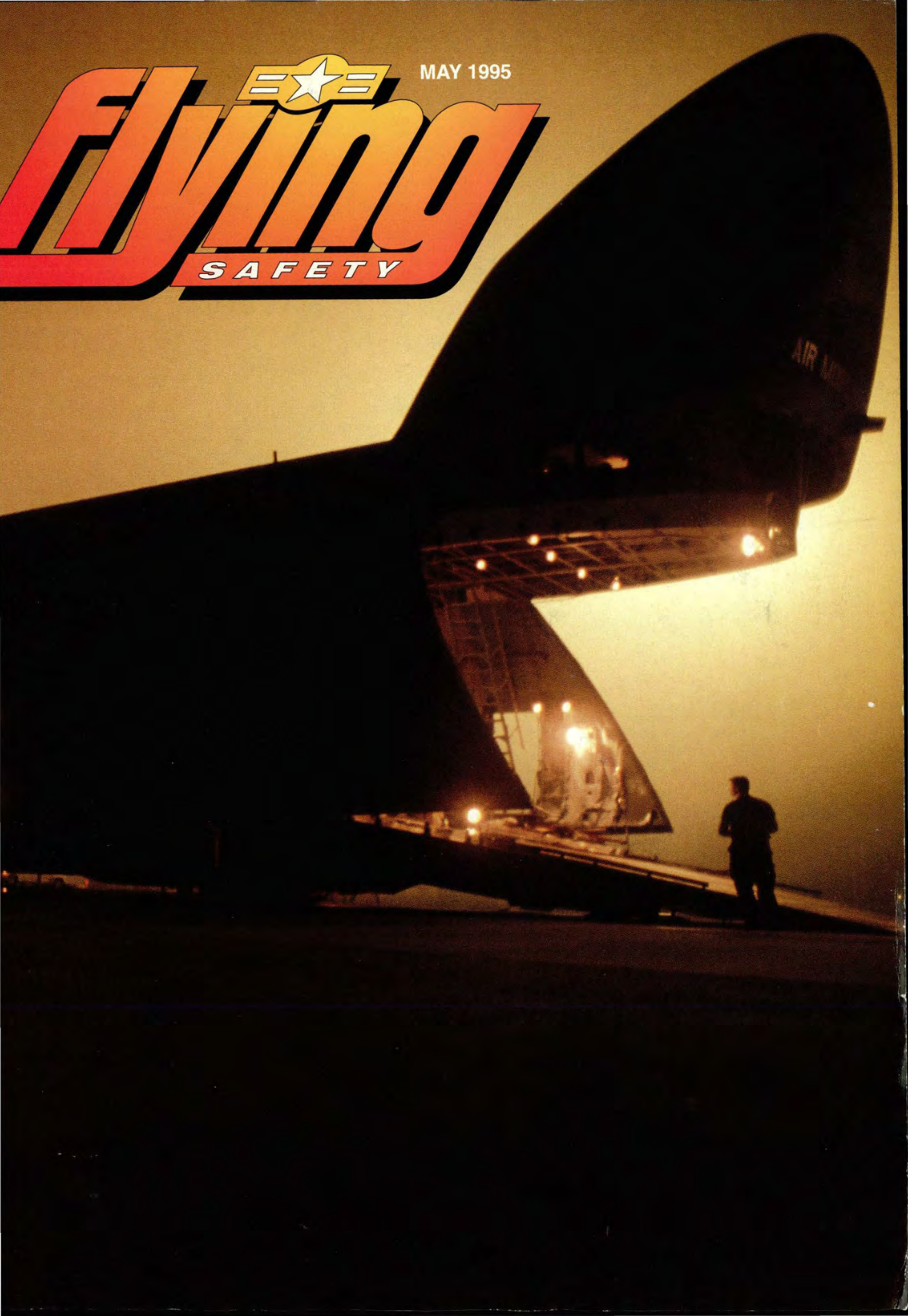
flying SAFETY

MAY 1995



SAFETY IS NO ACCIDENT

by GENERAL ROBERT L. RUTHERFORD
COMMANDER, AIR MOBILITY COMMAND

■ Safety is the cardinal principle upon which rests the wartime availability and readiness of America's airpower. Diligence, attention to detail, and doing things right the first time — each of these contributes to our overall task of being combat ready for global reach, global power, and global presence. Let's consider where we've been and where we're headed.

My up front assessment — 1994 was a good news/bad news story. First, the bad news: We in the Air Force experienced 36 Class A mishaps, resulting in 43 fatalities, during a year notable for its high OPTEMPO. The suffering isn't limited to the victims and their families; it touches all of us who serve. Now the good news: There is an outbreak of excellence within the Air Force. In most places, our continued safety vigilance led to overall reductions in reportable mishaps. I took the helm of Air Mobility Command in October 1994, and inherited a command in which safety was (and still is) part of the culture. I encourage you to be personally responsible for safety. It isn't just the job of the safety office to prevent mishaps — it's **our** job, too. Together we can make 1995, and the rest of this century, a good news story.

Each of us must be accountable for safety. If you see something that looks unsafe, it probably is. Don't assume somebody else will notice and fix the problem. You take responsibility for notifying the right authorities, or for personally fixing the problem. You can prevent most aviation mishaps with careful preparation — both personal and professional. Get plenty of rest before the mission begins, and know your mission before you climb into the cockpit. Your situation awareness improves with preparation. Whether on the flight line or in an office, the essence of mishap prevention is thinking ahead — and anticipating the possibilities.

Safety doesn't stay at home — you take it with you when you deploy. And we deploy a lot. We'll continue to support our nation's security interests wherever that may take us, but we'll do it with all due regard for safety. We can't afford to lose anybody or any of our assets to carelessness or recklessness. Every person lost to accidents, every aircraft down for repairs as a result of a mishap, and every spare part used to fix a preventable problem robs our nation of a portion of our readiness. We must be good stewards of our assets. But, beyond the financial responsibility we bear for the equipment we use, we have a more important, personal responsibility to every airman in our Air Force.

Safety is no accident — it's on purpose. Preventing mishaps is our personal charge and our continuing challenge. ■

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Page 4


Page 8


Page 14

Cover photograph by SrA Jeffrey Allen

SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS

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Official USAF Photo

■ This mission was like a standard simulator scenario which was so unreal I was sure it would never happen to me. It was a cold, winter night in 1994 when our KC-10A crew was scheduled to depart at 0300 from Altus AFB for a Coronet East deployment of six RF-4s from Boise, Idaho, to Incirlik, Turkey. I was flying in the left seat with a Dutch foreign exchange officer occupying the right seat. Between the two of us, we had over 4,000 hours of experience in various aircraft.

When we were alerted around midnight, I opened the door to what we all dread in weather, WOXOF. An initial call to the weather shop did not provide much hope either. The best they could do was 100 OVC 1/8 mile, and rain by 0300.

After a quick call to 2d Air Delivery Group (ADG) to coordinate with the RF-4s, and Fairchild AFB to reschedule the KC-135Rs, we delayed our takeoff by 1 hour. The next call went to the Tanker Airlift Control Center for approval to take off with 1,000 RVR. With approval granted, we went to work at base ops to complete the extensive mission planning.

While the pilot and I were working the mission plan, the rest of the crew went to the aircraft to prepare it in the event the fog would lift sufficiently for mission departure. The flight engineer and boom operator directed the aircraft preparation with our crew chiefs and the ground support personnel from Altus. Satisfied they would run with the ball and do everything possible to be ready, I was able to concentrate with the pilot in preparing ourselves for the mission.

With mission planning complete, we spent the last half hour in base ops discussing our heavyweight (583,000 pounds) takeoff, just under the max gross weight of 590,000 pounds. We discussed making a static takeoff in order to have maximum runway in front of us since we were working with a balanced field situation, (i.e., the amount of runway needed for our takeoff or abort was exactly what we had available).

Next, we discussed what we would abort for if necessary, and if airborne, what our takeoff alternate (McConnell AFB) was, and what we would have to do to safely divert the aircraft. Satisfied that we had discussed all possible contingencies, we departed base ops for the aircraft.

At the aircraft, the weather appeared to be improving. The crew had completed all preparations for an on-time departure. We made a phone patch through command post to 2 ADG and Fairchild to confirm our intentions to depart at 0350. With that, the KC-135s launched, followed by the RF-4s as the KC-135s came overhead Boise. Our takeoff would occur 1 hour after with an en route rendezvous over Iowa City.

After completing all checklists and with all our duty passengers on board, I briefed all crewmembers about how the departure would be accomplished. All previously discussed options in base ops were reviewed with the crew who would be on the flight deck. With everyone feeling comfortable with their assigned tasks, we proceeded with engine start.

As we taxied out, I discussed all abort options with the pilot, flight engineer, and boom operator. As we approached the hold line, the weather had improved to 100 OVC 7/8 mile visibility with a wet runway. With everyone properly briefed in the cabin and cockpit, we took the runway for the ride of our life.

I positioned the aircraft over the white hash marks on the end of the runway and transferred aircraft control to the pilot for his takeoff. With the engines coming up through 100 percent N1, we released brakes and started takeoff roll at 0345. As the aircraft approached 128 knots, the No. 1 engine EGT light illuminated. Checking the EGT light within limits, we continued.

At 132 knots, the aircraft experienced a momentary decrease in acceleration and slight yaw to the left, followed by immediate rudder inputs correcting the aircraft to centerline. At 140 knots, the boom operator notified the crew of a Loop B engine fire light illuminated on the engineer's panel, followed by multiple momentary cockpit fire indications of the No. 1 engine.

At 140 knots, 10 knots below decision speed, I called for an abort which was executed immediately by the pilot. As I was calling tower about the abort and requesting fire response, the boom operator was calling command post (on another radio dedicated to him) with the same information. After his call to command post, the boom operator relayed the abort speed to the engineer for the abnormal brake checklist.

As we continued down the runway, I was calling out runway remaining and speed to the pilot — 7,000 feet, 100 knots. At 6,000 feet, 60 knots, I told the pilot to come off the brakes and let it roll out, at which time I took control of the aircraft.

With all fire indications extinguished, our problem of brake temperatures going into the danger zone started. As I applied the brakes to slow the last 10 knots to clear the runway, all 10 brake temperature lights started to illuminate. I called the tower for the wind speed and direction. As we exited the runway, engines Nos. 1 and 3 were shut down. I turned the aircraft into the wind so the wind would blow down the centerline of the aircraft.

As the engineer started the APU, we shut down the No. 2 engine and, with no rolling motion, released the brakes. Appropriate checklists were accomplished, and emergency evacuation procedures were initiated. Since the fire department and ground personnel had sufficient warning, they were on scene as we shut down the last engine, and air stairs were available to egress the aircraft.

The timely inputs of all crewmembers in the cockpit made for a successfully accomplished abort without further damage to the aircraft or crew. Turning the aircraft into the wind and releasing the brakes also proved to be helpful. The brakes temped out at 475 degrees C without blowing the fuse plugs on the tires. However, the antiskid system worked as advertised and absorbed some 610 million foot pounds of energy and, in the process, melted all 10 brakes.

This incident validated one thing with our crew. Crew resource management (CRM) played an integral role in safely accomplishing a high-speed, heavyweight abort. CRM began prior to takeoff. Repeated crew discussions and briefings in base ops and the aircraft, covering various takeoff emergency scenarios, contributed immeasurably. Proactive CRM facilitated decisive crew coordination throughout this time-critical sequence of events. Everyone did their job as briefed.

The final thought I have is this. I tell all the crews I fly with it does not matter which seat you sit in. If you see something wrong, bring it to my attention. Be concise and accurate.

Remember, good simulator scenarios provide valuable training — so pay attention in the simulator. The pilot and I had this scenario just 3 weeks prior to this mishap. ■

FLYING SAFETY

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WHEN GOOD AVIATORS GO BAD*

A fighter-type aircraft impacted the ground during high-G maneuvering. The pilot made no attempt to eject. Investigation revealed he hadn't flown a high-G sortie in over 5 months, was dehydrated from excessive alcohol consumption, fatigued from an erratic sleep cycle, and was possibly self-medicating.

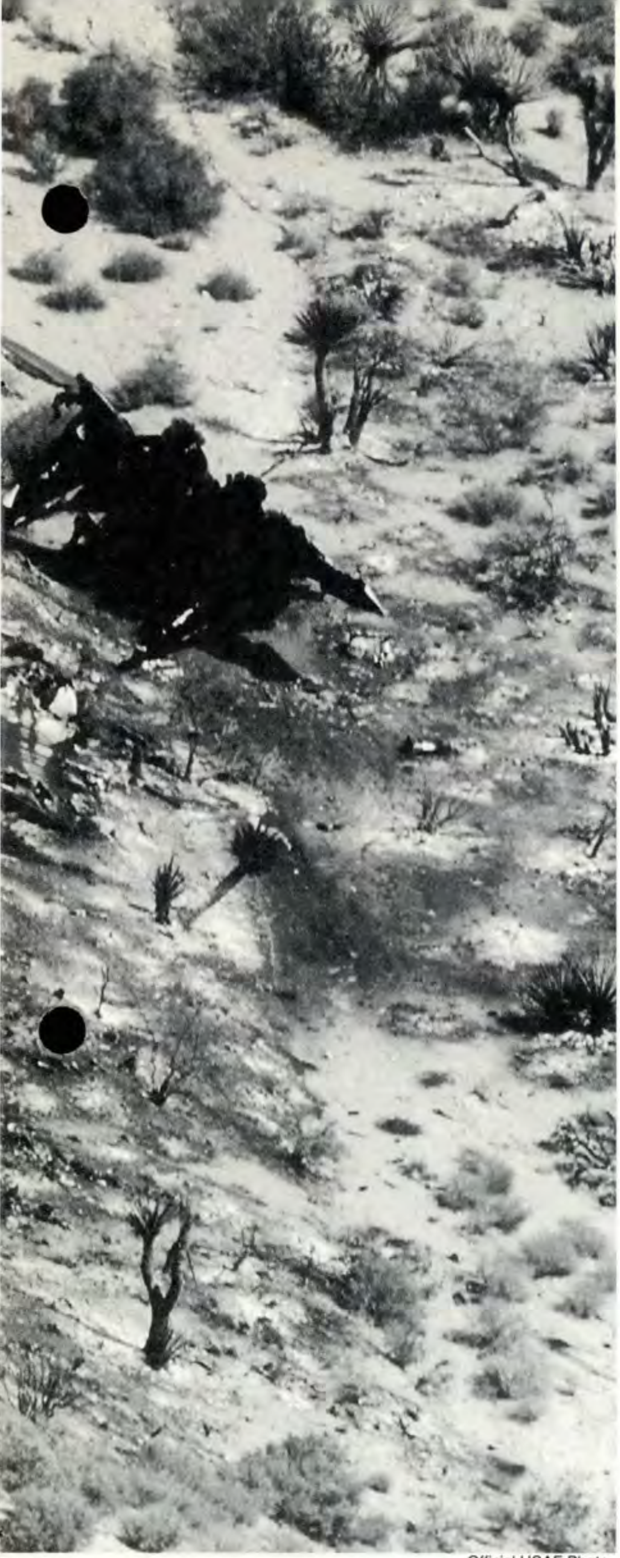
MAJ JEFF THOMAS
HQ AETC/XOTA

■ How do we define air discipline? Look up "discipline" in a dictionary, and you'll likely find *"A system of rules governing conduct or activity ... Controlled behavior resulting from disciplinary training."* Is it applicable to aircrews?

Let's massage the definition in an attempt to bring it in line with something you can take out to the jet. ***Adhering to established procedures throughout the course of a sortie. This includes not pursuing irrational or impulsive courses of action, actions that are inconsistent with established procedure, or actions not prebriefed.***

The archives are full of incidents caused by failing to heed the above highlighted definition. For example:

A fast-mover fighter-type aircraft, flying on an authorized low-level route along an area where friends of the pilot were known to work, performed a near full-stick deflection aileron roll at low altitude and impacted the ground, resulting in two fa-



Official USAF Photo

talities.

Two large Air Force aircraft collided after air refueling when the receiver aircraft moved to a position off the tanker's right wing (in violation of command directives) to allow tanker passengers to take pictures of the receiver. Fortunately, both aircraft safely recovered.

A fighter-type aircraft impacted the ground during high-G maneuvering. The pilot made no attempt to eject. Investigation revealed he hadn't flown a high-G sortie in over 5 months, was dehydrated from excessive alcohol consumption, fatigued from an erratic sleep cycle, and was possibly self-medicating.

Official USAF Photo

What do these incidents have in common? First, there was nothing mechanically wrong with any of the aircraft involved at the onset of the mishaps. Second, they were all preventable. Return to the definition we've developed, and apply the principles of good air discipline to the above-mentioned incidents.

But, you might argue, the last mishap doesn't seem directly related to our aircrew discipline definition. However, had the pilot exercised his responsibility to inform his supervisors that he was unfit to fly the sortie (i.e., the "actions that are inconsistent with established procedures" portion of the definition), the mishap and loss of life could have been avoided. We're talking about responsibility and discipline being "two peas in a pod" here, which begs the questions "What factors constitute aircrew discipline?" and "When have you crossed the line?"

Let's make an assumption. **Judgment** is a vital component of air discipline. Look at the first two incidents, and factor in the "good versus bad judgment" question. You make the call on the validity of judgment as a component of flight discipline in light of those two incidents.

Now apply the same criteria to the third mishap. Although no one intentionally violated regulations, the last incident reflects poor judgment, not only on the part of the pilot involved, but the supervisors who elected to fly the pilot on a sortie which had the potential to exceed his capabilities.

Let's make another assumption. To practice good air discipline, you need to **know yourself and your limitations** — limitations

continued

A large transport-type aircraft is delayed on the ground getting an IFR clearance. The pilot, known to be a "by the book" individual, elects to take off VFR and do some unplanned local ridge-hopping while awaiting IFR release. The aircraft strikes a power line, and shortly thereafter, impacts the ground, killing all aboard.

*Editor's Note:

Images used in this article are for illustration purposes only and are not from the actual events discussed.

continued

imposed not only by equipment capabilities (to include the human body), but limitations imposed by command directives. Roll back to the three incidents, and apply the limitations assumption. A picture of what constitutes air discipline should now be starting to take shape.

These events also reflect the definition and assumptions we've developed. However, to take these incidents a step further, the pilots involved here lost their wings when the Air Force initiated Flight Evaluation Board action against them. The moral: Not only can ignoring the principles of good air discipline cost you your life, but if you survive the event, there's a good chance it'll cost you your wings!

Need more examples?

A trainer aircraft, flying a low-level cross-country, deviates from the "game plan" and flies an impromptu low-altitude "airshow" over a small town, drawing the ire of many residents.

A fighter-type aircraft, returning home from a cross-country, drops down to do some unplanned "canyon running," impacts power lines, but manages to recover safely at home station.

These events also reflect the definition and assumptions we've developed. However, to take these incidents a step further, the pilots involved here lost their wings when the Air Force initiated Flight Evaluation Board action against them. *The moral: Not only can ignoring the principles of good air discipline cost you your life, but if you survive the event, there's a good chance it'll cost you your wings!*

Keep in mind that breaches of air discipline often aren't premeditated. They are targets of opportunity that suddenly present themselves, much like a money bag falling out of an armored truck you are behind in traffic. What will you do? Human factor experts have coined the term "Sudden Loss of Judgment" to describe when good aviators go bad. For example:

A large transport-type aircraft is delayed on the ground getting an IFR clearance. The pilot, known to be a "by the book" individual, elects to take off VFR and do some unplanned local ridge-hopping while awaiting IFR release. The aircraft strikes a power line, and shortly thereafter, impacts the ground, killing all aboard.

Bottom line: It can happen to almost any individual at any time. As aviators, we all have a responsibility, not only to our profession, but to those in our profession. Condoning violations of air discipline is as tragic and stupid as the violations themselves. Case in point:

Two observation aircraft pilots briefed and flew an out-and-back sortie. Prior to takeoff, one pilot knowingly briefed and planned to fly unauthorized low-altitude maneuvers. The pilot in the second aircraft joined in the decision to fly the profile. During the unauthorized maneuvering, one of the aircraft stalled at low altitude. The aircraft impacted the ground. The pilot was fatally injured.

These incidents bring to mind an anonymous quote coined years ago: *"We should bear one thing in mind when we talk about the troop who rode one in. He called upon the sum of all his knowledge and made a judgment. He believed in it so strongly that he knowingly bet his life on it. The fact that he was mistaken in his judgment is tragedy, not stupidity. Every supervisor and contemporary who ever spoke to him had an opportunity to influence his judgment. So a little of all of us goes in with every troop we lose."*

Several years ago, a Canadian Aviation Safety letter touched on the character required to fly. It pointed out pilots today are no more prone to human failure than earlier generations. In fact, they are probably less so due to better training. They may have the physical and cognitive skills to fly aircraft but may possess a character flaw that causes them to look the other way with regard to rules obviously developed for the "other guy." Review the incidents we've touched on to see if **character** is an important attribute of good air discipline.

History always seems to repeat itself, and these mishaps, while tragic, were all avoidable and not unique in their findings/causes. When Uncle Sam hands you the keys to a jet, he's assuming a level of maturity that some aviators, at times, seem unable, or unwilling, to demonstrate.

The majority of today's aviators operate Air Force aircraft with the utmost in skill and professionalism. Yet we still see "sudden loss of judgment" mishaps.

We must heed the lessons of the past. These mishaps illustrate the senseless waste of resources and lives that occur when good aviators go bad. Use good judgment, fly safe, fly mature, *fly with character.* ■

FLYING IN ALASKA

USAF Photo by MSgt Ed Boyce

CAPT RUSS MEGARGLE
19 FS/SE
Elmendorf AFB, Alaska

■ As I opened the garage door to leave for work this morning, I was greeted by 12 inches of fresh snow. It never fails. Just when the runways are finally clear and dry, and the ice fog has moved out, it snows again! Well, this is flying in Alaska in the winter where the unexpected always happens.

In the middle of winter, it may seem hard to believe spring is just around the corner. The signs of spring are showing up though. The groundhog didn't see his shadow. There's over 8 hours of daylight now. And with temperatures approaching 30 degrees Fahrenheit some days, there's a lot of activity at the local airports. This means civilian air traffic is going to increase by huge amounts.

You may know Alaska has more licensed pilots per capita than any other state — and probably just as many unlicensed ones, too! If you look around the airports, you now know where all the Cubs and Skywagons are. Most of these aircraft are flown regularly yearlong, but nothing like in the spring and summer. Some rivers here even have their own traffic advisory frequency for all the float-plane traffic — not to mention the guys who land on the gravel bars. The bottom line is there are ***a lot*** of planes flying around Alaska.

This brings me to why I'm writing this article. Alaska has some special considerations you need to be aware of if your unit is deploying for Cope Thunder or to support another mission. Alaska has large amounts of Class G airspace — which means uncontrolled for those who slept through IRC. Class G goes from the surface up to 14,500 feet MSL.

What does this mean to you? A good chunk of the MOAs are Class G airspace unlike the lower 48 where they are usually in controlled airspace. The pilot is his/her own clearance authority to fly in IMC in Class G airspace — no ATC clearance is needed.

What does this mean to you? Remember in pilot/nav training you were taught IFR traffic would not be permitted into an MOA if it was hot. Not so in Alaska. As long as a pilot is below 14,500 feet MSL, qualified to fly in IMC and in a plane certified to fly in IMC, they're good to go popping into the clouds whenever they want.

ATC radar coverage isn't that good in Alaska, especially down low, so don't rely on ATC for traffic calls. Another interesting point is that aircraft aren't required to squawk until in Class A airspace (above 18,000 feet MSL), unless, of course, you're in the Anchorage Class C airspace (ARSA). Where are you going to find most of the aircraft? Down low — most likely below 5,000 feet AGL. Be on the lookout for not only the bush planes, but for fighters, C-130s, and H-60s as well.

What do I want you to remember to make your trip to Alaska safer?

First, Class G airspace is *everywhere* in Alaska.

Second, our MOAs are big and contain a large amount of Class G airspace. Also, a lot of the prime hunting/fishing areas are within the MOAs.

Third, civilian traffic could be ANYWHERE! (How do you think everyone gets to those hunting/fishing areas anyway — we don't have any roads!)

Fourth, clear, clear, clear! Use your eyes as well as your radar. It isn't fun having a high aspect pass or worse with a DC-6 or Beaver.

Finally, enjoy Alaska. It's the best place to fly F-15s, and there's no other place with so much to offer. ■

MOUNTAIN FLYING PITFALLS

USAF Photo by TSgt Perry Heimer

CAPT "TINK" SULLIVAN
20 AF/SEF
F.E. Warren AFB, Wyoming

■ An experienced crew was on an incentive ride for AFROTC cadets. They departed base with plenty of gas, takeoff and landing data (TOLD) (but without a calculated density altitude), and an attitude to have a good time. It was a beautiful day — light winds from the south and clear skies. Departure base elevation was 6,000 feet MSL with DA about the same. Calculated weight was near max gross but within limits. Now the crew, with their pax, was ready to take off for the mountains. At 1230 local, temperature around 20°C, the helicopter departed the surly bonds.

The crew flew about 25 miles away from the base to an area frequented by other unit members. The crew performed a power-available check and found they had 100 percent available. They selected an area large enough for them to land and then began a high recon[1]. After that, a low recon was accomplished with no unusual hazards noted. The spot they chose was at 8,000 feet MSL. Later calculation of the site put the DA at 9,500 feet.

The crew set up on final with quartering light headwinds and still 100 percent power available. On short final (approximately 300 AGL), the crew began to notice an increase in power required and left pedal. Continuing on without a defined go-no go point, the crew began a dramatic increase in power and now a whole lot more left pedal. Soon they were below the tree line, pulling max power, and full left pedal. The aircraft then began an uncommanded right yaw, the low rotor warning horn came on (noted at 94 percent), and the crew ran out of ideas.

After a 200-degree turn and a few tree strikes, the helicopter came to rest on a rocky ledge. There were no injuries, but there was a lot of damage to the aircraft, and the aircrew wondered what happened.

It's easy for the armchair quarterback to look and say, "I can't believe they made that mistake." But as flying professionals, we must look and say, "How do I keep from making the same mistake?" A couple of little things the crew did or didn't do are what sealed their fate that day.

No DA on the TOLD card. You've got to know what you're getting into in the mountains. Just because site elevation is 8,000 feet doesn't mean it really is 8,000 feet.

One hundred percent available power. This doesn't always equal the out of ground effect[2] (OGE) available.

Go-no go point. If it doesn't feel good, go around. But if you don't have a definite point to make this call, when do you make it?

Heavy weight, in the mountains (high DA), little wind to help, and a confined remote area. This should send warning signals to everyone. Never stop thinking of what *could* happen, not what *should* happen.

Confidence. "Been there, done that." "I've flown in worse." "A little tough, but hey, we're alive to talk about it." It has been said "A superior pilot is one who stays out of trouble by using superior judgment to avoid situations which might require the use of superior skill."

Always be ready for the unexpected in the mountains! ■

I WAS THERE — A Testimonial

Capt Gene Becker
79th Rescue Flight
Grand Forks AFB, North Dakota

Flying at Grand Forks AFB offers many challenges. Mountain flying is not one of them. HH-1H Huey pilots do not train at Kirtland AFB, New Mexico, after pipeline training. New HH-1H pilots report directly to their unit after Fort Rucker Initial Qualification training. With the deactivation of Ellsworth's missile field, 20th Air Force HH-1H pilots receive no formal or operational mountain flying training. The only opportunities to fly in the mountains are USAFA support flights or cross-country training to one of the UH-1N flights.

Upon hearing of the availability of a mountain training course at Fort Carson, Colorado, we made arrangements to attend. The course consisted of 1 day of academic training which concentrated on high-altitude physiological effects as well as the effect on helicopter performance. Also covered were the effects of several weather phenomena such as mountain wave, bubble effect, and turbulence. The flying portion consisted of two flights. The first flight was to the "low" area. The LZs in this area were between 8,000 and 9,000 feet above sea level. The second training area was located above 11,000 feet.

This course was designed to familiarize US Army crews with mountain operations and is required for all pilots stationed at Fort Carson. We attended academics with US Army UH-1 crews and flew with a US Army instructor. Ours was MW5 Harry Ward. A Vietnam veteran with over 25 years of flying, he is the only Army aviator to win three "Broken Wing" awards. The "Broken Wing" is awarded to pilots who safely land an aircraft which has suffered catastrophic failure or a major malfunction. He has survived engine failures numbering into the double digits. The caliber of instruction was excellent.

For the low area, Capt Matt Burger and I flew up front with Mr. Ward in the back. He taught us the Army's technique of determining wind direction in the mountains as well as how to identify and deal with the line of demarcation. The line of demarcation marks the boundary between updrafts from the windward side of a mountain and the turbulence and downdrafts on the leeward side of the mountain. Getting low on the demarcation line and descending uncontrollably into "cumulo granite" has claimed many helicopters and crews due to the lack of power available at high altitudes to overcome a downdraft.

We each landed in two LZs. The first was to a saddle[3] at 8,500 feet. There was so much slope below that a landing was impossible. Power to hover was near OGE with the slope and trees located below the saddle. The next LZ was at 9,000 feet. This LZ was three rotor disks in size, but the trees were approximately 150 feet high. The only way in was to shoot an approach to 175 feet and descend vertically into the LZ.

Unfortunately, on the way back to Fort Carson to refuel, we encountered some turbulence and up/downdrafts which were coming close to exceeding the aircraft's limits. In fact, with the collective full down, we were *climbing* at 1,500 feet per minute as we passed Pike's Peak. So, we couldn't attempt mountain training at area #2. Too bad, because the first approach there was to a pinnacle located at 11,500 feet MSL.

Any HH-1H crews interested in attending the course should go. The training was excellent — something most HH-1H crews will never experience unless they transition to H-53s or H-60s. ■

USAF Photo by SrA Andrew N. Dunaway, II

MOUNTAIN FLYING TRAINING

Lt Col Dave Wilson
HQ AFSPC/SE
Peterson AFB, Colorado

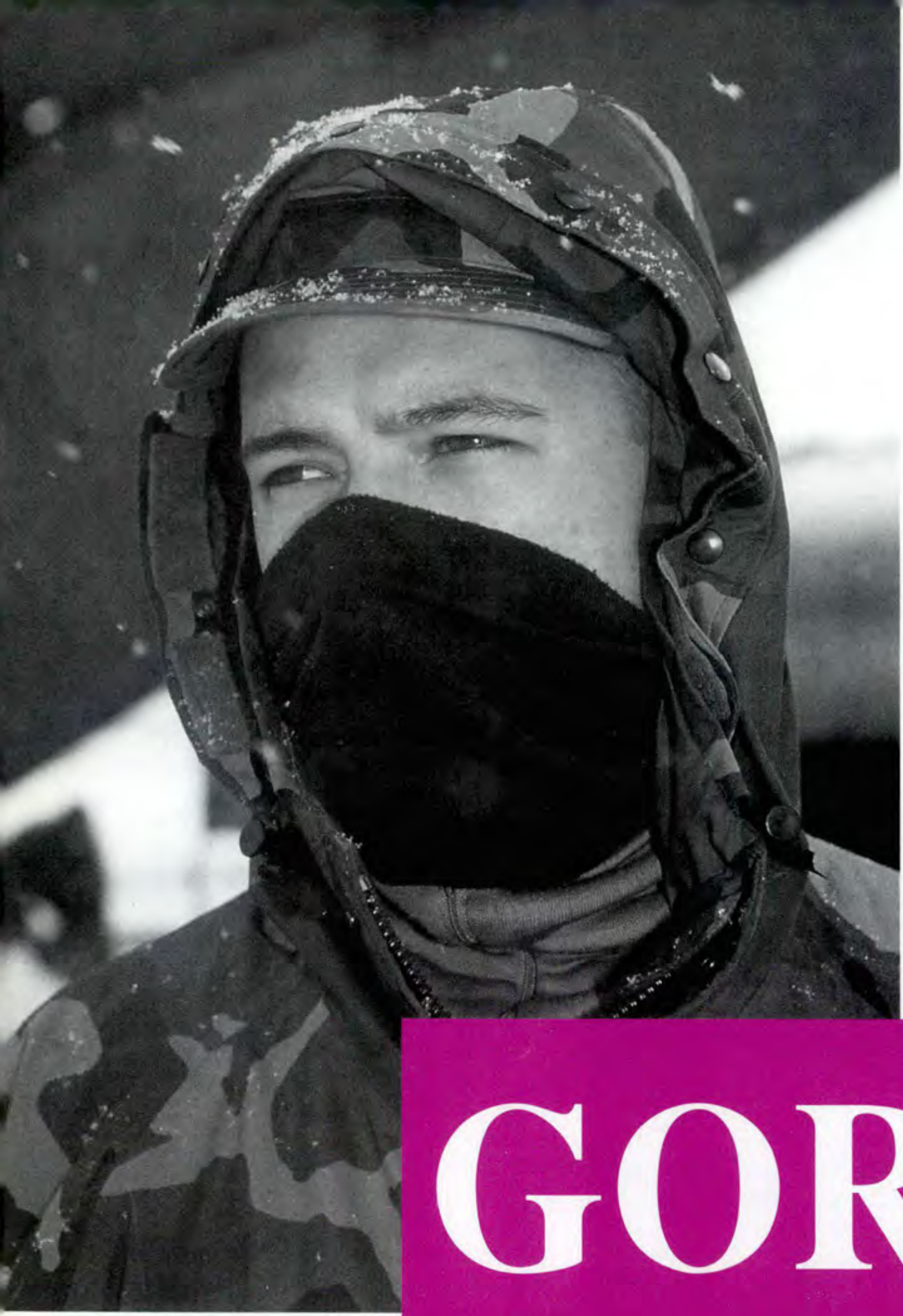
Air Force Space Command has great opportunities to interface with Army aviation due to our proximity to Fort Carson. We have six rescue flights that fly HH-1Hs and UH-1Ns. About a third of our active fliers have less than 1,000 hours total, and over half have less than 600 hours in their primary aircraft. This is in contrast to the Army aviators, some of whom have been flying helicopters for over 20 years.

Some AFSPC units are at or near sea level, so the pilots have little or no opportunity for high-altitude training. Their commanders noticed this when they flew with some of their younger pilots in support of summer survival training at the Air Force Academy. Their unfamiliarity with high altitude/high DA operations was readily apparent.

AFSPC's flight safety office worked out a memorandum of understanding with the 4th Aviation Brigade, Fort Carson, Colorado, to allow our pilots to attend their mountain flying course. They spend 1 to 1 1/2 days in academics, then about 1 day in flight training. The course is taught to all Fort Carson aviators, including HH-1, AH-1, H-60, AH-64, OH-58, and CH-47 crews. Our crews are sometimes taught along with the Army crews or given their own course of instruction. All training is subject to Fort Carson instructor availability and obligations.

If other Air Force units are interested in attending, please contact me at AFSPC/SEF, DSN 692-2553 for information.

[1] An aerial survey of the intended LZ to include P.A., temperature, winds, obstacles, ingress/egress routes, exact touchdown point, site elevation, size, shape, and suitability of the LZ, and go-no go point.
[2] Roughly the length of the ATC's rotor blades.
[3] An area with a depression in the middle and rising terrain at either end or side, i.e., a mountain pass.



GORTEX:

ANSWERS TO YOUR QUESTIONS

MR. CHUCK DORNEY, GM-14
Chief, AFMC System Safety
Wright-Patterson AFB, Ohio

Gortex is a multi-layered synthetic fabric which looks and feels like a stiffer type of nylon. And, because it's such great foul weather gear, Gortex was selected and procured for use in some of our Air Force adverse weather duties.

■ By this time, you've probably heard about the new wonder fabric called Gortex. Great stuff for foul weather gear — just ask any hiker, camper, or other outdoors person.

Gortex is a multi-layered synthetic fabric which looks and feels like a stiffer type of nylon. And, because it's such great foul weather gear, Gortex was selected and procured for use in some of our Air Force adverse weather duties. After procurement began, though, it dawned on someone there might be some restrictions with wearing Gortex clothing, especially during ground handling activities involving hazardous fuels and liquids or explosive devices.

You see, Gortex is a synthetic material, and several of the USAF aircraft servicing operations and munitions directives have much to say about the wearing of synthetic fabrics. Specifically, T.O. 00-25-172, *Ground Servicing of Aircraft and Static Grounding/Bonding*, generally prohibits aircraft fuel servicing crewmembers from wearing any outer clothing items having more than 65 percent wool or synthetic fabric combinations. Similarly, AFM 91-201 (formerly AFR 127-100), *Explosives Safety Standards*, prohibits wearing clothing having high static-generating characteristics when handling electrically initiated munitions items. By now, you've guessed the big question: Can I safely wear Gortex or not?

The Search for Answers Begins

The folks at Alaskan Air Command (now part of Air Combat Command) were the first to ask for our advice. They had procured cold weather defense ensembles made of Gortex and then discovered they couldn't wear them during many flightline operations. What to do?

We in the AFMC Safety Directorate got the inquiry because of our past work in the System Safety Engineering Analysis program, certifying aircraft for hot refueling, integrated combat turnarounds, and other exceptional operations.

At first, we didn't have the data to answer Alaska's concerns. However, we soon discovered previous laboratory testing on other fabrics found **certain fabric electrical properties** gave good indications of the fabrics' propensity to accumulate and discharge a static electrical charge. These acceptable properties, which are given in T.O. 00-25-172, are:

- Inside-to-outside resistance of less than 10^{10} ohms (measured with a megohm meter using two round, disc-like probes on both sides of a fabric sample with a 5-pound weight on the top probe).
- Surface resistivity (measured along the surface of the fabric with a megohm meter) of less than 10^{12} ohms per square centimeter.

These two criteria are relatively easy to measure with minimal laboratory equipment, but they don't paint a realistic picture of the fabric's static electricity properties. For instance, what really happens when someone wears the fabric in his/her duties in different physical and climate environments?

It's easy to understand that doing strenuous work on a dry day is different than a relaxed work environment on a rainy day, to demonstrate extreme examples. We know humid environments are less static prone, and anti-static additives reduce the static charge problem (until they are laundered out of the fabric), but how effective are these variables? The laboratory folks, Aerospace Guidance and Metrology Center (AGMC/MA) at Newark AFB, Ohio, were challenged with answering that question as well as others.

The "Blue Two" Tests

We had the folks in Alaska furnish us with a Gortex cold weather defense ensemble, commonly called a Blue Two uniform. A laboratory volunteer wore the ensemble in an environmental chamber that could have both the temperature and relative humidity varied upon demand. The laboratory conducted 53 experiments, each under different environmental conditions. The volunteer "charged" the ensemble, then discharged the suit through her bare hand, gloved hand, or through a hand tool.

Using electronic equipment, the lab folks measured the electrical energy of the static discharge spark coming from each trial run. Of the 53 tests, 5 were deemed hazardous because the discharge spark contained more than 0.25 millijoules of energy (the widely accepted criterion for determining a hazardous level). This energy level roughly corresponds to the spark you get when touching a metal doorknob after walking across a carpet.

After reviewing the test data, the safety community decided Gortex was too risky to wear when fueling with JP-4 and other low flashpoint fuels because flammable vapors frequently would be present during fuel servicing. (The risk assessment is determined by combining the low probability of a static spark with a high probability of a flammable vapor.)

However, we decided Gortex was acceptable for fuel servicing in cold weather locations with high flashpoint fuels, such as JP-8 with its minimum flashpoint of 100 degrees F. Our logic: Low spark probability and low probability of a flammable vapor equal low risk.

Understandable Confusion Follows

You can imagine the confusion that followed. We were asked questions such as:

What is a cold weather location? Answer: If it's cold enough to require the wearing of Gortex, you're in a cold weather location. If it's warm and rainy, you can wear Gortex because the high humidity will preclude a static charge generation.

What about aviation gasoline and MOGAS? Answer: *They're low flashpoint fuels and are too risky.* JP-5, J-8, JP-10, and diesel fuels are high flashpoint fuels and have an acceptable risk.

What about "switch-loaded" aircraft? Answer: First of all, switch-loading, or "mixed fuels," refers to situations where you are fueling with one type of fuel into an aircraft previously having another fuel in it. We decided, in these cases, if the last four fuel servicings were with JP-8 or other high flashpoint fuels, the risk is acceptable, and Gortex is permitted for fuel servicing personnel.

How About Munitions Handling?

After we established a policy for fuel servicing operations, it was time to look at the wearing of Gortex while handling munitions. We now know what static properties Gortex has but do not have much data on munitions. It was easy to assume that hard-cased munitions, such as bombs, **do not** present a hazardous situation. That's because if a person touches a bomb, the spark will dissipate on the case and not affect the components and explosives inside.

There is also what is called the Faraday effect. That's when like charges repel each other and remain on the outside of a munition. You may have seen a science demonstration where someone sits inside a spherical cage made of steel mesh and is not hurt

continued

We decided Gortex was acceptable for fuel servicing in cold weather locations with high flashpoint fuels, such as JP-8 with its minimum flashpoint of 100 degrees F. Our logic: Low spark probability and low probability of a flammable vapor equal low risk.

by a large electrostatic discharge. All the charges remain on the outside of the sphere to the point there are no charges anywhere on the inside of the cage.

Electrically initiated munitions, however, present another situation. There is little data on the sensitivity of these items to static discharges. Efforts are underway to ship some 20mm primers and electroexplosive impulse cartridges to the laboratory at AGMC. They will determine sensitivities to static electricity. *In the meantime, Gortex is acceptable to wear, but we have advised users to ground and bond themselves according to present directives and to handle munitions carefully* — don't directly touch electric primers, for example. Once we complete the laboratory tests, we'll revise AFM 91-201 and other directives accordingly.

Gortex is a great material for cold and wet weather clothing. If you follow the guidelines and precautions spelled out in current Air Force directives and tech data, you can safely wear Gortex clothing for most flightline and other operations.

How About Oxygen Handling and Servicing?

We now should address oxygen servicing. An oxygen-enriched atmosphere has two detrimental effects: It lowers the minimum energy needed to ignite something, and it creates a larger flame or spark. Remember that an ignition source is still necessary. It's a common misperception that liquid oxygen (LOX) and petroleum products are hypergolic, i.e., ignite spontaneously upon contact. Such **is not** the case — an ignition source is still needed. However, the ignition source **does not** need to be as large as one needed for a normal atmosphere.

In any case, no additional precautions or restrictions are needed for oxygen servicing. There are currently no special clothing restrictions for gaseous oxygen servicing (GOX), and none are needed. *LOX servicing, on the other hand, has detailed clothing restrictions spelled out in T.O. 00-25-172, and these restrictions need to be followed.* Gortex can be worn in LOX servicing operations, **but not as outer garments!** Use the personal protective equipment specified in T.O. 00-25-172 and the applicable aircraft servicing tech data.

Summary

Gortex is a great material for cold and wet weather clothing. If you follow the guidelines and precautions spelled out in current Air Force directives and tech data, you can safely wear Gortex clothing for most flightline and other operations.

If you have any questions, give us a call at DSN 787-6007, FAX 986-1305. ■

WARNING

The *Flying Safety* magazine staff really appreciates Mr. Dorney taking the time to write this article. We were receiving too many questions here at the agency and the field *not* to find an expert to properly address the issues and concerns and get "the word" out to our readership.

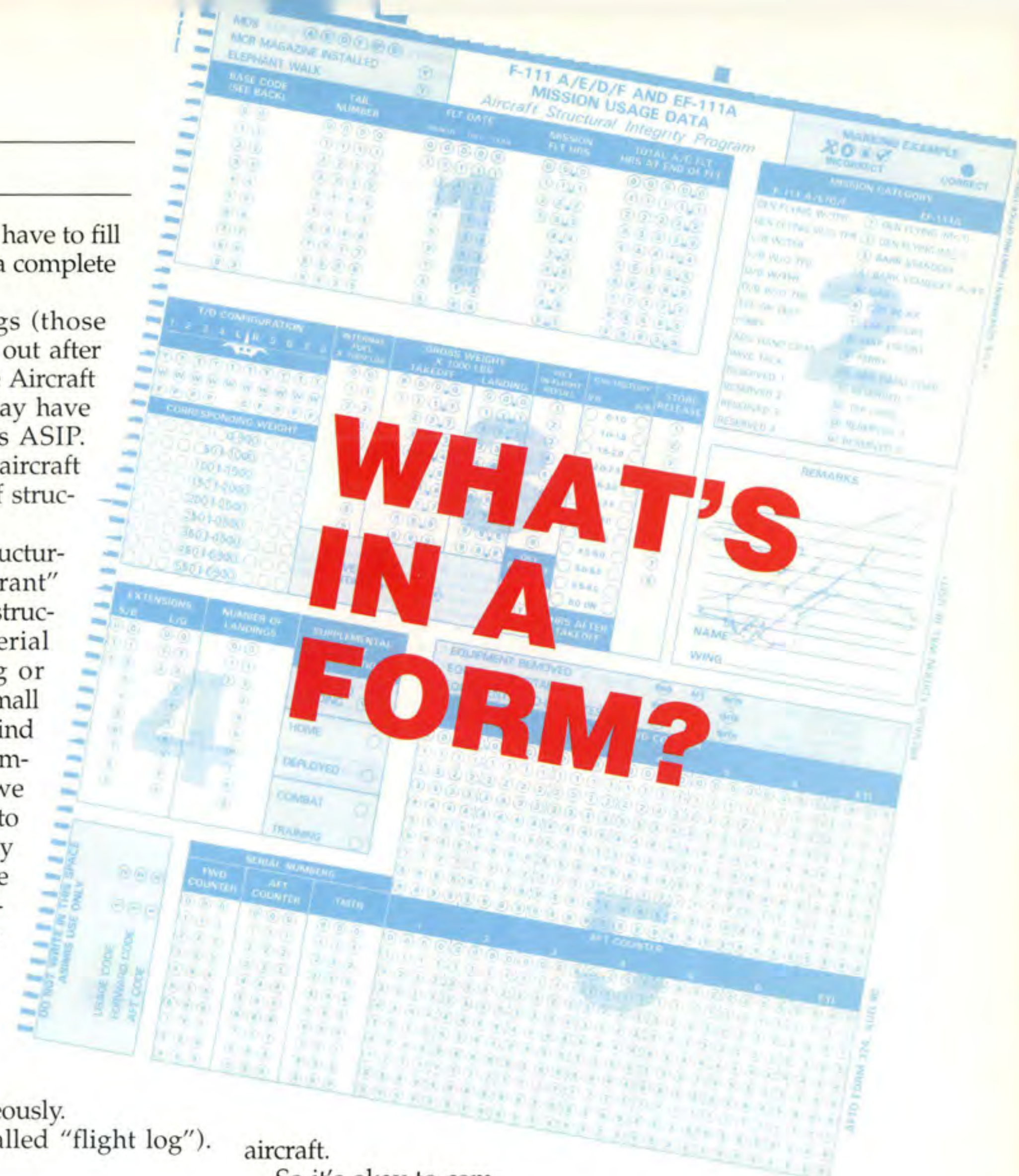
I, too, had many questions about the safety ramifications of wearing the Gortex cold/wet weather coat during refueling and LOX/GOX servicing operations, i.e., while assigned as a maintenance superintendent at a northern-tier base. Then, when I arrived at the Safety Agency, the field, as well as some MAJCOMs, still seemed to be confused about whether or not the Gortex coat was safe to wear around certain aircraft and munitions maintenance and ground handling events.

My old unit immediately saw the benefits of the "all around versatility" of the Gortex coat — relative tear resistance, water repellent, and much easier to keep clean. Unfortunately, there were too many unanswered questions about possible safety restrictions. Anyway, our squadron decided not to invest scarce dollars into something that wouldn't give us the most bang for our bucks. Also, it would've been counterproductive for our maintainers to change out their outer garments for certain maintenance activities.

Mr. Dorney's article assures us all these safety considerations are being addressed, properly researched, and publicized to the field. ***But remember, his article is not directive in nature! Current, on-the-shelf aircraft and equipment tech data, Air Force safety directives, and manufacturer manuals still take precedence.*** His article highlights that research has proven there are, in fact, some exceptions to wearing Gortex clothing around hazardous, explosive aircraft and munitions maintenance and ground handling activities, **but only under certain conditions!** After you have satisfied other applicable weapon system and equipment manuals, directives, and tech data, then, and only then, could you apply Mr. Dorney's criteria and safely wear the Gortex clothing. It'll probably take a while before all Air Force and MAJCOM safety directives, manuals, and tech data are revised to reflect the provisions for using Gortex-type clothing.

In the meantime, **when in doubt, always check with your wing safety shop and/or your MAJCOM safety office, FIRST!**
Tech Editor

WHAT'S IN A FORM?



BRITT COVINGTON
HQ Air Force Safety Agency

■ "Somebody please tell me why we have to fill out these stupid forms. It seems like a complete waste of time."

Sound familiar? Well, flight logs (those nightmare forms that must be filled out after every flight) are the backbone of the Aircraft Structural Integrity Program. You may have heard this program referred to as ASIP. Maybe not. But ASIP is one reason aircraft seldom fall out of the sky because of structural failures.

The Air Force manages aircraft structural integrity by using "damage tolerant" methods. We assume all significant structural components have some material anomaly, flaw, or manufacturing or maintenance damage which is just small enough that our inspections won't find it. It is a *certainty* these undetected imperfections exist in the fleet. And we know these imperfections will begin to grow as fatigue cracks at a rate directly related to how the components are loaded. So we inspect critical areas often enough to find the cracks before they reach critical crack size.

You ask, "What's critical crack size?" It's the length a crack can grow before a single, large load (maneuver, hard landing, gust, etc.) will cause the part to break instantaneously.

Back to the usage form (often called "flight log"). Why do we need it?

GOOD QUESTION!

This form tracks individual aircraft missions by tail number. It provides important information which allows engineers to determine all the different loads that have occurred on an aircraft over its entire life. More precisely, the loads reflected on this form are input into a computer program that simulates crack growth in parts. The computer then tells the engineer when a specific area of the aircraft requires inspection. The idea is to inspect and detect cracks which may exist in aircraft critical locations before they reach critical crack size. But inspecting for cracks too often can be cost prohibitive. By knowing loads and, therefore, crack growth rates, inspection intervals can be optimized without compromise to safety.

The effectiveness of this method depends largely on the accuracy of the loads data input into the computer program. Loads data comes right off the flight log forms. So whether the crewdog completely and accurately fills out the form — or not — goes a long way toward ensuring the structural integrity of the airplane — or not.

It's not the most enjoyable task of your workday, but completely and accurately filling out flight log forms is very important to the continued safe operation of USAF aircraft.

So it's okay to complain — as long as you keep filling out the flight log form completely and accurately.

If you have any questions on ASIP, call Britt Covington, HQ AFSA/SESE, DSN 246-0990 or E-mail to covingtb@smtps. saia af.mil ■

AFTO Forms and Associated Aircraft

AFTO Form 16, 16A	B-52
AFTO Form 18	KC-10
AFTO Form 60	T-38
AFTO Form 76	C/KC-135
AFTO Form 109	F-4
AFTO Form 117	E-3 USAF
AFTO Form 118	E-3 RAF
AFTO Form 119	E-3 NATO
AFTO Form 141	E-4
AFTO Form 151	C-130
AFTO Form 239	F-15
AFTO Form 278	A-10
AFTO Form 324	F-111
AFTO Form 451	C-141
AMC Form 89	C-5

JOSEPH F. TILSON

LOW LEVEL AN

Editor's Note: This article was originally published in May 1988. While some references are dated, the technical content remains sound.

■ Today we find a need to operate our large (B-52, 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 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 ol' 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 over three decades 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.

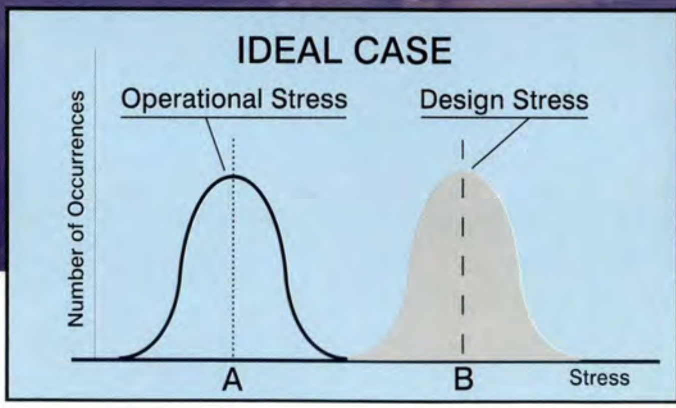


Figure 1

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.

Key Elements of Design

Gust is a key element in the large aircraft design. The structural designer assumes the aircraft will occasionally encounter a vertical gust of 55 feet per second (32 knots). 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 there are a great many variables in manufacture, maintenance, and operation of each aircraft. To assure that the pilot

BIG AIRCRAFT

Combat Camera Photo by Marvin Lynchard

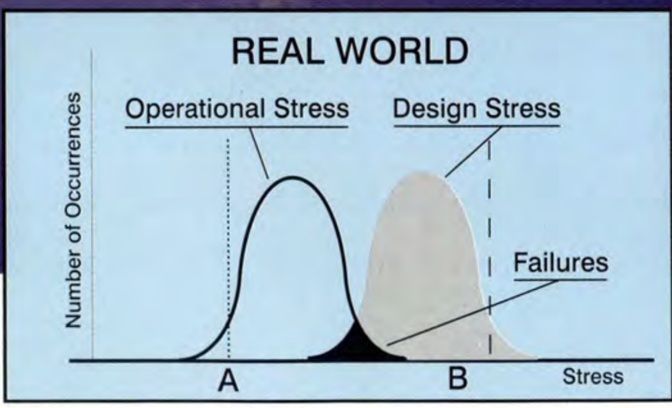


Figure 2

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 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 this was done for a great many reasons, none of which were to accommodate an overaggressive operator.

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 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 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 both curves have shifted toward each other. The curve which was at point A has moved to the right, indicating 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 which 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 figure 2 shows a shaded area where the two curves overlap. This means 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 try-

continued

Combat Camera Photo by Marvin Lynchard

ing 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 questions 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 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 which 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 knots) 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 have, at times, been found to have questionable structure and were appropriately allowed to operate only under certain flight restrictions. These restrictions were imposed to assure safe operation of the aircraft until the suspect structure could be properly inspected, modified, or replaced. The operators of restricted aircraft 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. ■

*Editor's note: **This month we've included a new feature I hope aircrews will find useful.***

The Air Force Flight Standards Agency (AFFSA) has agreed to allow us to reprint articles from their Airfield Operations Digest which apply to aviators, air traffic controllers, and airfield operations folks alike. As new items of interest become available, we'll be sure to include them in Flying Safety. If you'd like to comment on this new feature or would like to suggest a topic of interest to all of the above, please contact me, Maj Jim Grigsby, at DSN 246-0936, email a note to grigsby@smpts.sais.af.mil, or send a FAX to DSN 246-0931.

This month we'll turn our attention to two recent changes you may or may not have noticed yet: publishing "no light" approach minima on approach plates and a new format for DOD NOTAMs (Notice to Airmen).

PUBLISHING NO-LIGHT VISIBILITY MINIMUMS

TSGT DOUGLAS WINTERS
HQ Air Force Flight Standards Agency

■ HQ AFFSA/XOI (Instrument Standards Division) recently completed work on publication of no-light visibility minimums for instrument approach procedures. This new policy changes the way DoD aircrews obtain minimums when approach lights at their point of intended landing are out of service. The new method of dissemination is a note printed in the "Remarks Section" of the approach plate. This note indicates the increase required for each category aircraft. If no room is available in the remarks section, the note is placed in the "Plan View" of the procedure. This new method will be incorporated into AFMAN 13-209, *Instrument Procedures*.

This decision was made to better serve the entire aviation community. The pilot/aircrew member now has the needed information easily accessible, right on the approach plate, eliminating the need to write a cumbersome NOTAM or interpret an "Inop Components" table.

The air traffic controller is no longer required to publish the No-light Visibility in a local operating procedure (LOP) which was always subject to error when procedure changes occurred.

Finally, airfield management personnel are no longer required to send that "nasty," cumbersome approach minima change NOTAM. The NOTAM will simply read, "RWY XX APCH LGTS NOT AVAILABLE."

The Instrument Standards Division has sent a letter to all MAJCOM TERPS Divisions explaining this new procedure, thereby implementing this policy. It is recommended this issue be discussed at wing ATC board meetings and squadron hangar flying/safety meetings until all concerned become familiar with this new program. This process is being phased in, and not all approach plates will immediately reflect the new depiction. Aircrews are reminded the requirement of AFI 11-206, para 8.15.2 still apply.

HQ AFFSA/SOI, DSN 858-2013, is POC for this information.■

Courtesy Air Force Flight Standards Agency *Airfield Operations Digest*, Dec 94.

FLASH- NOTAM NEWS FLASH-NOTAM NEWS FLASH-NOTAM NEWS FLASH-NOTAM NEWS

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USAF Photo by LTC Roy Poole, USAF Ret.

SMSGT RONALD M. WARD
HQ Air Force Flight Standards Agency

■ The NOTAM (Notices to Airmen) output format was changed effective 7 March 1995. The field identifiers, i.e., B), C), D), E), etc., have been deleted. On the summaries, NOTAMs are printed alphabetically within each state/country using the installation name, not the ICAO identifier. Also, the DTG is now in plain text. See the example below.

Formerly:
TEXAS

KRND RANDOLPH AFB
B) 02011400 C) 02052500 E) TACAN
NOT AVBL KSFK KELLY AFB
B) 02010600 C) 02060800 E) ILS NOT AVBL

Now:
TEXAS

KSKF KELLY AFB
ILS NOT AVBL 1 FEB 0600 TILL 6 FEB 0800
RANDOLPH AFB KRND
TACAN NOT AVBL 1 FEB 1400 TILL 5 FEB 1500

This change will affect only the NOTAM output. Airfield management personnel still input NOTAMs IAW current procedures.

If you see any problems, please contact the DOD NOTAM Coordinator at DSN 851-3410 (voice) or (202) 267-5324 (FAX).

Courtesy Air Force Flight Standards Agency *Airfield Operations Digest*, Mar 95. ■

FLASH-NOTAM NEWS FLASH-FLASH

IT'S A PRIVILEGE

COL CHARLES MATTHEWSON
Staff Judge Advocate
HQ Air Force Safety Agency

■ **Q. I work for an Air Force contractor hired to do simulator training. I need copies of mishap reports to use for building training scenarios, but I'm being told I can't have them because Air Force privilege rules restrict them from being given to anyone outside the Air Force. Air Force trainers get access to your reports, so why can't I? By the way, I'm a retired Air Force pilot, and I know how to protect sensitive material.**

A. What you're "being told" isn't exactly correct. We recognize the need various contractors have for official information in doing their jobs for the Air Force. We also recognize, however, that we have to control our mishap information properly in order to maintain its privileged status. As with so many things, this means we have to strike the right balance between competing interests.

We can accommodate your interest if you'll submit a written request for the desired mishap reports to your host base chief of safety. The request will be forwarded to us, most likely through command channels, verifying your mission need. In your request, you should describe that need thoroughly, specify which parts of the report you need (e.g., factual narrative, analytical discussion, board findings, board recommendations), and propose a plan for safeguarding privileged material.

We will accommodate our interest by sanitizing the reports so they don't reflect the date, place, and other identifying specifics about the mishap. We do this to minimize the likelihood that a scenario will be seen as depicting any given mishap. Although some mishaps are very unique and will defy sanitization, we must go through this procedure anyway. While sanitizing the reports doesn't make them publicly releasable, it does provide some measure of protection to the mishap reporting process. Beyond this, we will outline the necessary control procedures you must follow in handling the report and provide you with the AFSA commander's authorization to use it in connection with your flight training program.

This same procedure basically applies to any contractor requiring access to one or more of our reports to help prevent mishaps. As more and more functions become the subject of Air Force contracts, we have to ensure the contractors have all the tools they need to do the job we hire them to do. A safety report is just another category of management tool, but it's a very special one which requires "limited use" and restricted handling.

Q. I've seen a lot of media coverage lately about engine problems — from defective seals to faulty fan blades. I always thought contractor problems were considered privileged. Why are we seeing determinations of cause made public? I'm a Logistics staffer and would like to talk freely about these things with contractors and with folks in other services. Can I?

A. You've raised another one of those issues with no easy answer, so I'll give you one of my favorite replies: "It depends."

As you point out, contractor representatives who support safety boards provide their evaluations as privileged material. We promise them confidentiality so they can be completely candid without fearing repercussions from acknowledging that their product's defect contributed to the mishap. The contractor's report goes in Part II of the safety report and is complete-

continued

IT'S A PRIVILEGE

continued

ly protected from release.

If a safety board uses an Air Force depot expert, rather than a contractor representative, to analyze a component, then this evaluation will not be privileged. It will be treated as virtually factual, expert testimony and subject to public release as a Part I product.

Other products are also releasable, such as the Product Quality Deficiency Reports you in the Logistics arena routinely deal with. Also releasable are the evidence and statement of opinion regarding cause generated by an accident investigation board under AFI 51-503, *Aircraft, Missile, Nuclear, and Space Accident Investigations.* With these other sources of fault-related information available, it is not surprising to see media coverage on these high-visibility mishaps even where contractor problems are involved.

Interestingly enough, a substantial segment of contractor personnel who work safety investigations with our boards have argued that it's ordinarily more of a problem for their companies to maintain confidentiality over their reports than it is to disclose them. They note the vast majority of mishaps are either operations or maintenance related rather than being product related, and product confidence is actually eroded by having to conceal causes.

They also argue that when cause is attributed to their product, they want nothing more than to fix it. They figure it's probably even cheaper to settle up when the liability is theirs than to suffer the ill will and expense of defending claims of liability when our operators or maintainers are causal.

Although it's difficult to be sure where the media's statements of fact and opinion are coming from, it's probably safe to assume the source is an appropriate one. Only when the source is clearly stated as the safety report or safety officials should we be very concerned.

The same is true of communications within the Logistics community and between you and interested parties outside the Air Force. As long as you're not citing the safety board or its report as the source of your information, it's probably all right to discuss the logistics-related aspects of mishaps. After all, your primary interest is to ensure a proper fix is implemented so we can prevent future mishaps. If you find yourself having to communicate about the safety board's findings and recommendations specifically, then just make sure any such memorandum contains the limited-use warning commonly found on safety reports themselves.

The state of the law is a lot different now than it was back in 1962 when the safety privilege was born to protect, in large part, contractor inputs to safety boards. Over 25 years later, in 1988, the U.S. Supreme Court fashioned another concept to shield manufacturers — the "government contractor defense" — from product liability suits. This greatly reduced the likelihood of the types of repercussions previously feared as a result of the Air Force's disclosure of contractor reports.

As a result of this development and others, we are now seriously considering a change to safety privilege policies that would put the vast majority of contractor evaluations in Part I, making them fully releasable while still excluding proprietary data and causation opinions. If that happens, you can expect to see even more in the media about contractor problems when they occur. ■

INSTRUMENTS RULE!

CAPT DAVID A. DUKE
512 SOS/SE
Kirtland AFB, New Mexico


USAF Photo by SrA Andrew N. Dunaway, II

■ "How's it looking on your side?" my good friend and aircraft commander, George, asked as we attempted to get our UH-1N Huey through a mountain pass.

"I've got about a mile visibility, but it's shutting down fast," I responded.

"Well, we're not making any extra money for doing this. Let's turn around — coming left."

"Stop left!" I shouted. "I've lost visual."

George immediately leveled the aircraft and initiated our prebriefed inadvertent IMC procedures. "With this climb, we should have no problem clearing the terrain," he commented.

My heart was pumping as I saw 79 feet register on the radar altimeter. I glanced at the attitude indicator to make sure we were level and was relieved to see George had things under control. As an HH-60G pilot, it had been a long time since I'd flown the legendary Huey — King of the Southeast Asia skies — and as the Ping Pong ball of IMC engulfed me, I was having second thoughts about the adventure.

I'd been looking forward to this ferry flight, from Albuquerque to Corpus Christi, but the Huey's lack of an automated flight control and stability augmentation system left me no misconceptions that I'd be able to fly it with any precision. I'd gotten used to an aircraft that flew itself, and as we climbed through 300 hundred feet AGL, I was relieved that George was on the controls.

"Thank God for instrument training," George remarked as we broke out on top.

I was filled with relief as I realized the danger was past. It looked like clear skies ahead. "How many regulations do you think we broke?" I asked with a nervous chuckle.

"Well, for starters, we flogged 60-16 (now AFI 11-206) fairly severely," he said. "Remind me to tell the boss when I call him tonight."

The incident reminded me of a time several years earlier when, during an exercise insertion, I'd found my landing zone fogged in. I was flying a Huey and had made dozens of insertions to the same LZ over the past few days. I could see all the landmarks surrounding the area, but the fog patch had chosen to rest right on my landing area. I skirted the perimeter of the fog in hopes of seeing the LZ. I knew I was within a kilometer of the site and hoped I could save my passengers a walk by putting them on target.

As I rounded a hill, I saw what I hoped would be a big enough opening to put me safely inside the LZ tree line. I set my sights on the small opening, but as I crossed the tree line, I realized the opening didn't afford me adequate visibility — Popeye!

I immediately initiated a climb and moved the cyclic to what I thought would be a level attitude. Because the fog bank was only about 200 feet high, I didn't immediately reference my attitude indicator, thinking I'd break out in just a few seconds. The few seconds passed and, glancing down to my vertical velocity indicator, I realized I had established only a slow rate of climb. I was at maximum power, but one look at my attitude indicator told me I was in a steep bank and getting steeper — in the direction of the hill I knew was on my right! I immediately leveled the aircraft and was relieved to see the VVI needle jump to an acceptable climb.

Whew! That was close! I thought, as sunlight flooded the cockpit. My copilot hadn't noticed my delay to get on the instruments and seemed unconcerned as we regained VMC. The potential embarrassment kept me from mentioning my initial oversight to him, and I sidestepped the subject by suggesting a landing at the clear field next to our planned LZ.

I reflect on these two episodes not to encourage you rotorheads to flirt with low-level IMC but to get you thinking about future similar episodes. Don't tell yourself, "I'll never go inadvertent IMC." Hopefully, you won't, but odds are you will. When it happens, good looks and positive thinking won't help you. Get on the instruments. ■

TOXIC FUMES/

Crew Incapacitation

CAPTAIN JEFF DAVISON
54 FTS
Reese AFB, Texas

■ The incident occurred during the first flight following depot-level maintenance on an F-111C aircraft. At 15,000 feet, we were in the process of completing the gear extension/retraction checks when an unidentifiable odor became noticeable in the cockpit.

My WSO and I both selected 100 percent oxygen, and a return to base was initiated. At the time, we were approximately 100 miles off the east coast of Australia. Approximately 1 minute later, both of us began to feel lightheaded and dizzy. I immediately started a diversion to Brisbane International Airport which was 25 miles closer than the base.

The WSO and I both could still smell the fumes, and we both selected EMER on our regulators. I also increased airspeed to minimize time airborne. We were both noticing increased difficulty in performing normal cockpit duties as well as completing checklist items. I considered ejection at this time, but for unknown reasons, I did not do this.

There was a solid weather deck going into Brisbane from 8,000 to 1,000 feet. I missed an assigned altitude of 7,000 feet, at which point the WSO initiated the level-off and started shaking me. He later said I appeared to lose consciousness for 10 to 15 seconds. I have no recollection of these details.

ATC was advised of our physiological problems, and they organized a single frequency approach for the recovery. I successfully landed the aircraft at Brisbane — but with great difficulty. Emergency crews assisted us from the aircraft and transported us to the hospital. Blood gas tests later revealed that even after breathing 100 percent oxygen for over an hour, my blood oxygenation levels were 75 percent of normal. After analysis of my blood gas tests, the flight surgeon said I should have been dead. No cause for the fumes was ever discovered.


USAF Photo by SrA Andrew N. Dunaway, II

Lessons Learned

Don't take physiological training lightly. I noticed my hypoxia symptoms immediately and reacted accordingly.

Check your safety equipment carefully. I was guilty of not doing so prior to the incident. My habits have changed drastically since then.

NEVER DELAY THE EJECTION DECISION!!! I did and am very lucky to be alive to tell about it. ■

USAF Photo by SrA Andrew N. Dunaway, II

THERE *I* WAS

■ The mission was a 2 v 2 night intercept and night air refueling. The working area weather was VFR. Home station was 2,000 feet broken and 7 NM visibility. The entire mission was uneventful until recovery on final approach. I was on a 9 NM ILS final and approximately 2,500 feet AGL when spatial disorientation took over.

I thought I was prepared for the ILS approach — approach plate out, final approach course and ILS frequency set, and interior cockpit lights set. What I failed to do was turn the anticollision light off before entering the weather and turn the landing light off prior to lowering the gear. Forgetting to perform these critical steps and not having a spatial disorientation game plan set me up for the biggest scare of my flying career.

I have had spatial disorientation — but never to the point of feeling helpless. No kidding, I was experiencing *INCAPACITATING* spatial disorientation! Nothing was making sense. I couldn't comprehend what the instruments were telling me. I felt as though I was completely upside down, pushing negative Gs. All I could do at that time was **try** to keep the ILS bars centered and, hopefully, recover from the spatial disorientation effects. Ejection entered my mind.

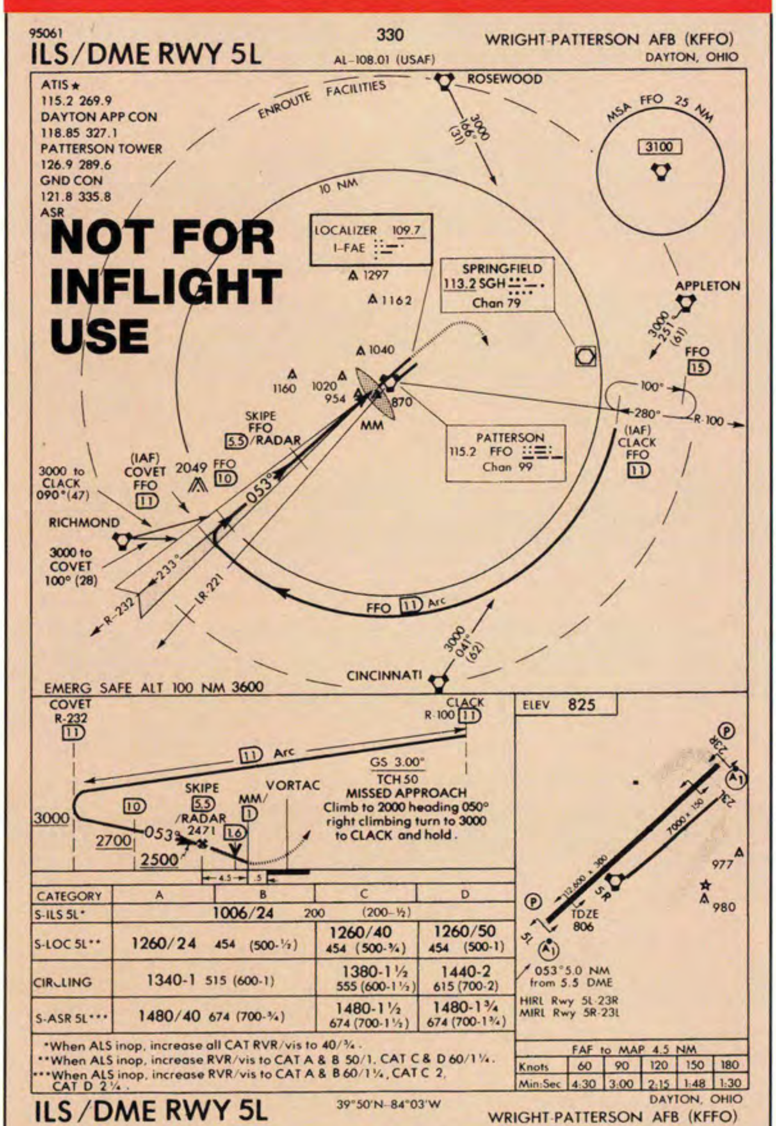
Looking back on my experience, I would have done a few things differently. First and foremost, I would always have a game plan for handling spatial disorientation. My plan is to follow the current MCR-55 series guidance and be ready to immediately engage the autopilot. For F-16 drivers, this will require retracting the landing gear.

Second, I would leave the landing light off until after the gear is down and the runway environment remains in sight. In the situation I encountered, I'm convinced spatial disorientation was mainly attributed to the disorienting effects of the landing light reflecting off the clouds as the landing gear extended.

Third, I would be ready to turn the anticollision light off before entering the weather. If already in the weather, I would very cautiously reach down while simultaneously using a very slow head movement to locate and turn the anticollision light off (remember the Vertigon experiment). One minute prior to my experience, I managed to quickly get the anticollision light off. However, my quick head movement to the left and down may have contributed to INCAPACITATING SPATIAL DISORIENTATION.

I have logged more than 2,000 hours in the F-16 in various kinds of adverse weather conditions. The weather I encountered on this mission was minimal, but it definitely led to the most HAIR-RAISING experience in my flying career. ■

AIR FORCE FLIGHT STANDARDS AGENCY



HQ AFFSA

The setting: Flying transition in your T-38, Category E airplane. Of course you're solo, with no one to ask for help. NOTAMs for the airfield are: (1) approach lighting RWY 19L out of service and (2) ATIS frequency OTS.

The object: Test your IQ by answering the following questions based on your knowledge of current directives and instructions.

QUESTIONS

1. Because of B-2 operations in the area, base operations has issued you the only PPR for the day. You contact Wichita approach 40nm from the airfield. Being bored silly, they issue you a vector onto the localizer final at 30 DME. Can you accept the clearance?

A. Yes.
B. No.
C. Ask the controller.

2. After that approach (they didn't violate you after the first one), you are cleared to fly the published missed approach and hold at 6,000 feet as published. Immediately after turning left toward KOSAC, you are cleared for the approach. What do you do now?

A. Continue the left turn and proceed to KOSAC.
B. Complete one turn in holding, and after completing the left turn at IAB 18 DME, turn at KAYEE using normal lead points to intercept the 15 DME arc for the approach.
C. Turn immediately toward KAYEE and start the approach.

Got 5 correct answers? You genius! Report to Randolph AFB for the soon-to-be-opened Advanced Instrument Flight Course (AIFC). They are going to need your help getting the new school set up.

D. Ask the controller what he really wants you to do — you're lost!!

3. Next time around, approach lets you establish yourself in holding at 6,000 feet. Approach then clears you for the ILS 19R as you're turning inbound at IAB 18 DME. When can you descend for the approach?

A. Immediately.

B. Established on the 15 DME arc.

C. Once you are turning to intercept the 15 DME arc.

D. Proceed around the holding pattern again. You can't make the descent by the time you intercept the arc and can't start the approach from 6,000 feet.

4. As you get established on the arc, at the proper altitude, approach clears you for the sidestep to RWY 19L. What are your minimums for the approach?

A. 500-1 1/2

B. 800-2 3/4

C. 200-1/2

D. 500-2

5. As you have been flying, the weather has become more Europe-like and dropped down to 200-1/2. You finally break out of the weather on the ILS 19R at minimums, on course and glideslope, and notice that, yes, there are VASIs there. What should you expect to see?

A. White over White.

B. Red over White — your future Thunderbird!!

C. Red over Red.

D. Never look at them. They're for wimps.

BONUS QUESTION: If the DME is inop and you are flying a localizer approach, how can you tell you are over the final approach fix?

A. You can't. There is no way to fly the approach without DME.

B. Radar will tell you.

C. The ILS should have DME associated with it.

D. When you descend through 2,988 feet and are on the glideslope.

ANSWERS

1. = A. AFM 51-37, 13-1a.(1)(b) and FAA Handbook (FAAH) 7110.65H, Air Traffic Control. AFM 51-37, 13-1a.(1)(b): The localizer signal has a usable range of at least 18nm within 10° of the course centerline unless the IAP depicts a greater distance or radar service is provided.

FAAH 7110.65H Ch. 4, 4-2 Exceptions, Note 2: When a clearance is issued beyond the altitude and/or distance limitations of a NAVAID, in addition to being responsible for maintaining separation from other aircraft and airspace, the controller is responsible for providing aircraft with information and advice related to significant deviations from the expected flightpath.

2. = A. AFM 51-37, Ch. 10-5c. If cleared for an approach while en route to a holding fix which is not collocated with the IAF, you are expected to proceed to the IAF via the holding fix, unless specifically cleared to proceed direct to the IAF.

3. = C. AFM 51-37, Ch. 10-6e. When cleared for the approach, maintain the last assigned altitude until established on a segment of the published routing or instrument approach procedure. At that time, the pilot may descend to the minimum altitude associated with that segment of the published routing or IAP.

AFM 51-37, Ch. 9-9. For those holding patterns where there are no published minimum holding altitudes, upon receiving an approach clearance, you must maintain the last assigned altitude until established on a segment of the instrument approach being flown.

4. = D. AFI 11-206, 8.15.2. Published visibility minimums on instrument approach procedure charts are based on full operation of all visual aids associated with the particular approach chart being used. Visibility minimums will be increased by 1/2 SM for instrument approaches conducted to fields with inoperative approach lighting or as noted on NOTAMs, ATIS, or the approach plate.

5. = A. The Caution on the approach plate states the VASI RRP is 236 feet prior to the ILS GS RPI. On course/on glideslope on the ILS would therefore bring you in high on the VASIs as depicted.

BONUS: B. FAAH 7110.65H, Ch. 5-123d.4: When radar is used to establish the final approach fix, inform the pilot that he is over the fix.

Your IQ rating:

5 of 5 You genius! Report to Randolph AFB for the soon-to-be-opened Advanced Instrument Flight Course (AIFC). They are going to need your help getting the new school set up.

4 of 5 Okay, you get to teach the new and improved Instrument Refresher Course once AFMAN 11-210 gets published.

3 of 5 Read the full questions next time, and make sure you review every approach plate before you fly.

2 of 5 Hope you don't get a no-notice visit by your friendly stan/eval buddy.

1 of 5 Please call the nearest Flight Service Station before you fly again so they can publish a NOTAM warning the rest of us.

0 of 5 Go back to UPT/UNT and start over. The rest of the students need your help lowering the curve.

If you have any beefs, gripes, whines, or suggestions for future questions, please contact HQ AFFSA/XOF at DSN 858-2126 or COMM (301) 981-2126. ■

FSO's CORNER

FSO

THE HATR PROGRAM — WHAT IS IT ALL ABOUT?

MSGT DENNIS R. KING
Chief, USAF ATC Stan/Eval
Andrews AFB, Maryland

■ The HATR (Hazardous Air Traffic Report) program seems to be going through some very difficult times. The biggest problem with the program is that it is not being used, or not being used correctly.

The HATR program was designed to provide trend information to all concerned reference hazardous situations in the air traffic system which have directly impacted your mission or may impact your mission in the future. The air traffic system is defined as pilots, controllers, ATCALs, directives, procedures, vehicle operators, and all the other components which are directly involved in flight safety.

The program requires that corrective actions are accomplished following a HATR. Through proper use of the HATR program and subsequent reports, the corrective actions and results are made available to all concerned within the air traffic system. Providing this information greatly enhances our ability to recognize and alleviate a possible problem before it actually occurs.

The HATR program is preventive in nature and not intended to be used as a quality indicator. If your wing safety office has not processed a HATR within the past few years, your wing has either one of the safest operating air traffic systems in the world, or someone is not utilizing the HATR program as it was intended.

Not using the program and keeping incidents at wing level may temporarily reduce personal embarrassment. But, what if an incident occurred at your base and you corrected the problem without loss of life or major damage. Then you decide to keep it to yourself because nobody wants to admit they had a problem to begin with. Now, 6 months later, the same thing occurs at another base, only this time the result is four dead and two aircraft destroyed. Could they have used your experience to prevent their own? Probably so! Are you partially to blame for their problem? Most definitely!

Bottom line: Coverup in our business generally results in bigger problems later. Don't allow this to happen. A little personal embarrassment now could alleviate possible tremendous guilt later.

For complete information on the HATR program, refer to AFI 91-202, *Mishap Prevention* (Atch 3), or contact your wing safety office. ■

Strut Settling Mishap

■ A maintainer was given a month off to rest and recuperate after being injured when his aircraft settled on his head! OUCH!!

The aircraft had returned from a mission and refueling was completed. While working under one of the aircraft's wings, the aircraft suddenly settled about a half foot, conking the crew chief on the head. Besides being knocked to the ground, he received a compressed spine injury. He was fortunate his injuries weren't worse.

This "settling effect" isn't something new to our force of maintainers and aircrews. Aircraft have been known for years to "fall" on maintenance stands and people after refueling. Settling has also been known to happen soon after cargo loading on the airlifters.

So be careful out there, and remember, there are times when heads-up maintenance is not always the order of the day.

No Tool X Low Oil = Mission Abort

An F-16 pilot was forced to abort an air-to-ground training sortie just moments before entering the range. The engine's low oil light had come on which resulted in an IFE and a return to base.

Official USAF Photo

After shutting down the engine in the de-arm area, an oil leak was soon discovered visually. Further troubleshooting revealed the oil leak originated where the AC generator (alternator) stator housing attaches to the engine-driven gearbox.

Several days before the mishap, the alternator had to be removed to facilitate other maintenance. Apparently, during its reinstallation, a rubber packing between the alternator and gearbox was not correctly installed, eventually causing the leak. The packing, when properly installed, serves as an oil seal to prevent leaks.

Mating the alternator stator housing to the gearbox and getting the packing seated properly at the same time are not easy tasks. For this reason, the tech data requires a locally manufactured set of guide pins be used to ensure the alignment and mating are done correctly while also getting the preformed rubber packing properly seated. (Another function of the guide pins is preventing damage to the alternator rotor windings.) In this case, maintainers had not used the tech data-required guide pin set during the alternator's last reinstallation.

In fact, neither the mishap unit nor any of the other flightline maintenance units had a set of guide pins available for their maintainers to check out and use. (One backshop-maintenance unit did, however, have the guide pin set in its engine maintenance shop and *used* it too!) Having been successful in the past, this seems to have perpetuated an unsafe practice.

Unfortunately, there are strong indications that other F-16 maintainers are also not adhering to tech data on the required use of the guide pin set. Other pilots experienced a low oil light on the first sortie after the installation of the engine-driven alternator. All maintenance was performed on the flightline, and the guide pin set **had not** been used. None of these other units found any leaks on the engine ops checks after the alternator's installation.

The primary fact remains, the guide pin set is directed by tech data — it isn't an optional-use tool. *If your tech data calls for one, make sure you get — and use — it!*

continued

Cockpit Canopy Opens in Flight

A jet trainer departed on an incentive flight with a passenger in the back seat. After a few aileron rolls and a G-awareness turn, the pilot started a climb. Several thousand feet later, there was a loud, explosive-like noise in the cockpit. With the engines running all right and no warning lights, the pilot and passenger went on 100 percent oxygen and descended.

A chase plane discovered one side of the rear cockpit canopy had unlocked. Luckily for the passenger in the back, the other side remained locked or the rear canopy would've separated from the jet.

A maintenance inspection later found that maintenance installed the wrong type of rear canopy hook assembly bolts and had reused the old self-locking nuts. There were other tech data violations, too.

Make sure you have safe mechanics out there performing safe maintenance. Also, make sure your unit has strong, effective maintenance trainers and task inspectors and a solid maintenance followup program.

Which *Block* Are We On?

An F-16 pilot sensed something just wasn't quite right with his jet while slowing down on the landing rollout. That sixth sense caused him to go ahead and exit the runway early. A heads-up call from maintenance caused the pilot to shut down the engines. The precautionary actions were warranted! The main landing gear wheel and brake assemblies were severely damaged on one side of the jet!

A depot analysis later found a larger inner wheel bearing, used on the Block 50-series jets, was stuffed into a Block 40-series outer race. (Kind of like the ol' saying, "Stuffing a size 10 foot into a size 8 shoe.") The mishap bearing eventually failed due to excessive overheating.

Block 40- and Block 50-series F-16s *both* have the same type of outer main wheel bearings, but *not* so with the inners. An unsuspecting maintainer would have to have a keen eye to spot the difference between the two similar inner bearings.

Besides the different imprinted part numbers, the Block 50 bearing has a greater width than the Block 40 version. However, once incorrectly installed, it's nearly impossible to detect the error. (So if you have to perform an in-progress inspection, you'd better do it *before* the wheel assembly is completed!)

The improper bearing should have been discovered during an in-progress inspection which was required by tech data. *Both* the maintainer and inspector failed to heed the **CAUTIONs** in the tech data directing the maintainers to ensure the proper bearings (by part number) were, in fact, the right ones to be installed.

These specific tech data cautions indicate the weapon system and item managers, plus engineering experts, had already considered the possibility of the inadvertent mixing or improper installation of Blocks 40 and 50 components. Regardless of the precautions the experts built into the maintenance tech data, we still have maintainers who do not read or heed them!

It didn't help the mishap unit's situation any to possess *both* Block 40 *and* 50 jets. You can imagine the care and attention to detail everybody — maintainers, supply, and inspectors — have to exercise to prevent the accidental use of almost identical components.

Making sure these similar components are physically separated and clearly marked for easy identification would be a good place to start! It also wouldn't hurt to emphasize this problem to those who are certified to be task inspectors either! ■

Official USAF Photo

*U.S. GOVERNMENT PRINTING OFFICE 1995-679-016/03012

THE 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
Paul R. Pryor

CAPTAIN
Christopher D. Chelales

4404th Composite Wing (Provisional), APO AE 09894

■ While flying a combat loaded F-4G returning from an Operation Southern Watch mission, Captains Paul R. Pryor and Christopher D. Chelales experienced a loud explosion followed by sparks in the rear cockpit during the rejoin for a battle-damage check. Serious airframe vibrations were immediately noted throughout the aircraft. The battle-damage check revealed no external damage.

Their aircraft was unable to maintain altitude, and a controlled descent was initiated at 300 knots. The No. 2 engine EGT was lower than Dash One limits, and airframe vibrations were so severe the rear cockpit radar scope was unreadable. The No. 2 engine was shut down in accordance with checklist procedures.

After shutting down the No. 2 engine, the airframe vibrations remained violent, and any power settings above 90 percent on the No. 1 engine increased the severity. The aircraft was descending through 20,000 feet and was unable to maintain altitude in its present configuration. The closest suitable divert base was Jubail Naval Base, 30 miles east, near the Saudi Arabian coast. They were unable to contact Jubail tower. Landing clearance was relayed through approach control at Dhahran Air Base.

Consideration was given to jettisoning their combat load, if required, as they were losing altitude rapidly. They maneuvered their heavily loaded aircraft towards Jubail Airfield and arrived over the field at 9,000 feet, at which time they elected to retain their munitions. Maneuvering for a thrust-deficient landing at an unfamiliar field, they approached the field in a position to perform a descending, left-hand 270-degree turn to land.

During the final portion of the single-engine approach, the No. 2 engine seized with an accompanying rise in EGT to 1,000 degrees centigrade. After landing, smoke was emanating from the intake and exhaust areas. They taxied the aircraft clear of the runway, shut down, and egressed the aircraft.

WELL DONE! ■