilot's fatigue resulted in mistakes. Fortunately, the fresh, eager, young copilot made up for the pilot's mental and physical sluggishness.

The Search Widens

Forty-five minutes later, the sector search was done, and Chris started an expanding square search. The cockpit was silent. The crewman was leaning close to the cabin door, peering out. Ken, staring into the green lenses of the night vision goggles, searched on the left side of the airplane. Chris concentrated on keeping up with the aircraft.

It seemed the adrenaline had worn off, and his mind just wasn't "up to speed." The blackness of the night and the silence in the cockpit didn't help. Raising his visor, Chris rubbed his heavy eyelids and sat up straight under the straps. His back was sore and tight. He tried to stretch out his stiff legs, but his feet were met by the pedals.

Thirty minutes later, Chris was really starting to get frustrated with himself. He had to ask homeplate to repeat the next search area twice. His fingers kept finding the wrong buttons, and it took twice as long to get anything done right. He just was not "all there."

As they passed a mile southwest of datum, the crewman yelled out, "I've got a strobe at 4 o'clock!"

"Keep your eyes on her and call my rollout," Chris blurted out as he banked the airplane hard to the right.

Five minutes later, they were shooting an approach to the water. Two survivors had been spotted. Chris had mumbled through the standard brief while Ken swiftly ran through the Before Hover Checklist. As they reached 70 feet on the radar altimeter, Chris brought in the power. Chris concentrated on the attitude indicator as the black night offered no reference. Ken called out the 50-foot desired hover altitude, but the helo dropped lower toward the water.

"Watch the descent — you're at 35 feet, Chris," Ken called out on the intercom.

At 15 feet, they both pulled up on the collective. The radar altimeter needle seemed to bounce off the 15 line on the gauge as it worked its way back to 50. Heart pumping, Chris brought the helo into a stable hover. They then recovered all the occupants of the burned-out boat. The boat was never seen.

Homeward Bound

The trip to the hospital was uneventful. The adrenaline was back to pumping in the whole crew. Chris had Ken do the approach and landing on the rooftop helo pad. When they got back to the air station, everyone was all smiles — but weary. Within a half hour, the messages had all been written and sent, the case folder completed, and the Operations Desk closed.

As Chris sat on the edge of his bed, he noticed how his body had reset to the painfully stiff state it had been in 3 hours ago when this all started. The bad headache had never gone away, and his muscles never did feel just right. He dropped his head on the pillow and was out cold in a matter of minutes. Thankfully for the ready crew, no more cases filled their duty day.

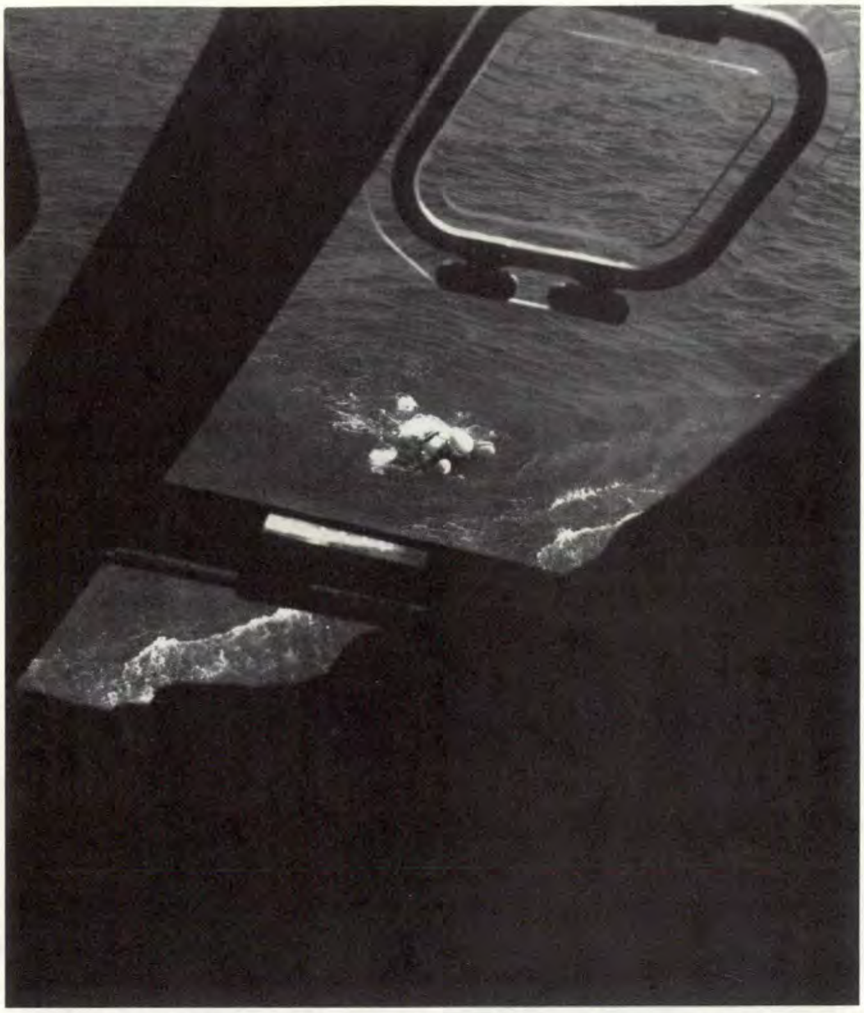
The Moral

The bottom line of this tale is that the case was successfully prosecuted. It was done, however, in spite of the condition of the aircraft commander. His body was "spent" by the time he was called upon to fly a tough mission. We, as aviators, benefit from some pretty good "union rules" when it comes to time off for crew rest.

The truth of the matter is that your "off time" does not come with no strings attached. There is a reason for the strict crew rest standards mandated by all services. Tired aviators make more mistakes and bend airplanes. Worn out aviators make widows and orphans. But a prudent aviator also uses some common sense even when not in a required time off situation.

What you do in the hours preceding any flight can have a real impact on the success of the mission. Whether it's a SAR case, routine training hop, or some shipboard work, they all require that you be at your best, physically and mentally, to meet the challenge.

If you've "spent" your body's reserve early in the day or into the wee hours the night before, you could be depending on leftover energy to do your flying. That could come up just shy of what might be demanded in the cockpit. Give your crew and the mission the best you've got to offer. ■



During the long and difficult night search, the pilot's increasing fatigue resulted in more and more mental errors and made it hard for him to keep up with the aircraft. When the survivors were finally located, the exhausted pilot almost dropped the helicopter into the water with them.

On the way back, the pilot's adrenaline was pumping enough to keep his attention focused. But, he wisely deferred to the copilot to make the approach and landing on the hospital's rooftop helo pad.

EMERGENCY

LT COL JIMMIE D. MARTIN
Editor

■ During pulloff from a night dive bomb pass, the A-10's Master Caution and Right Hydraulic Reservoir caution lights illuminated. Shortly after, the Right Hydraulic Pressure light illuminated and the right hydraulic pressure dropped to zero.

During the return to base at 5,000 feet, the pilot contacted the SOF and together they accomplished the right hydraulic failure procedures in the Dash 1 checklist. The recovery plan at this time was to fly a no-flap, straight-in approach and landing, taxi off the runway into dearm, and shut down.

Change of Plans

A few minutes later, the pilot called the SOF and said he would like to isolate the left hydraulic system since he didn't know what caused the leak. He was concerned that if the left hydraulic system had also been affected, there was a chance of losing hydraulics for flight controls when the landing gear was extended.

The pilot would use an alternate landing gear extension to isolate the left system. He then modified the recovery plan to include stopping straight ahead on the runway and having the landing gear pinned since there would be no downside hydraulic pressure on the gear. He opened the landing gear circuit breaker, pulled the emergency brake handle, and performed the alternate gear extension.

More Trouble

However, only the right main and nose gear indicated safe after this was accomplished. The pilot made a go-around, orbited over the field, and finally got the left main gear to indicate safe after reseating the light bulb. He then made an uneventful no-flap straight-in approach and landing.

After he brought the aircraft to a stop on the runway, the rescue crew chocked the wheels and installed the landing gear pins. When they pulled the chocks, the aircraft began to roll. The pilot tried to stop it with brakes, but was unsuccessful. The aircraft drifted to the right, and the right main gear and nosewheel departed the runway. The pilot shut down both engines and ground egressed.

What Happened?

What went wrong? Was there another system failure? No — With the right hydraulic system depleted and the left system isolated, the only braking available was through the emergency brake accumulator. This system guarantees a minimum of five brake actuations before the pressure is depleted. These applications were used up during the landing roll except for a little bit on the right brake.

When the pilot changed his plans and decided to isolate the left hydraulic system, he and the SOF only discussed the first four steps of the alternate gear extension checklist. Consequently, neither realized the aircraft would only have emergency braking available.

Emergency Guidelines

No harm was done in this case; just a little extra excitement at the end of a night emergency recovery. But you can see the potential for disaster in such a situation. Here are some suggestions to keep in mind when handling emergencies:

■ **Declare the emergency.** This sounds obvious, but some pilots seem to feel this will tarnish their image. Declaring an emergency doesn't mean you're a wimp who can't hack it. Let people know you're coming and what the problem is so they can be prepared. Get the priority handling necessary to keep things from going from bad to worse.

■ **Get help.** Use chase aircraft. Use the SOF, tech reps, or whatever is necessary. In most cases, the SOF has access to material you don't carry in the aircraft. This is es-

pecially true for fighters. It's much easier for the SOF to read checklists than for the pilot of a single-seat fighter to try to do it while flying an aircraft that may not want to fly. In a multiseat aircraft, use the entire crew. Make crew coordination and involvement high priority.

▪ **Know your aircraft.** Know the performance parameters, but you also need intimate knowledge of aircraft systems — how they operate and how they interact. This is not to teach you how to repair it, but to know how to handle problems.

A basic premise of handling any emergency is, don't make the situation worse. A good understanding of your aircraft's systems and clear thinking about the consequences of your actions will help you to follow that premise and result in an uneventful recovery.

▪ **Plan your recovery.** When faced with an emergency, mentally rehearse your actions all the way to engine shutdown. Review all the necessary checklists in their entirety. Review aircraft systems — what will be lost, degraded, or otherwise affected and when.

▪ **Don't rush.** Don't place additional pressures on yourself or create the opportunity for errors by acting in haste. True, some emergencies require quicker actions and decisions than others, but don't overdo it. Use the available time wisely.

▪ **Be flexible.** Don't get locked in on one course of action. The situation may change so that a new course of action is required rather than your original plan. Unforeseen circumstances may arise. Keep an open mind and replan, if necessary. But, be thorough when you do so. Think your actions all the way through.

▪ **Be firm.** Although this appears to conflict with the previous suggestion, it really doesn't. This means to pick a course of action that will resolve your emergency and follow it through. Don't keep changing your mind. If you have a workable plan, use it. Random changes only lead to rushing and incomplete actions.

In addition to these guidelines, I'll add one more for those helping. This applies to those acting as chase, SOF, or otherwise assisting.

▪ **Help, don't hinder.** Give the emergency crew all the assistance they ask for. Give additional information, as necessary, but don't give so much advice or ask superfluous questions so the crew doesn't have time to handle their emergency. Put yourself in the aircraft and limit your transmissions to those that are absolutely necessary.

This is by no means an exclusive or exhaustive list. I'm sure you could come up with more. They are guidelines. Use them as they apply. The important thing is to be prepared in advance. Study your emergency procedures, know your aircraft, and really apply yourself in the emergency procedure training. Be prepared for everything from minor to major emergencies. ■

THE "CAN DO" ATTITUDE

MSGT GEORGE KROEPIL, JR.
35th Equipment Maintenance Squadron
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■ One of the most admirable and desirable qualities in the business of maintaining aircraft is a "can do" attitude. Each of us can think of at least one member in our unit who possesses this personality trait.

This is the individual or team who, given the necessary tools and time, can almost assuredly complete the task. Whether it be launching and loading aircraft under simulated combat conditions or preventing an aircraft from going "hangar queen" status (not flown in 21 or more consecutive days), people will find a way. Once found, this "can do" attitude becomes invaluable to the work section. But, as many of us know, this "can do" attitude can also become a problem.

This same attitude can and sometimes does contribute to mishaps, especially in the area of maintaining aircraft. But what about this "can do" attitude in our everyday workload? Recently, I experienced this attitude first hand.

An example took place in the inspection section of our maintenance squadron. The inspection section performs all major and minor scheduled inspections for our assigned aircraft and also repairs all discrepancies found during the inspection. When one aircraft is completed, it rolls out of the hangar and in rolls another. It is a continuous cycle. Since the inspections are scheduled in advance, it is essential that each aircraft be finished on time.

The "can do" attitude is essential for completing the Air Force mission. However, it can be a hindrance if this attitude overrides good judgment and results in improper actions.

To add to the anxiety of going off schedule, every major inspection could produce a "hangar queen," which must be reported to higher headquarters.

Aircraft 0288 was scheduled for a 600-hour periodic inspection, the most extensive inspection accomplished on this type of jet. It takes 11 days to perform the inspection, which consists of 255 work cards containing 1,275 items, the removal and installation of 130 access panels, and the repair of all discrepancies. In addition, the No. 1 engine was scheduled for time change, which would give us 12 days to complete the inspection. If everything went as scheduled, the aircraft would roll out of the inspection hangar and fly well ahead of the "hangar queen" status day.

This was a big "if" as the saga of 0288 revealed.

Day 1: At 0700, the aircraft is scheduled to be in the inspection hangar but arrives at 1230 p.m. and the work begins.

Day 2-4: Everything going as scheduled. Inspection discovered

723 discrepancies. Maintenance crews have been working minimum 10-hour days. Things look good.

Day 5-8: Repairs are in progress and no delays in sight. Should be ready for installation of No. 1 engine tomorrow. It has been 10 days since the aircraft has last flown.

Day 9: Engine installation complete, but during various system operational checks, the vari-ramp system will not fully operate. Troubleshooting in progress. With 14 days since the last flight, the "can do" attitude is present.

Day 10: Vari-ramps still a problem, but crews continue putting aircraft back together. Have to press for engine run tomorrow. Still could make the 12-day schedule.

Day 11: Vari-ramp problem corrected and ramps x-rayed, but a major problem has surfaced. During the engine run, a fire warning light illuminated. No fire, but a faulty fire loop in No. 2 engine bay. Must remove engine to replace loop. Crews working around the clock as the 16th day from last flight passes.

Day 12: No. 2 engine removed and requirement for inspection of that engine bay completed. Seventy-three discrepancies found. Repairs in progress. People are still smiling and morale is high. Cooperation is abundant despite the long hours and constant setbacks. The "hangar queen" pressure is understood but has no ill effects.

Day 13: Started falling farther behind but received support from the flightline folks. No. 2 engine installed and aircraft is ready for maintenance run. It has been 18 days since last flight. Beads of perspiration are forming at the hairline.

Day 14: Saturday; no cartoons today. The readjusted completion time of all maintenance was set at 1600 hours today. It is now 1500 and the last wrench has turned. Engine run went without a hitch. The job is finished . . . well, not quite. The aircraft has to fly before 2400 Monday or it will become a dreaded "hangar queen." The ball is now in the crew chief's court, who has been involved in the entire inspection process.

Monday: Tension mounts as the day begins. Aircraft 0288 sits on the flightline as preparations for its first flight in 21 days are underway. The crew chief reads through the forms, services all the systems, and runs the checklist over and over so that nothing is forgotten. The weather is good as the aircrew shows up at the jet and begins the preflight. A crowd starts to gather in the background. The crew starts the engines and all conversation stops. Anticipation rises as the aircraft taxis toward the runway. All eyes are fixed on the approach end of the runway searching for the black smoke prevalent before takeoff. Suddenly, anxious onlookers see the black smoke and 0288, gear retracted, headed upward.

For us, this was a success story. No, we didn't finish the aircraft in 12 days, but the "can do" attitude didn't override our professional attitude. Although the "can do" attitude can become a problem in situations such as this, the more important professional attitude prevailed. The professional remains within the "box" of established rules, regulations, and procedures. With an honest "can do" effort to complete a task at hand, the professional will say "back off" if something is not correct or within the known "box."

In summary, the "can do" attitude remains a very worthy attribute for any maintenance person. But we must ensure this "can do" attitude is used in conjunction with a strong sense of professionalism. If it is, then the "box" of our particular working area, rules, regulations, and procedures becomes clear. The qualities of a "can do" attitude and professionalism combined have unlimited potential. ■

TRAINING TO BE BEST

PEGGY E. HODGE
Assistant Editor

■ To "fly, fight, and win" requires quality training. It ensures our operational readiness and mission success. Our major commands realize the impact of effective training programs, and with the low mishap rates the Air Force has had the past few years, it shows.

A profile of a relatively new training program — the Military Airlift Command's (MAC) Combat Aircrew Training School (CATS) — keeps us "in the know" on what our commands are doing and serves as a reminder of some time-proven essentials that will "train us to be best."

Formation

One of the most valuable lessons the Air Force recognized from the Vietnam war was a need for realistic training scenarios to better prepare our crews. It was after the Vietnam war and from this lesson that CATS got its start. Lt Col Norman Sevigny, the school's commandant, explains.

"It started at a grass roots level. There were a lot of folks in the business following the Vietnam war who felt we probably weren't tactically employing our aircraft as well as we should — we weren't training as well as we should — we weren't realistically thinking about how we're going to employ our aircraft when the shooting war starts.

"This was voiced at a lot of tactics conferences. It came out in different meetings — training meetings the command sponsored in the late 70s and early 80s."

There wasn't any central place to train airlift tacticians. The tactics existed without the structured attention a school could give.

"There was nothing formalized," explains Lt Col Sevigny. "I think it was this sense of frustration — 'We're not training the way we ought to be training . . . we're not working our intelligence sources the way we ought to be working them . . . we know we need to be doing better, but we're not doing it . . . ' — that led to the formation of the CATS program."

The Program

CATS officially began in the fall of 1983 at Nellis AFB, Nevada. The convenient interface with the USAF Tactical Fighter Weapons School and the existing intelligence and threat training facilities made Nellis the best site for CATS. Nine instructors conduct approximately 13 classes a year and 4 senior officers courses.

Basic CATS Program The school's program provides academic training for instructor pilots, instructor navigators, and intelligence officers and NCOs in threat analysis, advanced tactics, techniques, and combat operations of assigned MAC aircraft worldwide. For your reference, a sampling of the coursework follows:

■ **Threat Analysis** Course work in this area includes principles of radar, Soviet radio electronic combat (REC)/countermeasures, Soviet fighter aircraft/employment, and free world air defense systems.

■ **Combat Operations** Examples here include the study of US and Soviet army operations, general employment planning and the Airlift Control Center, and a unit on the

Air Force and Army's command and control to include airborne elements such as the airborne warning and control system and the airborne battlefield command and control center.

■ **Mission Planning** Study here includes units in assault area study, situational tactics, and various fighter and free world airlift capabilities.

■ **Mission Execution** And finally, course work here includes aerial combat maneuvering, low level flying, and psychological and physiological effects of combat.

The CAT graduate is a trained tactician with two primary responsibilities. In time of conflict, the tactician is responsible for effectively employing MAC forces, and in peacetime, the tactician is responsible for conducting realistic training, that is, in-unit combat aircrew training.

In-Unit CAT Program The in-unit CAT program is a wing- or group-managed and flying-unit run enhanced combat aircrew training program. It is a reduced academic version of the CATS and includes a flying execution phase.

Senior Officers Course Lt Col Sevigny explains the senior officers course as "the most important course we teach. It's for 2 days and designed for wing DOs, wing commanders, squadron commanders, and senior staff members.

"In 2 days, we don't attempt to give them a mini-CAT course, but what we do is make them aware of what it is we're teaching their tacticians, and what they can expect from them when they get back home. We aggressively solicit the senior officers' support for tactical development in the command and realistic combat training to become the standard of what we do."

Goals

Lt Col Sevigny describes the school as "basically having two goals — we want to succeed in combat, and we want to survive. To be brave and dead doesn't get you much when you have to send another aircraft in to do the same mission. I hope to achieve mission success by approaching a mission in an intelligent manner.

" 'Planning intelligently' doesn't mean all missions can be done or all missions are survivable. You may get to the point where given a threat, a requirement, and the support you have available, you've got to come back to your boss and say 'I can't get there from here. It's not doable with this level of support. We need 1, 2, 3, 4, and 5 . . . '

"We need people in a command who are aware and smart enough to make those determinations."

Why CATS?

MAC developed CATS to conduct combat aircrew training in the tactics, techniques, and operations of MAC assigned aircraft. Lt Col Sevigny sums up his answer in a statement they use at the school — "Life is tough, but it's much tougher if you're stupid." The school "makes its students smart" on the subject of how to employ your aircraft to survive and succeed in warfare. And you can't do it if you're not smart.

"The level of tactical and threat awareness in the command is not at the level it should be and certainly has not been in the past — but it's getting better.

"A school like CATS is designed to turn out a thinking tactician — a guy who not necessarily knows all

continued

What the school hopes to achieve is a quantum leap from our present capability and attitudes. Equipment gains and projected technological capability will allow us to operate under conditions we cannot accept at present. We must ensure that when the equipment is ready, our crews are trained and capable of the mission to be expected of them. We must ensure the combat force has the information they need to "fight and win."

"A spinoff benefit from attendance at the course," explains Lt Col Sevigny, "is a growing understanding of the capabilities and limitations of other weapon systems in other combat units and a real meshing of our experience and capabilities so that we will approach problems as a 'united front' and not as individuals. The better we know each other and what we can and cannot do, the more successful we will be as our forces are employed."

the answers, but certainly knows the right questions to ask, knows sources of information to find the answers, and can apply sound tactical reasoning to a situation when we have to employ aircraft.

"It's no longer sufficient to assume we're going to carry the army into the battle unopposed, and we're going to just drop the troopers anywhere without worry of interdiction by enemy forces. There are ways of getting in and out of battle areas, and there are ways of not doing it. You can't go in with a poor knowledge level in your force, so we're trying to raise that knowledge level."

A Training Success

Lt Col Sevigny feels the school is making a big impact in the field. "We're getting queries from folks in other commands who fly big aircraft. We're getting questions from Tactical Air Command's aircrew flying the EC-130 in Europe, who realize their tactical development is not what it should be. They're coming to us with questions and a desire to attend CATS.

"We've had students from the Marine Corps and the Navy. Our instructors have taught at Army, Marine, and Navy flying squadrons — by request.

"We recently had a training conference at MAC — they're putting together what they call the 'Tiger Team.' This is a team that takes a look at some of the problems we have in training — and it was interesting to note that every C-130 pilot at this training conference was a CAT graduate.

"Our students are leaving here and making their mark back in the field. I think they're going to have an impact on the command.

"And I feel good about it. I think we're more capable — we're better trained to fight our battle tomorrow than we were 3 years ago. We're certainly not at the level we need to be, but we're making progress.

"The school is producing this quality with a staff of only nine people — that's the incredible thing about it. This is probably one of the most cost-effective training operations the command has."

Time-Proven Essentials

The CATS training program, although unique in its mission, reminds us all of some time-proven essentials for aviation and success.

- Flying a successful mission requires knowledge, preparation, study, and practice.
- Raising our knowledge level of the risk does make a difference.
- Developing an attitude of airborne survival is essential.
- Knowing your equipment systems and limitations — first and foremost — is important to your mission and your survival.
- Putting some extra time in on target or route study and knowing well the lay of the land can prevent mishaps and problems.
- Being mentally willing to back down (knock it off, abort the route, etc.) is a valuable mishap prevention tool. It is very important to strive for completion, but for every set of circumstances, you need a mental "no-go" point.

Training To Be Best

The cornerstone of Air Force readiness is quality training — it is essential to our mission success. Through programs such as CATS, we are training to be ready . . . and "training to be best." ■

To be an effective fighting force, our troops in the field must be resupplied with "bombs, beans, and bullets." And our MAC aircrews are going to bring it to them. "We're increasing our emphasis at the CAT school on our involvement in a modern shooting battle," explains Lt Col Sevigny. "We are going to have to fight just like the rest of the forces, and we need to be just as smart."

HUMAN FACTORS IN F-16 MISHAPS

LT COL GEOFFREY W. MCCARTHY
Commander
USAF Hospital Misawa

The following article is specific to the F-16, but also has some valuable lessons that can be applied to any aircraft. We recommend it for all fliers.

The author is uniquely qualified to write on this subject. He is one of only six pilot-physicians in the Air Force who are actively flying.

The author's numbers differ slightly from the official AFISC totals in a few places. This is due to interpretation where there is more than one category in a single mishap. The number differences are not significant and do not affect the message. So, read it for what you can learn, not for exact statistics. Ed.

■ The F-16 is the safest single-engine aircraft in USAF history. With approximately a thousand Electric Jets flying and scarcely a dozen Class A mishaps a year, it's tempting to think these mishaps are at an irreducible minimum — or are they? I've been flying the jet for 5 years, tracking mishap trends, especially in the human factors area, doing the occasional mishap board (the one I couldn't jink out of . . .), and consulting on a few others.

Here is my analysis of the Fighting Falcon's 12-year Class A history, divided among logistic and operational types of mishaps. Take a few minutes to study the numbers of F-16s and pilots lost as shown in Figure 1. Does this information fit your impression of this jet's history? Or has it illuminated a different pattern of causes, as it has for me?

My conclusions from the human factors and flight surgeon viewpoint for each of the categories follow. Stuck off here in the Land of the Rising Yen, my total count might be off by one or two, but it's trends and fixes that I seek here. (I'll save the

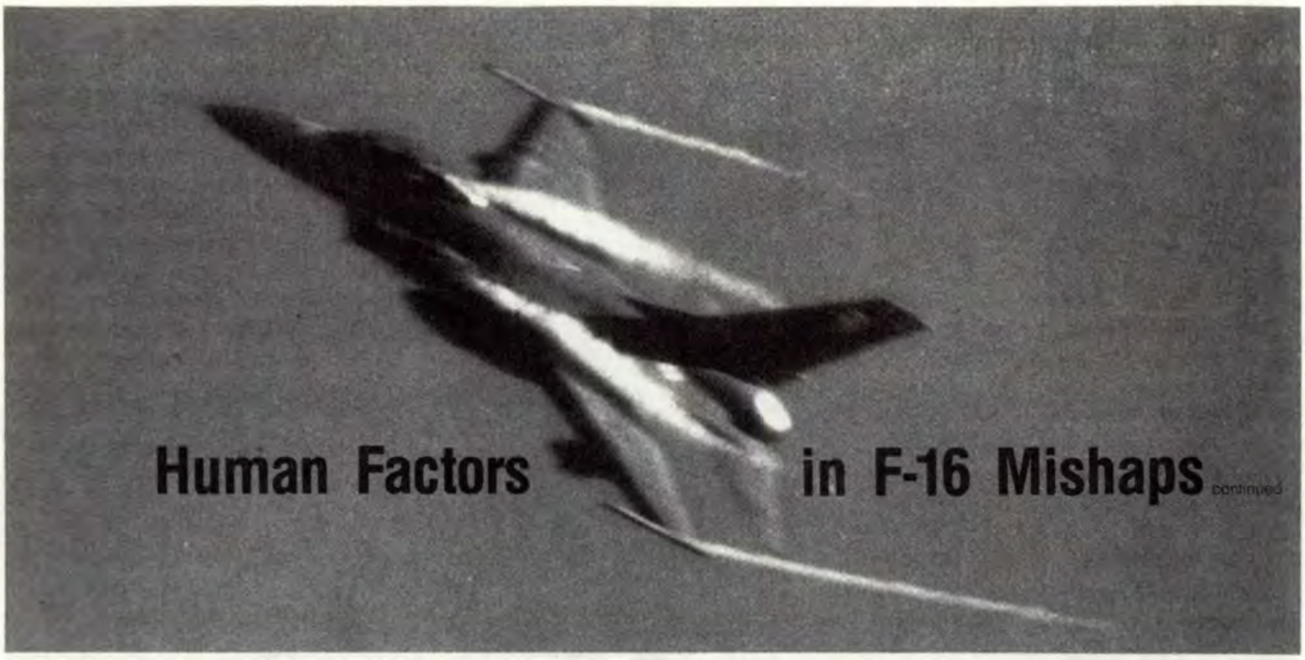
continued

Figure 1
Yearly F-16 Class A Mishap Categories (Fatals)

Years	Logistic	GLC	SA	LOC	Midair	Misc*	Totals
75-79	2			1		1	4
80	3			1		1	5
81	3 (1)		1			1	5 (1)
82	9		5 (4)	1	1	1	17 (4)
83	5	2 (2)	3 (3)				10 (5)
84	3	2 (2)	4 (4)			1	10 (6)
85	4	1 (1)	3 (3)	1	1 (1)		10 (5)
86	4		2 (2)	1	1	3 (1)	11 (3)
87	7		2 (1)		3 (3)	2	14 (4)
Totals	40 (1)	5 (5)	20 (17)	5	6 (4)	10 (1)	86 (28)
% of Totals**	47% (4%)	6% (18%)	23% (61%)	6%	7% (14%)	12% (4%)	— —
% Fatal	3%	100%	85%	0%	67%	10%	33%

* Fuel Starvation, 3; Bird Strike, 2; Takeoff and Landing, 4; Exceeded Structural Limits, 1; plus one fatal crew chief ingestion.

** Rounded to nearest whole number (total exceeds 100%).



Human Factors in F-16 Mishaps

continued

most important, and most troublesome — loss of situational awareness (SA) mishaps — till last.)

Logistics

Not my bailiwick — except I fly the jet, and right now the temperature in the Sea of Japan is around 40 degrees, so I'm real interested in equal numbers of takeoffs and landings. Thirty-two of these 40 were engine related; all but one resulted in ejections. (Successful flameout landings not included.)

Of 36 ejectees with engine problems, only 6 had minor injuries, the rest had none. I've met and examined several of these guys, and they could easily have briefed their next mission right then. (Well, okay, one pilot was in that 40-degree water and we might have had to warm him up another half hour or so, but you get my point.)

The "cost" of doing business in this single-engine jet is these occasional ejections, which the ACES II handles splendidly. The only fatality here was unusual — a since-fixed flight control anomaly at very low altitude.

Loss of Control

Still not my bailiwick — none in 1987. All six pilots involved in prior years wisely bailed out — none were injured. Pilots seem to believe in the 10,000-foot rule, and seem to trust the Air Force will treat them fairly later on — unlike another group, as I'll show later.

Miscellaneous

Three hard landings, and believe it or not, a hard takeoff, three fuel starvations (trapped and unnoticed fuel, not leaks), and two jets unflyable after severe bird strikes make up this grab-bag category. What can I say? No real human factor concerns, and no real injuries, either.

Midair Collisions

Notice how we're sneaking up on the human factors now. I made this a separate category because of the three in 1987, with the sad addition of three more fatalities. None of these were against unknown aircraft — all were prebriefed friendlies. Of the six F-16 lifetime midairs, two happened during tactical maneuvering with formation members. Two were in head-on engagements, one versus an F-4, one versus an F-15. The remaining two were with other F-16s — a lead change and a blind rejoin in a valley.

The aeromedical factor here is visual. Remember, this jet was *designed* not to be seen. Plus, we've done our best to paint it sky-mimic shades of gray. Play this one by the book, and know where all the members of your flight are all the time. If not, you can't trust your eyes, nor your adversaries' eyes. Be at a different altitude from them.

G-Induced Loss of Consciousness

Heavy hitter, the major F-16 operational problem, the purest of the pure human factor mishaps — right? Look at the numbers again. For all the publicity, (even *Business Week* has discovered GLC) the numbers are small. The deaths aren't trivial, by any means, and the absolute lethality of this problem led to a highly focused effort to solve it.

There haven't been any in 2 years now*, knock on wood, but don't get complacent. Chances are, you've been invited to learn how to strain properly. Now all you have to do is stay in shape and keep the method high on your list of conscious priorities during the fight — real high. This jet is *not* better than the practiced, properly straining man.

*Since this article was written, two F-16 mishaps occurred which appear to involve G-induced loss of consciousness. Ed.

Loss of Situational Awareness

I saved this one for last, because it's more complex and far more important than the other categories — only 23 percent of the total, but almost two-thirds of the fatalities. And they are 85 percent fatal. Worse, to my mind, they represent a limitation to fully using this jet's awesome combat capability.

First, my definition: These are any mishaps which have as their mechanism loss of SA and unintentional flightpath change. Remember the kinds of spatial disorientation (SDO) as you think about these.

- Type I: Unnoticed vector, and often altitude, change.
- Type II: Perceived SDO.
- Type III: "Vestibuloocular disorganization" — vertigo so bad your eyeballs may actually be cycling back and forth, making it impossible to focus on the gauges, much less to think your way back to straight and level. Very few aviators have come back to describe this one.

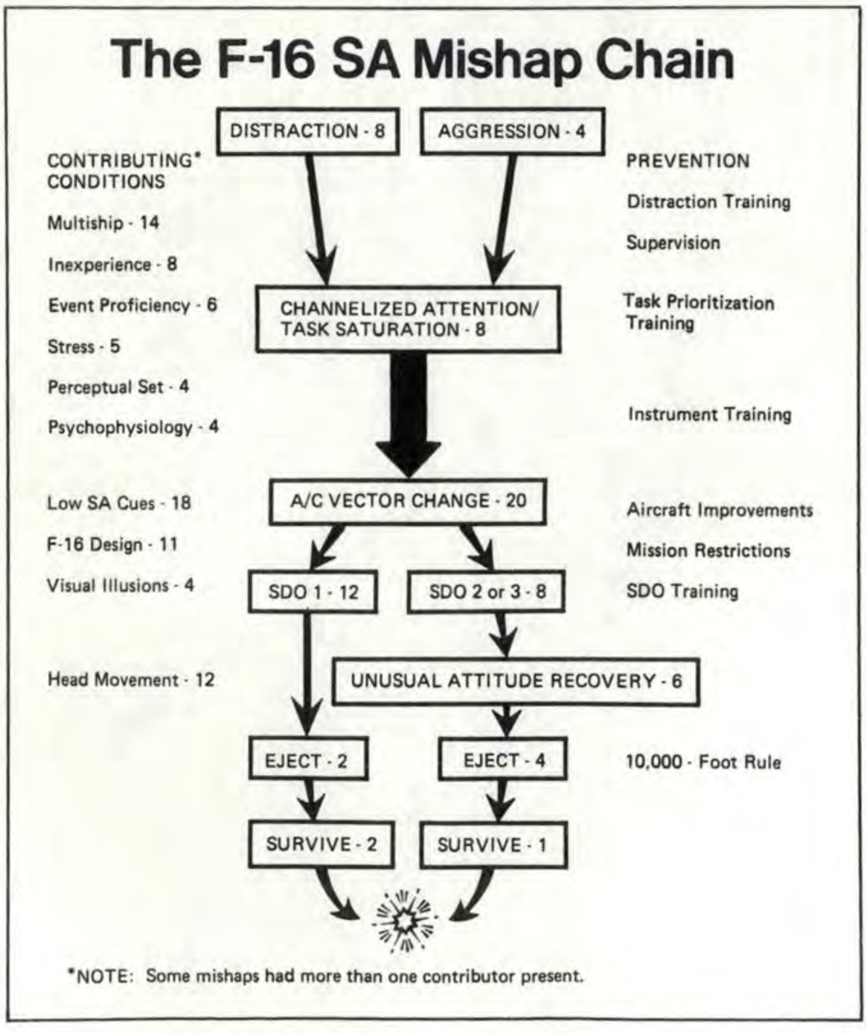
Now, a quick look at some SA mishap flight profile data. Thirty-five percent were at night. Given that we fly around 10 percent of our time and sorties at night, it seems to me that night flying is three to four times as dangerous as day. You could have told me that.

None of these mishaps were in large force exercises. All were routine two- to four-ships, and only three were from deployed locations.

Twenty-five percent (five) happened during departure — all daytime. Four of these five are closest to a pure SDO mishap: Into the overcast in control, out of it 10 to 30 seconds later in a steep, unrecoverable dive. It's no use laying on restrictions on takeoff weather, either — all of these climbed to at least 3,000- to 5,000-feet AGL.

Sixty percent (15) were during the employment phase, split evenly among air-to-ground weapons delivery (4, 3 at night); air-to-air (4, 1 at night); and low level navigation (4, all day). The remaining 3, or 15 percent, were night instrument recovery mishaps. This distribution remains the same for all fighter SDO mishaps.

Figure 2



*NOTE: Some mishaps had more than one contributor present.

Traditional analysis aside, there is a definite pattern to these sobering events, a progression you instinctively know already: Procedural breakdown, then flightpath vector change, followed by collision with the ground (Type I SDO) or terminal SDO (Type II or III).

For these 20 Class As, I've taken the major mishap chain factors (those which, if removed, would prevent the mishap), compiled the conditions making this sequence more likely, and "prescribed" some solutions. See figure 2. The numbers in the sequence are hard numbers; more than one contributor was present in some mishaps. A few definitions and explanations will help.

Distraction An *unexpected* cockpit event, guaranteed to arrest the attention of even the most imperturbable jock. Like both the A/C and FLCS battery lights coming on simultaneously, a "thump" during a tense ILS final, a "problem" transmitted, or no bomb release when all conditions were met.

Aggression Pride goeth before a fall. An irrational will to succeed in "combat" to the exclusion of all else. Three of these surrendered SA during an engagement, the fourth had "never gone through dry." Still hasn't, and won't have another chance. My all-time favorite, though, is the two A-model drivers, close friends and rivals, who apparently decided to fight to the death — and did, two smoking holes 200 meters apart. A true story; fortunately not a USAF mishap.

Psychophysiology Fatigue, nutrition, circadian rhythm, life problems. A small number compromised their chances through these. But even clean living didn't save the other 16.

Stress Pressure to perform way above the norm. For stan eval, the DO, or a last practice flight-lead check.

Channelized Attention/Task Saturation Best defined in reverse: Not

continued

coming back frequently, real frequently, to the attitude and altitude SA gauges. Often tied to inexperience or event proficiency, which, incidentally, are my estimates of currency. For instance, a highly experienced victim of one of these had not flown an actual weather approach in over a year.

Two others were doing their first night approaches since graduating from fair-weather RTUs. Channelized on what? Five of these spent too much time in the REO or MFD, another followed the allure of some train lights and perhaps his HUD target locator line into the ground.

Aircraft Vector Change Of course it does, all the time, and you correct it back. But 30- to 70-degrees nose down? No way, not by itself. Try this simple test: Set up a level, 30-degree bank turn, just like an instrument departure. Turn the jet loose for 30 seconds and see what it does. I've found it actually rolls out some bank, more often than not, and sure doesn't head rapidly downhill as in these mishaps.

I think these extreme nose-down angles result from failed unusual attitude recoveries. The best proof I've seen that channelizing attention causes altitude changes was an A-10 simulator study a few years back. It showed that even IPs would take up to 44 seconds and lose up to 900 feet doing routine cockpit tasks, even after being asked to maintain altitude. And that was with no distractions. Experiments on MiG drivers doing road recce under flares (I wonder where?) showed they looked outside for 30 to 40 seconds at a time.

Low SA Cues Not a coincidence that 90 percent of these mishaps occurred in suboptimal visual conditions: Night, clouds, haze, or flat, featureless desert. Fully *80* percent of the data your brain uses to keep you oriented are free from ambient (peripheral) visual inputs, the automatic, unconscious kind. Only trained, conscious, frequent reference to the focal-visual override data from the gauges will save you in these conditions.

The F-16 deprives you of the other 20 percent of orientation data, like sound, vibration, and stick force — worse in the C model, with its overpowering ECS noise. One of these pilots lost 150 knots and 4,000 feet without noticing it. The small, low ADI, weapons-oriented HUD, canopy reflections (not so bad in the C model), and instrument lighting derive from the day-fighter design.

Head Movement Either to cope with the distraction or to check the position of the other jet. Moving your head can generate or worsen a vestibular illusion. And remember, checking six has recently been identified as a new form of SDO leading to an unperceived descent. The cockpit of this jet is so narrow that *any* console light or switch is a potential "vertigo trap," not just the obvious ones, the oxygen regulator and the FLCS test switch.

Perceptual Set AKA expectancy. The human mind is a pattern recognizer and uncritically accepts inputs that fit its anticipated pattern, like the 30-degree right, 150-degree left bank symmetry of the pitch ladder, or a false horizon at night.

Prevention

Collision-with-the-ground, formerly CFIT, before that pilot error, or vertigo — call these what you want, but they are a constant in fighter aviation. The rate of single-seat SDO mishaps has essentially not decreased as far back as my data go (1970). But mishap causes can be changed, as GLC and logistic mishaps were.

Reversing an ops factor trend depends on supervision and training. And training is not just an article like this, or a flight safety meeting, or a technique mentioned in a mission briefing. Maturing a skill into a dependable, automatic response requires practice in a part-task trainer, a simulator, or best of all, the jet. Once firmly encamped on that high plateau of the learning curve, though, mental rehearsal can preserve up to 80 percent of your proficiency.

A large percentage of the human factor mishaps can be eliminated through proper training. But, once the trend has been reversed, we can't relax. If we do, the problem will recur. GLC mishaps are a good example.

Distraction Training We are taught how to handle the unexpected malfunctions, from nuisance to heart-thumper, but usually only to refine our emergency procedures knowledge. How frequently our eyeballs come back to the ADI, or the amount of deviation of the jet during the analysis and correction is not part of the grade sheet. And what of malfunctions that are not even in the Dash 1, as at least three of these dead men confronted?

An ingrained, even Pavlovian response back to the ADI when any nonstandard cockpit event occurs could have saved the eight distractees, plus, by passive transfer, some of the others. Right now you get some of this exposure from General Dynamics, Pratt and Whitney, and General Electric, like that Master Caution at night with the lights dim after takeoff. Or the altitude warning on takeoff, if we ever get the CARA back. Or a new one I discovered last week, on the wing in night weather, when the engine anti-ice light lit up the Master Caution to tell me it had turned on the anti-ice system. Thanks, I needed that.

The trouble is, those become expected, and no longer distract. The training technology is already available. We medics have devices that can track your eye movements, even when you aren't aware of them. (We could even use the new one we have. You know, the model that doesn't require the sharp needle in the eyeball.)

Task Prioritization Training "Maintain aircraft control" is the prescribed first step of handling any emergency. And I've heard good briefings recently on the safe method to fly a trail departure (even though only one of these and one F-15 mishap occurred doing this). But we still have these SA mishaps, which makes me more convinced that words in regs, "command guidance," or articles such as this one are not enough.

The first, cognitive phase of training, maybe, but practice and feedback are still needed. We teach and practice priorities for the instrument cross-check, and the "How Low Can You Go?" tapes are valuable, but more specifics for other employment phases are needed. A recent safety board also cited inadequate multiship task training as a factor. The same MiG drivers are told to spend *90 to 95 percent* of their time on the gauges under flares.

F-16 Improvements The line-in-the-sky and radar "break X" have probably saved a jet or two already. The C's bigger HUD with its wide horizon line is much more effective. The radar altimeter and the proposed autorecovery system will help, later. For now, I'd rather be fully trained.

Instrument Training Like the value of the dollar, has recovered somewhat of late. In another era, in another single-seat RTU, we were exiled to the *instrument squadron* for a painful month under the despised rear-seat hood. Later we had simulators only, and now a better blend of sim and flying training. Designing a workable vision restricting device is a high priority right now, which could profitably resurrect proper:

Unusual Attitude Training Even the best-trained pilots will inevitably come back to the ADI and get that sinking feeling that the jet's not going where they feel it should be. Now you have a choice, autopilot or unusual attitude recovery. Every one of you can recite the recovery method verbatim, but once again, I'm a bit skeptical. Unless you've practiced it under the same conditions of visual deprivation and vestibular conflict, you aren't fully proficient. Current sims simply don't provide that. Instrument and unusual attitude training breed confidence also.

SDO Training The Red Flag approach: Fearful things, once faced, lose their sting. Planned, disorienting, vertigo-generating demos, then a smooth, thoughtful recovery — hooded acro. Until the next generation centrifuge-like, SDO trainers are ready, only flying training will suffice. In 5 years of flying this jet, and the previous 3 in the Hog, I haven't been graded on unusual attitude recovery on a check ride. Have you?

The 10,000-Foot Rule Not a rule, actually, but should be. Nobody hesitates to eject when the jet has turned to engineless flight. And we do a great job of convincing guys to bail out at 10,000 feet if the aircraft is out of control. But what if the *pilot* is unable to control the aircraft?

At least five, probably six, of these eight victims of SDO would be alive if this guidance was expanded to include perceived severe SDO below 10,000 feet. Four ejected, three way too late; one survived. Perhaps these pilots feared the end of their flying careers if they admitted SDO, as was the feeling about admitting GLC a few years back.

An unreasonable fear, I think. Given the weather conditions, supervisory errors, and inexperience, it looks to me like their commanders would have sent five of these six right back out to fly again — after some training — which is what SA mishaps are all about. ■

Safety Warrior

But for the Grace of God

The following article was adapted from the September 1948 *Flying Safety* magazine. It tells a chilling story about the possible results of a break in flight discipline of one aircraft as it affects another.

■ A great man once said, "God must love the common people, he made so many of them." A junior officer in the Air Force, one of the thousands who do the flying and fighting in the tactical units, goes about his duties today secure in the knowledge that a Grace beyond human knowledge does stand watch.

This pilot, call him Lt Jordan, walked away from the wreckage of his F-80 after another plane forced him to attempt a go-around from an emergency landing.

The flight began as a local formation training hop from an Eastern air base. Approximately 40 minutes out at 20,000 feet, Lt Jordan noticed his engine running rough and notified the flight leader. The flight leader and his other wingman started back to the base escorting Lt Jordan home.

Reaching the vicinity of the field, Lt Jordan called the tower for landing instructions and advised them of his difficulty. A letdown was made in preparation for a landing on runway no. 5. Some 5 miles from the runway on the initial approach, Lt Jordan again called the tower saying his engine was vibrating excessively. The tower replied that he was cleared for landing and advised that a B-25 on the base leg was being instructed to go around.

Lt Jordan flicked his eyes over the panel and licked his lips briefly as the field rushed underneath. He made his pullup and lowered his gear. He was okay now.

Major Slatterly and Captain Bleek in the B-25 were returning from a 400-mile jaunt up the coast. They had been a little late getting off on the return trip, and it would be a close race with the clock to get back by quitting time.

Reaching the field, they entered traffic behind a landing B-17. The pilot slowed the Mitchell down in an attempt to stay far enough behind the landing Fortress, but to no avail. He was forced to pull up and go around.

As they turned on the second base leg, the two B-25 pilots noticed an F-80 several miles out on the approach. The turn onto final was made and the approach set up when the tower called for a second go-around, directing the B-25 to make a 360-degree turn to the right.

From here on, the story is muddled. Both B-25 pilots swore they received no instructions to go around, pleading poor reception because of heavy traffic on B Channel. However, both tower operators had another story.

Both tower operators swore they heard an acknowledgement of the go-around order in the form of a question, "Tower, did you say make a 360 to the right?"

The mobile control officer stated that when Lt Jordan requested the tower to send the B-25 around shortly after his peel-off, the tower advised him that the B-25 had been instructed to go around. Immediately after this transmission, the mobile control officer saw the B-25's nose drop drastically as the plane went ahead and made a landing. Both the F-80 pilot and the Mobile Control Officer heard the go-around order which the B-25 pilots did not receive because of "jamming" on B Channel.

One tower operator continually advised the B-25 to go around all the way down the final approach, while the other operator held a red light on the plane throughout the approach.

As Lt Jordan pulled up in his breakaway, he sighed in relief. He was in perfect position for a landing even if his ailing engine quit altogether. His relief was short lived.

As he rolled around where he could see the field, he noticed the B-25 still on the final approach. Hastily he called to the tower to send the Mitchell around and received the reply that the B-25 had been ordered to go around.

Lt Jordan continued his approach, watching the B-25 apprehensively. The F-80 was eating up the distance rapidly — too rapidly. The Mitchell was not going around! The B-25 rounded out and touched down directly in the path of Lt Jordan's plane.

Lt Jordan immediately added power, getting only 87 percent, and retracted gear and flaps for an attempted go-around. At 300 feet, approximately a mile and a half from the field, he started a turn to the left. There was a loud noise in the engine compartment, and the engine quit cold.

The mobile control officer heard Jordan's cryptic, "It quit. I'm going in."

Lt Jordan locked his shoulder harness, pulled the battery disconnect switch, and shut off throttle and fuel switches. He headed for a fairly open area ahead.

The F-80 slashed down through a fringe of timber, shearing off two trees approximately 6 inches in diameter, struck the ground, and skidded finally to a stop against an embankment. For a moment there was dead silence following the roar of the crash. Slowly the dust settled over the still wreckage. Then miraculously the pilot stirred, freed himself from his harness, and crawled from the wreckage. He suffered only minor injuries.

Because another plane failed to heed tower instructions, Lt Jordan might be dead today. When he happens to pass a field of stones and crosses, he knows the source of the small voice that murmurs, "But for the Grace of God . . . " ■

It's hard to believe anyone could walk away from this pile of wreckage with only minor injuries. It's also hard to believe that another pilot's stubbornness in refusing to follow controller instructions caused this mess.

USAF SAFETY AWARD

The Koren Kolligian, Jr., Trophy

■ The Koren Kolligian, Jr., Trophy was established in 1957 in memory of First Lieutenant Koren Kolligian, Jr., declared missing in the line of duty off the coast of California on 14 September 1955. The Kolligian family established this memorial because of Lieutenant Kolligian's great feeling for the Air Force and love of flying. The award recognizes outstanding feats of airmanship by individual aircrew members. The trophy is awarded annually to the USAF aircrew member who most successfully coped with an in-flight emergency situation during the award year.

THE KOLLIGIAN TROPHY FOR 1987

CAPTAIN BRADLEY J. COLLINS

86th Tactical Fighter Wing

Captain Collins was flying a dissimilar air combat training sortie at Decimomannu Air Base, Sardinia, when his F-16 aircraft experienced a zero oil pressure condition. At the time of the incident, the aircraft was 6,000 feet above the water, over 600 knots airspeed, and 50 miles from the nearest recovery field. He accomplished all required steps to recover the aircraft, but the engine completely seized 15 miles from the field. Despite the engine flameout, inoperative normal landing gear extension, inoperative nose wheel steering, and inoperative brakes, he successfully accomplished a flameout landing and cable arrestment. Throughout the incident, Capt Collins exercised superb judgment in continual assessment of recovery conditions and alternatives to a safe landing which would ensure minimizing the impact of a forced ejection. ■

Hurricane Hunters Handle Hercules

LT COLONEL CHRISTOPHER D. MAYS
Commander, 53 WRS
Keesler AFB, Mississippi

■ Just about to touch down on the runway and ready to call it a day, the Hurricane Hunter crew was about to get real busy. As the main wheels touched down, the aircraft leaned to the left, the gear warning horn went off, and the gear indication system showed an unsafe left main gear. This was most unusual as the gear had been checked down and locked and reported so to the tower.

Before the aircraft could settle on the gear doors, the pilot took the aircraft around and initiated the necessary procedures and radio calls to begin solving the problem. Working together, the crew completed all applicable emergency checklists and chained the gear down to prevent separation on landing. Several agencies responded to prepare the airfield for recovery of the emergency aircraft and minimize any further complications.

The crew brought the aircraft back in for an uneventful landing and finished the day with an emergency ground egress. Subsequent inspection discovered a critical gear component had failed, giving normal indications until weight was put on the gear. All in all, an exciting day where quick thinking and professional actions prevented serious damage to a valuable resource. ■

FSO's CORNER

Spot Inspections

CAPTAIN DALE T. PIERCE
919th Special Operations Group
Eglin AFB Aux Fld 3, Florida

■ A few weeks ago, while I was talking to the Tactical Air Command Inspector General's FSO, he told me about a spot inspection program developed by a squadron FSO at Nellis AFB, Nevada. Major Hambrick was particularly impressed with the program's functional and easy-to-use format. So I called out to the 430th Tactical Fighter Squadron (TFS) to get the details.

The 430 TFS Spot Inspection Program is a systematic approach to enable the squadron FSO to accomplish something that is done in a haphazard fashion in many units. The program addresses a number of areas applicable to flight safety. Those chosen for the 430 TFS are the following.

- **Quarterly:**
  - a. Dropped objects.
  - b. Maintenance engine runs.
  - c. Maintenance facilities and procedures.
  - d. Exercises and mission plans.
  - e. Low-level routes.
  - f. Egress training.
  - g. SOF program.
  - h. Range control officer.
- **Every 6 weeks:**
  - a. Squadron flight safety meetings.
  - b. Materiel deficiency reports.
  - c. Life support.
- **Monthly:**
  - a. Aircraft launch and recovery.
  - b. Maintenance debriefings.
  - c. Flight briefing rooms.
  - d. Flight planning room.
  - e. Flight briefings.
  - f. Squadron ADFSO.
  - g. Foreign object damage.

The documentation for the program consists of two parts; a status board and a logbook. The status board lists the months of the year along the top and spot inspection areas down the side. The main area of the status board displays a matrix that shows for each month whether a spot inspection was conducted, whether deficiencies were found, and whether required followup is complete. At the bottom of the status board is a legend explaining the symbols entered in the matrix.

The logbook makes up the second part of the documentation. The logbook is a 1-inch, black, three-ring binder. The pages in the logbook are of two types. Each left-hand page is a brief checklist in question form that covers one of the areas identified on the side of the status board. Each right-hand page has a series of blank boxes relating to the checklist items on the left-hand page. The boxes are for the spot inspector's name, the date of the spot inspection, findings, and any followup action required or taken.

The system makes trend analysis fairly simple, serves as its own reminder of outstanding spot inspections, and provides a consistent standard for different people to use when conducting spot inspections. What could be better?

Captain Mike Smith provided this month's FSO's Corner idea. He's the FSO at the 430 TFS at Nellis AFB, Nevada, AUTOVON 682-8361.

The FSO's Corner needs your ideas. What are you doing in your program that would help other FSOs if they knew about it? If you have something, call me (Dale Pierce) at AUTOVON 579-7450 (SMOTEC), or send your name, a brief description of your idea, and your AUTOVON number to 919 SOG/SEF, Duke Field, Florida 32542-6005. ■

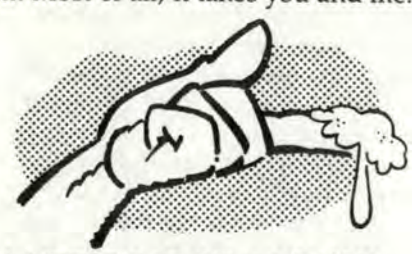
MAINTENANCE MATTERS

PENS ARE FOR WRITING

■ While passing through 31,000 feet on initial climbout, an Eagle pilot heard a hissing sound in the cockpit. Shortly thereafter, he began to pressure breathe. The pilot selected 100-percent oxygen, declared an emergency, and landed the aircraft uneventfully.

Post flight inspection revealed a ballpoint pen was lodged in the aircraft's cockpit pressurization relief valve.

Foreign objects are everyone's problem, and it takes everyone, operational units and the maintenance activities, working together to solve it. Most of all, it takes you and me.



A LITTLE DAB WILL DO YOU

Years ago, a famous hair cream commercial ended with the phrase, "A little dab will do you." Somehow, that phrase might apply when we look at our aircraft lubrication procedures.

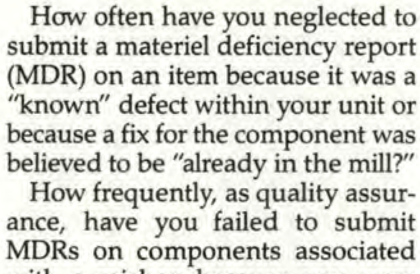
While flying at 31,000 feet, a KC-135 crew noticed the ailerons were extremely hard to move. All attempts to free the ailerons, such as turning the autopilot off and pulling system circuit breakers, were fruitless. The crew declared an inflight emergency and, while descending to land, the ailerons returned to normal. Fortunately, the crew made an uneventful landing.

When maintenance closely examined the aileron system, everything from control rigging to the autopilot system checked good. Looking further, they discovered all of the drain holes on the left and right inboard spring cartridges were clogged with grease. There was also approximately a half cup of water in each spring cartridge. Where did the grease and water come from?

During the previous phase inspection, maintenance folks had overlubricated the left and right spring cartridges. There are water drain holes in the bottom of these cartridges. Over a period of time, the grease came off the springs and blocked the drain holes.

When the aircraft spent an extended period of time at altitude, water that had accumulated in the spring cartridges froze and created the binding in the ailerons. As the aircraft descended, the water thawed and the binding decreased.

This unit briefed their people on the importance of properly lubricating the spring cartridges in the flight control system. Perhaps there's a lesson here for other units, as well, on the importance of the careful lubrication of aircraft components.



BREAD AND BUTTER

How often have you neglected to submit a materiel deficiency report (MDR) on an item because it was a "known" defect within your unit or because a fix for the component was believed to be "already in the mill?"

How frequently, as quality assurance, have you failed to submit MDRs on components associated with a mishap because you were certain which was the faulty component in the sequence of events?

How many times have aircrews or maintenance people not documented a "one time" or intermittent component failure because they thought it to be no more than a fluke?

Here's one high accident potential that, based upon daily mishap message traffic, seems to occur all too frequently.

During a local mission, a pilot experienced a violent uncommanded nose down pitch with his aircraft. No caution lights were illuminated and all warning light circuits checked good. He had just declared an emergency when the aircraft again pitched down violently.

Through some skillful flying, the pilot landed uneventfully at home base where the aircraft was immediately impounded.

Like a team of skilled surgeons, a group of maintenance technicians went to work on the aircraft.

Using the applicable tech data, the team troubleshot the flight control system extensively and found no less than three pitch control components defective. In addition, they documented every maintenance action in the aircraft forms. But they forgot one thing. They turned all of the faulty parts back into the supply system without any MDR action.

All too often, we overlook the action of submitting defective components, especially those involved in potential or actual mishaps, through the MDR system.

How do you know a component, any component, does not have major defects that would affect all aircraft in our community if you don't allow statistical documentation and followup correction?

The bottom line is to let the engineers determine via MDRs which component was faulty. Let the analysts compile the statistics, flag the high failure items, and give us the feedback.

What's our bread and butter in the mishap prevention business? The proper submission of MDRs. ■

OPS TOPICS

Smoky Takeoff

■ Shortly after takeoff, the F-4 pilot got a call from tower that his aircraft had dispensed ordnance during the takeoff. The pilot remembered seeing the green "power on" light on the ALE-40 system for a few seconds.

The navigator had placed his checklist over the ALE 40 dispenser panel before takeoff. When he did so, the checklist moved the switch guard up and the ripple switch to the ripple position. All 15 Smokey Devil flares were dispensed on takeoff.

Crewmembers, be careful where you put your checklists. To prevent accidental activation, make sure you don't place them on or near switches.

Don't Turn

A few minutes after takeoff, the pilots of a B-52 noticed a 5-degree heading difference between the primary and alternate systems. They shut down the No. 1 INS and used the alternate system. At that time, it had a 10-degree heading error.

The error increased with each turn and soon reached 35 degrees. Fifty minutes after takeoff at 20,000 feet, things got more serious. Both pilots lost their attitude indicators, heading indicators, TACAN, and VOR.

The crew found the phase C circuit breaker had popped and wouldn't reset. Remaining in VMC, they descended to 10,000 feet to burn down fuel while they troubleshot the problem with the command post. However, their situation wasn't covered in any of the flight manuals.

The crew penetrated a thin broken cloud deck using the standby attitude indicator and flew a no-gyro PAR approach to an uneventful landing.

The problem was traced to the remote attitude indicator rate gyro. Prior to this mishap, no one was aware that a failure of the rate gyro would remove power from critical flight instruments.

Had they known, the crew could have removed the connector from the rate gyro and reset the circuit breaker to restore power to their flight instruments. Fortunately, the weather was VMC.

To Reset or Not To Reset . . .

During preflight, the KC-135 crew noticed the No. 2 forward and aft boost pump circuit breakers (CB) had popped and reset them. A few minutes later, both CBs popped again and were reset once again.

During engine start, both CBs popped a third time. This time, the crew decided something might be wrong and aborted the aircraft.

When the electrical specialist started to work on the aircraft, he disconnected the wrong cannon plug in the left wing, reset the popped CBs, and turned on the boost pumps. The CBs popped again.

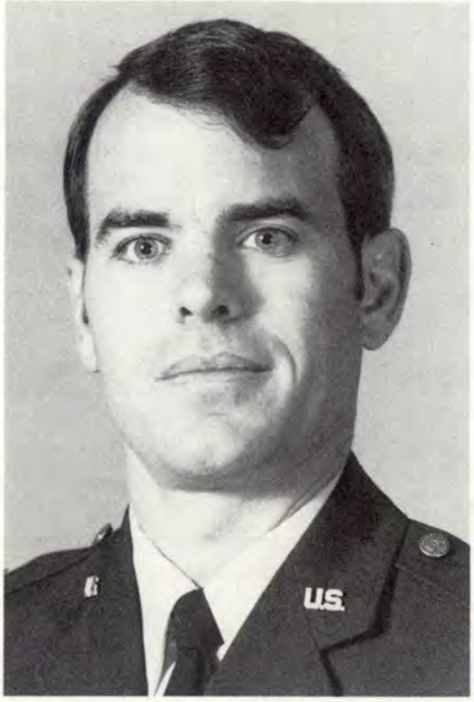
The technician went back to the wing to see what was wrong and found the cannon plug and wiring harness were on fire. He summoned help and a ground crew member extinguished the flames with a hand extinguisher.

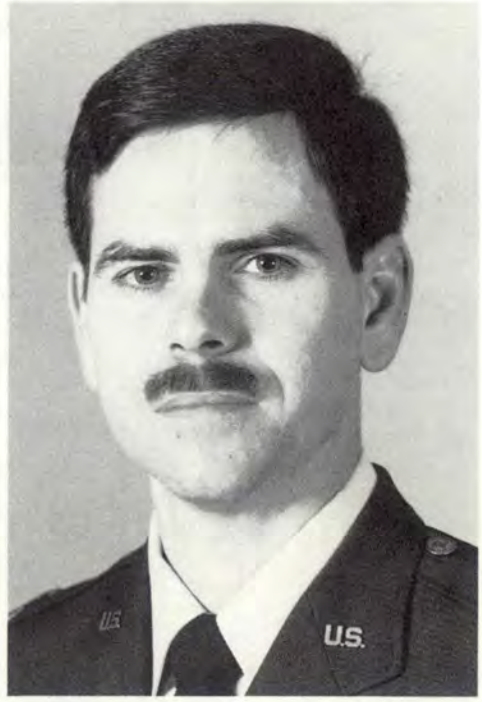
The question is, "How many times should you reset a circuit breaker?" A good technique is — *Once.* A popped CB is telling you the circuit is overloaded. If you keep resetting it, you're just asking for trouble. ■

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 Mishap Prevention Program.





CAPTAIN
Jeffrey A. Burrows

CAPTAIN
Patrick W. Thiele

480th Tactical Fighter Squadron

■ On 10 February 1987, Captain Burrows, pilot, and Captain Thiele, electronic warfare officer, were flying as no. 2 in a flight of three F-4Gs at night. During the recovery, they noticed the leading edge slats were rapidly cycling in and out. Captain Burrows informed the flight lead and locked the slats in the out position.

Shortly afterward, Captain Thiele noticed smoke and fumes in the rear cockpit and that two fuel boost pump circuit breakers had popped. He directed the pilot to go to emergency and 100-percent oxygen. The smoke coming from the circuit breaker panel increased in intensity, and Captain Thiele told the pilot to shut off the generators.

Captain Burrows shut off both generators to stop the smoke and pulled the emergency vent knob to clear the smoke and fumes. He then informed lead he would have to make a formation approach until clear of clouds, followed by a night approach and arrestment on a wet runway without the stability augmentation systems and using the emergency attitude indicator.

Captain Burrows flew the wing position for the weather penetration, and on 8-mile final, with the field in sight, assumed the lead. Using a combination of emergency instruments and the VASI lights, he completed a flawless approach and landing, successfully engaging the cable.

Upon teardown of the circuit breaker panel, maintenance found evidence of wire cases fused together. The technician theorized that if the generators had not been turned off, the resulting fire would have been catastrophic.

The thorough systems knowledge, decisive action, and excellent crew coordination displayed by Captains Burrows and Thiele prevented the possible loss of a valuable combat aircraft and its crewmembers. 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 Mishap Prevention Program.

MAJOR

Robin K. McAllister

61st Tactical Fighter Training Squadron
MacDill AFB, Florida

■ On 15 June 1987, Major McAllister was the instructor pilot in the front seat of an F-16B. His student in the rear cockpit was flying a TACAN approach. During the low approach, just prior to gear retraction, the engine RPM suddenly rolled back, followed by several severe compressor stalls.

Major McAllister immediately took control of the aircraft. Quickly analyzing there was insufficient runway to land, he gently maneuvered away from the ground and turned the EEC/BUC switch off. With no improvement in engine response and airspeed decaying to 145 knots, he placed the EEC/BUC switch to BUC, gently turned the stricken aircraft away from the populated area, jettisoned his centerline tank, and told his student to prepare for ejection.

Soon after BUC was selected, the compressor stalls stopped, but thrust remained low. With his aircraft at 200-feet AGL and 140 knots, Major McAllister started a shallow climb and requested an immediate landing. The most conveniently aligned runway was closed, so he was forced to rapidly change his plan while continuing to maneuver his disabled aircraft.

Deftly trading airspeed for altitude, he flew to a base key position for the open runway. Major McAllister then executed a flawless approach and landing. Shortly after getting his aircraft stopped, the engine completely flamed out.

Clearly, Major McAllister's time-critical decision making and superb flying skill are responsible for preventing possible loss of life and for the safe recovery of a valuable combat resource. WELL DONE! ■

FOD SEARCH

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FOD is where you find it.

You should never stop looking for FOD. How many examples of FOD can you find on this page, reading in a straight line in any direction (horizontally, vertically, and diagonally). For the answer, all you FOD Finders turn to the index on page 1.