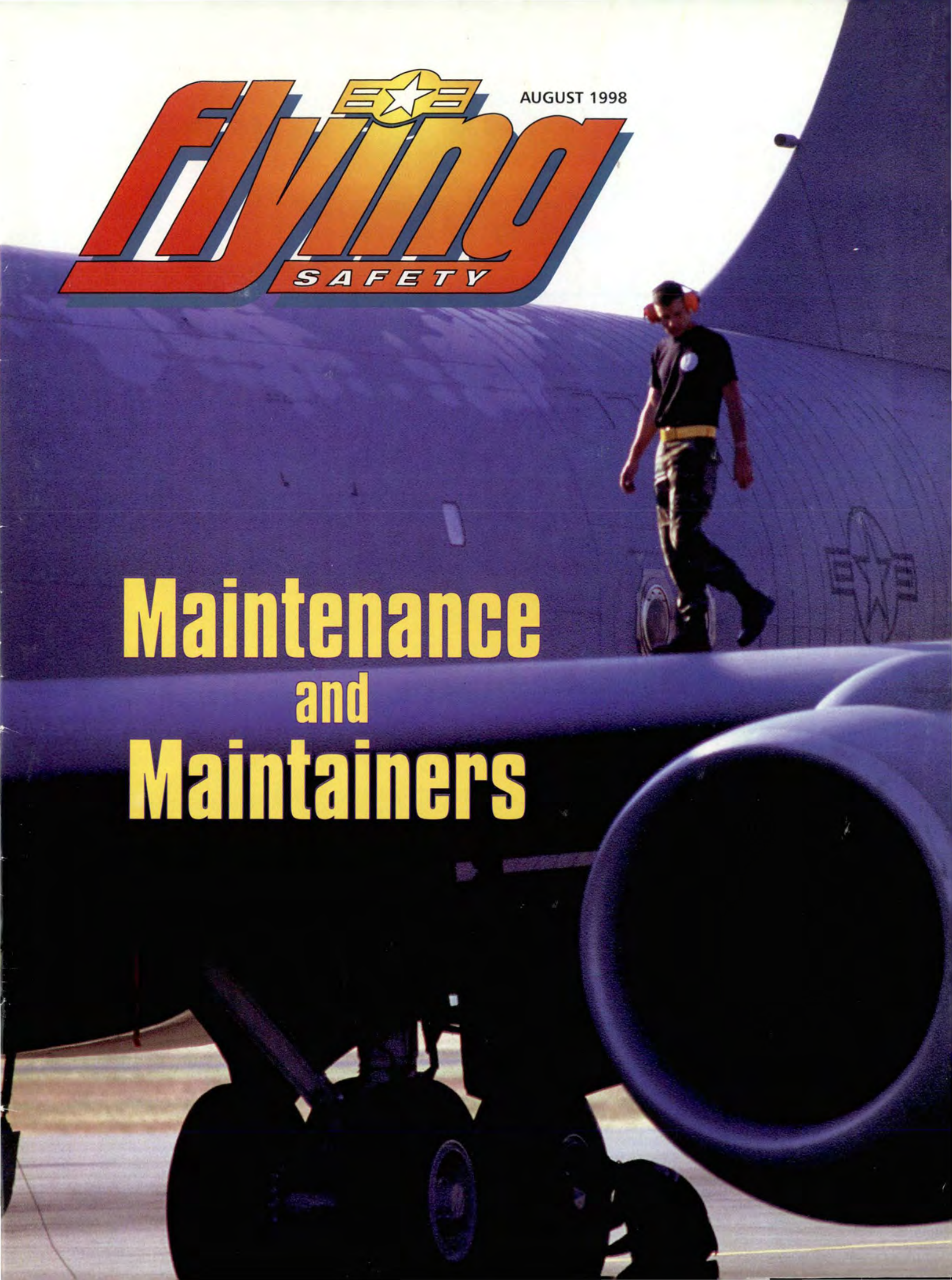
flying SAFETY

AUGUST 1998



Maintenance and Maintainers

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Front cover photo by MSgt Perry Heimer at RODEO '98

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PURPOSE — *Flying Safety* is published monthly to promote aircraft mishap prevention. Facts, testimony, and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. The contents of this magazine are not directive and should not be construed as instructions, technical orders, or directives unless so stated. **SUBSCRIPTIONS** — For sale by the Superintendent of Documents, PO Box 371954, Pittsburgh PA 15250-7954; $25 CONUS, $31.25 foreign per year. **REPRINTS** — Air Force organizations may reprint articles from *Flying Safety* without further authorization. Non-Air Force organizations must advise the Editor of the intended use of the material prior to reprinting. Such action will ensure complete accuracy of material amended in light of most recent developments.
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FSM notams

DOD INTERNET NOTAM SERVICE

The long-awaited DoD Internet NOTAM Service (DINS) has become a reality and is approved for general use. It may be accessed at website http://www.notams.jcs.mil.

Effective immediately, bases should begin using the new system as their primary means to obtain NOTAMs. For the time being, the Air Force Flight Standards Agency (AFFSA) will continue to transmit paper NOTAM summaries. Use the paper products as a backup until the new system is "fine tuned." If there are no significant problems, they plan to stop transmitting paper NOTAM products on 30 September 1998.

The DINS website operation is very simple. Instead of sending the summaries and updates to the unit to post on the wall, AFFSA sends them to the website. These are exactly like the paper NOTAMs hanging on the wall in Base Operations. Users make their requests by using the four-letter ICAO location identifier. If you don't get NOTAMs on the location requested, (1) there are no NOTAMs on the location, or (2) the ICAO identifier was misspelled, or (3) the locations are not covered on the military summaries (check the FLIP en route supplement for the NOTAM coverage symbol).

The website "reads" the summaries and updates for you. It is not extracting information from a database. If you receive the statement "location xxxx not found on the summaries or updates selected," it means the location was not found on the summary or update selected.

You can call the NOTAM coordinators at DSN 994-4205/6/7 for assistance. ✈

Aircraft Maintenance—Yesterday and Today

Official USAF Photos - *FSM* archives

CMSGT ROBERT T. HOLRITZ
Technical Editor
Reprinted from *Flying Safety*, Nov 92

As Chief Holritz states at the beginning of this article, the USAF has reduced mishap rates. Compare the 1921 major mishap rate of 467 per 100,000 flying hours to today's rate of 1.10 per 100,000 flying hours (as of June 1998). Better pilot training, aircraft designed from the outset with reliability and maintainability in mind, improved maintenance methods, and more highly skilled aircraft maintainers have all contributed to safer flying.

And here's a note of historical perspective that made all of us on the staff do a double take: From January 1950 through June of 1958—not including combat losses suffered during the Korean War—the Air Force suffered 2,764 aircrew fatalities and 5,599 aircraft destroyed. During that 8-year period, we lost an average of 27 aircrew and 55 aircraft every month!

Air Force end-strength has stabilized at two-thirds of its size a decade ago, but our ops tempo remains high. It's more important than ever that we adhere to tech data, prevent FOD, and never sacrifice safe, quality maintenance for the sake of expediency, lest we return to the aircraft mishap rates of yesterday.

—The Editor

If today is an average day, Air Force aircraft accidents will kill one person, injure another, wreck one airplane, inflict major damage on three, and minor damage to two.

But if you think those stats are bad, consider the 1921 major mishap rate of 467 accidents per 100,000 hours! We've come a long way since then. Almost without exception, our mishap rate has declined every year. And, with a Class A rate of 1.11 per 100,000 flying hours, last year was our best yet.

We have whittled away at the mishap rate by providing pilots with better training, designing more reliable aircraft, and changing the way we maintain them.

Old Sarge

During the post-WW II era, when the Air Force was a new service, aircraft mechanics were basically hard-core wrench-benders. They knew every rivet of their aircraft. And, whether it be a sluggish engine or a jammed gun, it was the crew chief's job to get the aircraft ready for the mission.

The pockets of his one-piece gray uniform contained a variety of sockets and miscellaneous parts. He, typically, had no leadership training. And since the formal concept of OJT was not adopted by the Air Force until the mid-fifties, he was not even tasked with training his assistant,

Bench stock and tech data were usually in some remote, dimly lit corner of the hangar. Searching for the correct data and parts could be very frustrating—let alone time-consuming.

"Bloody-knuckle" technology was the order of the day as these F-84G mechanics could readily attest. Sharp edges on panels caused a big share of grief for the unwary or inexperienced.

Oft times adding to an already tough situation was the weather, as the photo illustrates. Pity the troops who had to deal with all those heavy tarps when they were wet or frozen.

if he had one. But somehow, the young mechs managed to survive with the basic skills taught in tech school and gradually gained enough expertise to carry on the mission when "Old Sarge" retired.

Sarge rarely used technical data. It usually stayed in the shop unless, on an extremely rare occasion, Sarge ran into a problem and needed to refer to the manual. As a result, it wasn't uncommon for parts to be improperly installed. This contributed significantly to the high mishap rate of the early days.

Sarge's system worked well, as far as he was concerned, until the coming of jet aircraft in the early fifties. Systems suddenly became much more complex, and mechanics began to specialize on engines, hydraulics, avionics, or just plain aircraft in general. (Thus was born the term APG.)

FOD

Foreign objects had always been a problem. But the jets added to the problem by eating anything left near the intake. Still, while foreign objects became an increasing problem, they were considered just another hazard of taking to the skies. In fact, it wasn't until 1956 the term FOD became part of the Air Force's vernacular.

It's interesting that, although stray tools regularly caused major mishaps, tool control was lacking, and tool inventory was virtually nonexistent. Each specialist had his own tool box which contained a variety of hardware, depending on what the specialist was authorized or what he could scrounge. Occasionally, a wrench forgotten by a mechanic would jam the flight controls, and an aircraft and crew would be lost.

Unbelievably, until the early seventies, no one gave any thought to shadowed tool boxes. Today, tools are strictly controlled, and it would be considered criminal to dispatch a technician with just a canvas pouch of tools.

Supply

Control of supplies and bench stock was, at best, unorganized. The system was strictly manual. Ordering a part often took hours before finding out if it was even on base. Bench stock was often located in some unsecured place in the corner of a hangar. Establishing the correct level for each item was, at best, hit and miss.

This situation remained unchanged until the Air Force began to install the UNIVAC 1050 computer in the mid-sixties. While this system helped ease the load on the supply system, it required a large facility which had to be air-conditioned to cool the myriad of vacuum tubes of the huge computer. Today, a computer with the same capacity could easily fit on the corner of a desk.

Duty Day

It had long been the practice to

continued on next page

limit the duty day of aircrew members. But for the maintenance folks, there were no such restrictions. They were expected to work until the job was completed. And it was actually considered a test of manhood to stay awake extra hours to make the mission. As a result, people were falling asleep while operating machinery. They were also making mistakes which contributed significantly to the high flight mishap rate.

This might still be the case had it not been for a munitions maintenance squadron commander who decided people who worked with nuclear weapons should be afforded the same crew rest as aircrews.

One day in 1965, he showed up at the nuclear weapons maintenance facility with several high-ranking medical people. Without compromising security, he explained the duties of the weapons specialists. He then proceeded to tell the medics that while the chance of a nuclear mishap was virtually nonexistent, it was vital to national security to ensure these weapons worked as they are designed.

Within a year, a regulation was published limiting the duty day of people who worked with nuclear weapons. It was followed shortly after by another which extended the same restrictions to all maintenance people. Undoubtedly, this new restriction was a major factor in the decrease to 13 major maintenance-caused mishaps in 1967.

The more things change, the more they stay the same. That may echo the sentiments of the tire shop on occasions, as depicted here, but there would be little argument over the advances in technology and computerization of flight-line tasks. Even the water jugs have changed.

Test Equipment

In 1949, test equipment available to Old Sarge was limited to his experienced eyes and ears and perhaps an uncalibrated voltmeter. However, in 1950, things began to change. The breakthrough was an airborne engine analyzer. The Air Force bought 45 of these amazing instruments and installed them in B-50s, C-97s, and the huge B-36. No longer did the crew chief have to put up with vague writeups in the Form 1A, *Aircraft Discrepancy Record* (the forerunner of the AFTO 781A).

Using the analyzer, the flight engineer could get a reading on any one of the B-36's 336 spark plugs. Although primitive by today's standards, the analyzer made diagnosis of serious engine problems much more precise. The airborne analyzer was the forerunner of built-in test systems in modern hi-tech aircraft.

SOAP

In the early days, the crew chief used to check the oil of his aircraft's reciprocating engine by running a small sample between his fingers. If it felt gritty or if there were any flecks of metal, someone would make a decision whether or not to tear the motor down and look for a worn part.

By 1962, the Army and Navy were already using spectro-analysis to check the condition of gas turbines and helicopters. Unbelievably, the Air Force did not get into spectro-analysis until 1963, and then its interest was mainly to check reciprocating engines. In fact, the Air Force did not have any facilities designed for handling Spectrometric Oil Analysis Program (SOAP) samples until the late sixties. One can only guess how many engine failures and Class A mishaps could have been avoided if the Air Force had used spectro-analysis early on.

Today the Army, Navy, and Air Force have a joint oil analysis program with standardized specifications. This was done to enable the services to share facilities. The Joint Oil Analysis Program (JOAP) is now used extensively to accurately detect impending engine failure.

Although the "user friendly" F-5A was light years ahead of its predecessors, the advances made between it and the F-15 would be called "radical" by many a mechanic.

Maintainability

Undoubtedly, the biggest problem maintainers had to face with the first jets was poor maintainability. From the first aircraft to take to the skies, designers had only two things in mind—performance and safety. The maintainer was not considered. And, while the new jets performed well, and most of the time safely, they were extremely complex and difficult to maintain. Clearly, the days of the good Old Sarge's hammer and monkey wrench were over.

The maintenance-hours-to-flying-hours ratio skyrocketed. In the mid-fifties, technology leapfrogged over maintenance until 1960 when the Air Force finally realized no matter how good an aircraft performed, it was of little use sitting on the ramp awaiting repairs, and the concept of maintainability was born.

Simply stated, the Air Force now required ease of maintenance to be a function of design for any new aircraft or piece of ground equipment. As Lt Col Edward R. Fallon, Jr., then of the Directorate of Maintenance Engineering, HQ USAF, put it, "These (design) characteristics will make it possible to meet combat operational objectives with a minimum of maintenance effort and expenditure of supplies." It also meant increased reliability and safety.

Unfortunately, the Phabulous Phantom was already on the drawing board before the concept was in effect. The F-4, the workhorse of the Vietnam war, was the last combat aircraft to be produced under the old concept and, until it retires, maintainers will struggle keeping it flying. It has stress panels with numerous fasteners of varied length. Engine changes may take days. The rear seat has to be removed to gain access to much of the radio equipment which requires frequent maintenance. And, while many maintainers think fondly of the "bent-wing fighter," few will miss the Phantom "bites" from the aircraft's razor-sharp underside. It was said you could always tell if a crew chief had been to Southeast Asia by his ribbons and the Phantom's scars on his back.

The first real maintenance-friendly aircraft in the Air Force inventory was the F-5 "Freedom Fighter." One of the basic philosophies of the F-5's design and those which follow was to place those components which need frequent maintenance in the most accessible locations. Engine change time was now a matter of hours, not days.

When the F-15 came into the inventory, maintainers found it hard to believe it was designed by the same company which built the F-4. Panels were replaced by access doors with latches instead of an abundance of fasteners. Built-in test capability drastically cut troubleshooting time, and for the first time, engine changes could be made in under 2 hours. The emphasis on maintainability eliminated many time-consuming tasks, increased reliability, and took another slice out of the flight mishap rate.

We've Come a Long Way

We've come a long way since the days of "Old Sarge." We've learned how to work smarter and safer. However, although last year was our safest yet, aircraft mishaps for the year still cost nearly $500 million. Will we ever have a Class A-free year? Perhaps not. But with better test equipment, more reliable and easier-to-maintain aircraft, we can continue to whittle away at the mishap rate. ✈

Chemical Hazards in the Workplace
Are You Protected?

CAPT ANNE BARRETT
Certified Industrial Hygienist/Bioenvironmental
Engineering Flight Commander
22 ADOS/SGGB
McConnell AFB, Kansas

Late one evening, a maintenance worker arrived in the hospital emergency room, her hands inflamed with red patches, swelling, and large cracks in the skin. She had spent the day bathing grimy aircraft parts in a cleaning solution—*without any gloves.* Besides the swelling and cracks, the solvents had tightened the skin around her fingers so much they appeared to have no fat in them at all—like a famine victim. But this was no famine victim—this was a young maintenance troop in a lot of pain. In the end, however, the doctor could do essentially nothing to help her, except send her home with painkillers and moisturizing cream.

Whether you spray-paint, sand, or dip parts in a solvent/degreaser tank, or use sealants, adhesives, epoxies, fuels, or hydraulic fluids, chances are that you could be exposed to chemical hazards. Without their proper evaluation and control, you too might risk your health from a chemical encounter of the worst kind.

Let's face it. Air Force operations consume a great deal of chemicals, many of which present hazards to human health and the environment. In order to protect Air Force workers from these hazards, and also comply with Occupational Safety and Health Administration (OSHA) standards and regulations, each Air Force installation must implement a rigorous Chemical Hazards Surveillance Program. The Bioenvironmental Engineering Flight (BEF) at each base is the program's office of primary responsibility, maintaining the requirements found in the OSHA and Air Force Occupational Safety and Health (AFOSH) standards. Because of increasingly stringent regulations from OSHA and the Environmental Protection Agency, many Air Force folks wonder how they can keep using the chemicals they need to do their jobs. Here's where your BEF staff can greatly help you with all the problems you may have with chemical usage. They can offer you viable solutions that will get you back to business in no time.

Chemical Hazards

Most people think almost solely of toxicity when dealing with chemical hazards, but toxicity, the ability of a chemical to damage an organ system or to disrupt a biochemical process, is just one of the many ways a chemical can be harmful. Chemicals can possess one or several dangerous physical properties, such as explosivity, flammability or combustibility, radioactivity, corrosivity, and toxicity.

While a chemical can be hazardous only because of its toxicity, toxicity and hazard are not the same. The *hazard* posed by a chemical comes from its ability to *cause harm* through its explosiveness, flammability, corrosiveness, or toxicity. So, how a person works with the chemical can have a great impact. Overall, if you don't use a toxic chemical, it is not a hazard.

Two other important considerations when evaluating a chemical hazard are how much and how often the chemical is used and whether expected health effects are acute or chronic.

The acute toxicity of a chemical refers to its ability to do damage as a result of a *one-time* exposure, such as children ingesting a household product left within their reach.

Conversely, chronic toxicity refers to the ability of a chemical to do damage as a result of *repeated* exposures over prolonged periods of time, such as during the normal course of employment.

Finally, the exposure route or method by which a substance enters the body has a great deal to do with which organs will be affected and how severe the reaction. Chemicals can enter the body through inhalation, skin absorption, ingestion, or injection.

In most industrial workplaces, chemicals enter the body primarily through inhalation and skin absorption. Inhaled substances can react in different ways. Asbestos, for example, can get trapped in the lungs and cause damage, while many inhaled gases and vapors pass readily into the blood with little or no effect on the lungs.

When a worker *touches* a chemical, such as fuel or sol-

NOTE: The hands in the photos do not belong to the subject in the story.

vent, the skin can have four reactions:

1. The chemical can cause no reaction—i.e., the skin effectively acts as a barrier against penetration or injury.

2. The chemical can cause irritation of the skin surface (dermatitis).

3. The substance can penetrate the skin, damaging or sensitizing deeper skin layers.

4. The substance can penetrate the skin entirely, enter the bloodstream, and act as a systemic poison.

Look around your workplace. Do you handle chemicals of any fashion? Are you exposed to chemical fumes or vapors in your environment? If the answer is yes, then you probably need a chemical hazard evaluation from the Bioenvironmental Engineering Flight to determine your exposure to chemical hazards.

Chemical Hazards Surveillance

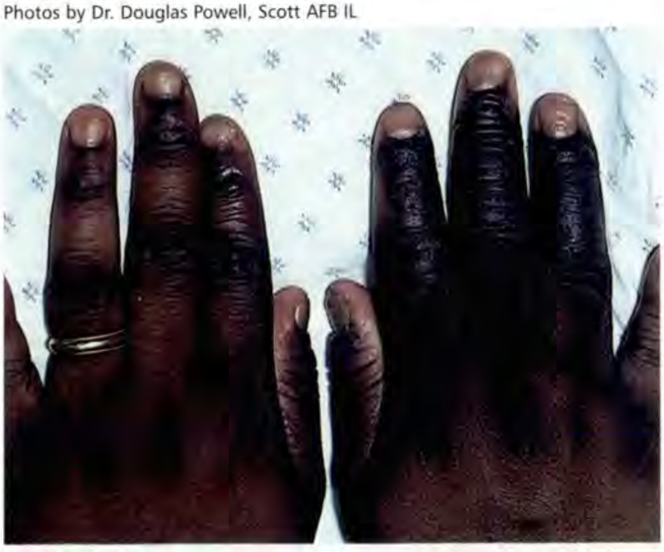
BEF personnel perform chemical hazard evaluations as part of the periodic or special occupational health surveys they conduct in each industrial workplace. First, they identify and evaluate all hazardous chemicals used in the various processes performed in the work section. Then, if they find a chemical hazard, BEF personnel will recommend ways to control it.

BEF personnel will usually recommend substituting the chemical with something less hazardous. Why spend thousands of dollars on monitoring and measurement surveys, expensive controls (such as ventilation systems and respiratory protection programs), medical surveillance programs, and waste disposal when another less hazardous chemical could do the job?

If substitution of the chemical is not possible (because of tech order requirements, for instance), other options, such as engineering controls (ventilation systems, chemical source isolation/enclosure, or process automation) can be considered. Of course, instituting these controls can be costly.

If engineering controls are not possible, the next step is administrative controls. These may include personnel training, monitoring the work area or worker for contaminant levels, rotating workers in and out of hazardous areas to avoid exposures above permissible exposure limits, and preventive maintenance on hazard control equipment.

Photos by Dr. Douglas Powell, Scott AFB IL



As a general rule, Personal Protective Equipment (PPE) should be used only as a last resort or an interim measure until permanent controls (such as ventilation) are installed. However, there is often no alternative to using PPE, and workers must choose PPE very carefully to ensure it will do the job for which it was designed. For example, a worker using acids should always wear PPE to prevent contact. But what kind? Since goggles would protect the eyes from acids, but not the face, a face shield would be more appropriate.

Once BEF and workplace personnel work out a plan of action and agree upon controls, training can begin. An effective training program is probably the best way to prevent injuries and diseases from occurring in the workplace. Remember the good old Hazard Communication (HAZCOM) program? If you have a good HAZCOM program, then you've trained your employees on the chemical exposures that they may receive in the performance of their job. You've also trained them to use the controls and protective measures essential for the safe handling of chemicals, to include emergency response procedures.

In addition to safety/health precautions and emergency procedures, a good chemical inventory, accompanied with Material Safety Data Sheets (MSDS) for each workplace chemical, is a must in your workplace. MSDSs contain information on the constituents of the product, as well as pertinent health and safety information. These sheets should be located in an easily accessible area so workers can get to them very quickly in case of an accident.

Another chemical hazards surveillance tool is chemicals issue control. In an effort to control the amounts and types of chemicals used in the Air Force, each base now has some type of chemical issue control system, usually known as the "HAZMART." Supply personnel run the HAZMART with help from BEF and the Civil Engineering Environmental Flight. Their goal is to control the acquisition of hazardous chemicals by base units. This control is not meant to make the user's life miserable, but rather to ensure Air Force personnel cannot acquire hazardous chemicals without a true mission need and prior review by BEF. If the user truly needs the chemical, BEF personnel can evaluate the hazard and make appropriate recommendations to the user. The HAZMART, although still fairly new, has already made great strides in reducing the amount of hazardous chemicals used in the Air Force, as well as their tremendous costs.

Remember, BEF is your ally in the occupational health arena and can be of great help with all your chemical usage needs. Maintain good communication with your BEF. Tell them what your mission requirements are. They will then research and find solutions that fit your mission, while preventing your workers a painful experience with mangled hands—or something much worse!

Courtesy *The Mobility Forum*, May-Jun 98 ✈

Where did this come from?

CAPT ROBERT ZABEL
VAQ-128
Whidbey Island, Washington

It was one of those days a Flight Safety Officer, or Aviation Safety Officer for you Navy types, just loves. I was the FSO (Flight Safety Officer) for a squadron of EF-111s. As I was sitting in the Maintenance Officer's office chatting about the upcoming Safety Standdown, a young troop walked in carrying a broken bolt. I sat back and listened while the airman explained why said bolt was in his hand and not on the rim of a wheel where it belonged.

Apparently, the intrepid trooper just happened to notice an errant squadron mate was in the process of throwing it in the trash. Luckily, the squared-away airman was the curious type, as he asked where the bolt came from. Turns out it was found on the ground outside the hangar. Well, that answer only increased the trooper's interest.

After an exhaustive investigation, the trooper determined the bolt originated from one of the assembled wheels lined up smartly in the tire rack. The trooper, who happened to be well versed in the physical sciences, figured the force with which the bolt departed the wheel to be along the lines of a slug fired from a .45-caliber pistol.

At that point, my curiosity was piqued. I asked if any other "projectile" bolts had recently been found. The answer was startling. It turns out another bolt had been found on the line in the immediate vicinity of aircraft. I scratched my head, as you may be doing as you read along.

Time to put things into proper context. These bolts are used on the main mounts of the EF-111 which, when retracted, are in close proximity to the fuel-oil heat exchanger. Needless to say, having one of the bolts come apart in flight is, shall we say, undesirable. Amazingly, in spite of the seriousness of the problem, the Maintenance Officer in attendance didn't seem compelled to pursue the issue further.

Ah, but I, the eager FSO, couldn't leave it alone. I immediately pulled out the safety manuals and the triplicated form. Actually, I made a few phone calls to various experts in the field in an effort to solve the case of the splitting bolts. I sent a sampling of the bolts from supply and the remains of the two culprit bolts to the lab for analysis. The report showed the problem was related to the chemical properties of the metals used to manufacture the bolts. I should have known the bolts were failing because of—you guessed it—none other than "hydrogen imbrittleness" and the premature removal of the bolts' "cadmium coating."

In academic rock terms, certain chemical processes may weaken materials. Discovering these processes took a little sleuthing, and that sleuthing led me to a little-known and less-understood document called the MIL SPEC (Military Specification). If you ever want to fall asleep quickly, start reading MIL SPECs. Actually, MIL SPECs are several books, one of which specifically addresses chemicals acceptable for cleaning aircraft parts.

To backtrack a little, the bolt found on the line came apart after a troop working off extra duty had been assigned to clean all the wheels on the EF-111 line. In an effort toward reform, the newly motivated troop decided to completely rid all tires of that nasty grease buildup. Unfortunately, he chose a product called Citra-Clean™, a wonderful floor cleaner, as his weapon. You see, Citra-Clean™ is a catalyst for the aforementioned chemical processes. In fact, citric acid-based cleaners are not authorized for use while cleaning USAF aircraft parts.

And so the mystery of the exploding wheel bolt was finally solved.

There are a couple of lessons to be gleaned from this tale. In no specific order of importance:

- When there is any doubt as to the validity of an answer, research the issue until you are satisfied. I have found people are always willing to assist and will usually take the time to help you find answers.
- MIL SPECs were created for a reason. Use the appropriate tool or cleaning product at the appropriate time and on the proper piece of equipment.

Lessons learned in this business are often paid for with blood, so let's not keep learning them over and over. ✈

Capt Robert Zabel is a former EF-111 EWO. He currently flies with the "Fighting Phoenix" of VAQ-128.

Editor's Note for USAF Maintainers: The MIL SPEC for AF-approved aircraft cleaning products is MIL-C-87937B, "Cleaning Compounds, Aircraft Exterior Surfaces, Water Dilutable." Use of products other than those listed in applicable tech data is not only illegal, but as the author points out, potentially very dangerous. Does your work center use only approved cleaning compounds?

Safety Thought of the Week (3/5/98)

Today's weapon systems are extremely complex and getting more so. No one person can remember every part or procedure...

Courtesy USMC Safety Division

The best way to stay out of trouble around complex equipment is to read the book before you begin work, refer to it as you work, and review the book after you complete the job. Even if you've done the job a thousand times, take a few moments to review the book before you begin. If you've never done a job before, get somebody to show you how, but make sure that you both use the book. If the book is wrong or there's another way to safely do the job, tell someone. Here are some examples why.

Three mechanics were trying to start a truck after installing an engine and transmission. After several failed attempts, the mechanics determined that the protection control box and ignition switch were inoperative. Utilizing a *nonstandard* starting procedure, they bypassed the defective components as well as the transmission neutral safety switch.

During the first bypass attempt, the truck tried to move forward. The mechanic in the driver's seat ceased trying to start the truck to ensure the transmission shift lever was in the neutral position, the parking brake was applied, and the wheel chock was in place.

On the next attempt, the engine started, and the truck took off out of the maintenance bay with all three mechanics in the cab. The mechanic in the driver's seat tried to stop the truck by slamming on the foot brake. The mechanic in the middle seat tried pulling the emergency fuel shutoff cable and putting the transmission in reverse and back to neutral. With the engine racing, the truck picked up speed, hit a small cargo vehicle, and continued approximately 60 feet before ripping through a chain link fence, taking out four 8-foot concrete poles and finally crashing into a concrete wash/lube rack.

Sound like the script of a "Home Improvement" episode? I started giggling just imagining Tim "The Toolman" Taylor doing something similar. Funny? Try this:

Close stations march order (CSMO) was sounded for the battery. Gun No. 2 commenced "Preparation of Howitzer for Towing" procedures, and completed the following steps: Step 9 (install travel lock); Step 19 (lock down wheels); Step 24 (disconnect spade keys/spade plungers from the trails); and Step 27 (remove the base plate).

At this point, the section chief asked the gunner if the muzzle plug had been installed (Step 3). The gunner responded with a no and was directed by the section chief to put the muzzle plug in. The muzzle was elevated, so the gunner had a Marine sit on top of his shoulders to install the muzzle plug. The Marine couldn't reach the muzzle, so he grabbed the muzzle brake, wrapped his legs around the cannon tube, and pulled himself toward the muzzle to insert the plug. With the Marine hanging from the muzzle brake, the howitzer fell (muzzle end forward) to the ground. The muzzle brake struck the Marine on his helmet and forehead. Not so funny. This Marine died.

Just as serious: A mechanic was conducting scheduled maintenance on an aircraft's ejection seats. For seat installation, the arming checklist requires that a collateral duty inspector (CDI) and a quality assurance representative (QAR) remain on the aircraft until the seat is fully inspected. Both seats were installed in the aircraft without drogue chutes, even though no procedure exists for installing drogue chutes in the ejection seats after they've been installed in the aircraft.

The CDI directed, and the QAR permitted this unauthorized procedure. And both departed the area *prior to the final inspection*. While installing one of the drogue chutes, the mechanic removed the ejection gun safety pin and unintentionally initiated the ejection sequence. He was fatally injured, and a second mechanic was injured when the seat fell on him.

I'm sure all of us, at one time or another, have heard a maintenance officer or our Commanding Officer say that maintenance is to be done "by the book." By the book—what does that really mean? Just what it says. You do maintenance in exactly the order, using the procedures and tools, written in the manual. Why? Most of the procedures were thoroughly thought out and tested, or were modified because of incidents similar to those discussed above. Most of what we do, and how we do it, has been—quite literally—written in blood.

Today's weapon systems are extremely complex and getting more so. No one person can remember every part or procedure on a modern combat aircraft, a tank, or other equipment. Even the most experienced of us can forget the simplest of steps. That's why they write maintenance manuals—so that you don't have to remember every little detail and won't skip steps or forget parts.

Shortcuts and modified procedures will eventually lead to disaster. *If you don't have time to do a task right the first time, will you survive to do it over?* ✈

Midair Collision Avoidance and the No-Reaction Envelope

or How to Expand Your Aircraft Without Really Trying

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What if I told you the faster you fly the bigger your aircraft becomes? While you might think it absurd, that is, in a sense, what happens. You see, it all comes down to how you think of it—or more precisely, how fast you think of it.

When was the last time you thought about how fast you can think? Probably never, right? However, when it comes to midair collision avoidance, how fast you think can make a difference. Do you recall the last time you discussed midair collision avoidance? If so, it's safe to say you talked about the need to maintain good situational awareness (SA) (i.e., see and avoid) of all the aircraft sharing your sky and, above all, to maintain a good separation distance. But simply knowing an aircraft is there means nothing if you can't avoid it. To do that, you need space and time to maneuver. That's where quick thinking comes in.

We've all been told to "think fast," but just how fast *can* we think? Well, to start, the brain is actually a very fast piece of "wet-ware." Up until a hundred years ago, the "speed of thought" was indeed one of the fastest things around. It wasn't until the invention of high-speed flight that we faced a mechanical match in terms of not being able to process information faster than what was coming in.

So what is meant by "speed of thought"? In a nutshell, it's the time needed for your brain to detect a cue from the environment (by way of your eyes, ears, or other senses), process the information to arrive at a correct response, and react to the cue. Perhaps two of the best-understood areas of brain information processing (and, fortunately for us, the most relevant to midair collision avoidance) are visual detection and reaction time. Visual detection is simply the ability of the visual system (the eyes and related visual processing areas of the brain) to identify a visual cue, while reaction time (RT) is a measure of the time required to react to the visual cue.

Okay, time for a speed run. You're going to collide with another airplane. How fast can you react? Start your watches and let's take a look:

1. Reflected light from the converging aircraft strikes the retina of your eyes in, for all intents and purposes, no time flat. The photoreceptors of your eyes must now take these photons of light and convert them into an electrochemical signal that your brain can understand. This requires between 20 to 50 milliseconds (0.02 to 0.05 seconds)!

2. The signal is then relayed through several layers of cells in your retina until it exits through the optic nerve on its way to the occipital lobes of your brain, located all the way at the back, which process sight. This signal is combined into a recognizable shape (big airplane!) and processed for rate of movement, size, texture, contrast, color, etc. (big green airplane with bad nose art coming fast!). This information is then sent to the decision-making frontal lobe of your brain located, well, in the front, where a decision on what to do is made. Total time elapsed is now about 150 milliseconds (0.15 seconds)!

3. Your collision avoidance decision (break right!) is now relayed to the brain's muscle control area and several lower brain centers which decide which arm to use, the muscles needed, and how hard they should work. Total time elapsed is now between 200 to 300 milliseconds.

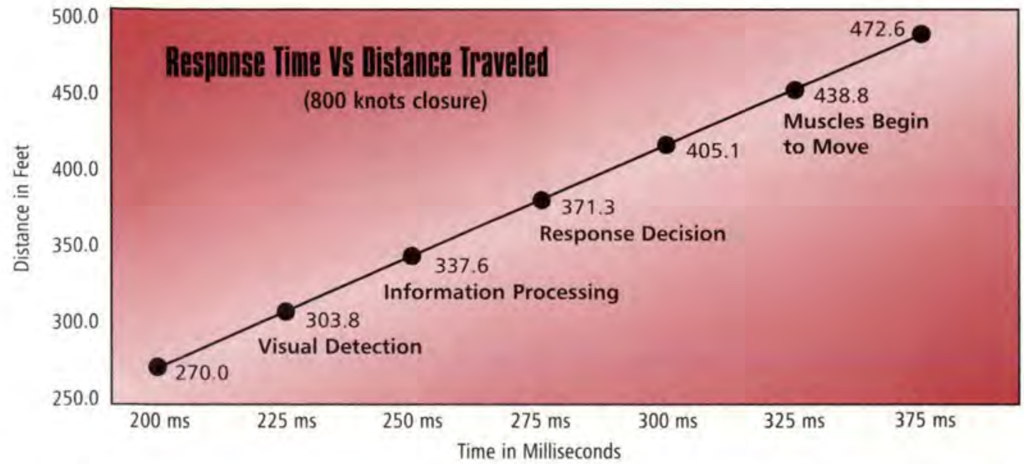
4. Finally, the signal to move is sent from your motor cortex, through several other regions of your brain for fine tuning and further processing, down your spine and to your muscles which move the controls and save you, hopefully, from near certain collision. Total time from detection to reaction—between 300 to 500 milliseconds (0.3 to 0.5 seconds).

Wait a millisecond! How can it take *between* 300 to 500 milliseconds to respond? That seems rather vague. Well, unlike computers, which don't change in their response time very much, squishy brain cells don't always react at the same rate. The brain's visual detection system and overall performance can be affected by many factors including poor nutrition, dehydration, hypoxia, accommodation time (focusing from near to far and vice versa), empty field myopia, and a myriad of situational awareness traps such as temporal distortion, distraction, and fatigue. Also, the more complex the task needed, the longer the time required to process the movement.

I know what you're thinking. "Only 300 to 500 milliseconds, is that all? Surely that's a fast enough reaction time to avoid another aircraft."

While it may seem fast enough, remember that aircraft on a collision course cover a lot of ground really fast. Consider the following scenario. An F-16 is on a head-to-head collision with another F-16. The closure rate of the two aircraft is 800 knots. Let's assume the pilot's reaction time is 350 milliseconds. A little math work will quickly show that at 800 knots closure, the two aircraft will cover 473 feet in 350 milliseconds!

To avoid the other aircraft, the pilot must first detect the oncoming threat. An F-16, with a 33-foot wingspan, at a distance of 473 feet, will cover only 4 percent of the pilot's visual field—roughly the width of your thumb held at arm's length—obviously not an easy target to see. Keep in mind that 473 feet is the distance at the threshold for a 350-millisecond reaction time. It doesn't include the time required to visually acquire the aircraft and for the aircraft to respond to control inputs which can take several seconds. This means that the other F-16



must be even further away to ensure a miss, making it even harder to see.

The figure breaks down the hypothetical 350-millisecond reaction time of our pilot's thought processes and the distance covered at 800 knots' closure for each component of his/her reaction. From this figure, it is obvious the 473 feet is the *minimum* reaction distance allowable. That is, with the given parameters, once the oncoming aircraft is within 473 feet of his or her aircraft, the pilot is physically incapable of reacting fast enough to do anything.

So what does all this mean in terms of avoiding a midair collision? It means that taking steps to improve your reaction time may help prevent a midair collision.

And it's not hard to do. Simply maintain proper nutrition and hydration, get sufficient amounts of sleep, and ensure a good brain oxygen supply. Ensuring a good oxygen supply entails not only checking for properly working oxygen equipment in the aircraft, but also doing those things which will increase the oxygen to your brain, such as regular exercise. As an added bonus, not only will regular exercise increase the brain's blood supply by helping to clean clogged arteries, but it also helps reduce stress, which can also affect your mental performance.

It almost goes without saying that smoking, which increases the levels of carbon monoxide in the blood and prevents the transport of oxygen, will also *increase* reaction times.

Finally, watch the caffeine intake. While one study found small doses of caffeine (300 milligrams, equivalent to approximately 2 to 3 cups of coffee) actually increase reaction times by up to about 40 milliseconds, larger doses eventually *decrease* reaction times.

The existence of a minimal reaction time also means that surrounding every aircraft is an imaginary, dynamic "no reaction" envelope—an envelope, or space, through which no other aircraft can unknowingly penetrate without dramatically increasing the probability of a midair collision. Since it is a dynamic envelope, its radius will continuously expand and contract with respect to closure rates and each individual pilot's reaction time.

To demonstrate the dynamic nature of this reaction envelope, the table lists the distances covered (and, therefore, the size of the no-reaction envelope) for different closing velocities and reaction times. By looking at the table, it is easy to see that the faster the closing velocity, and slower the reaction time, the more distance can be covered and, therefore, the larger the no-reaction envelope.

The table lists reaction times from 200 milliseconds to 1,000 milliseconds (1 second). Reaction times below about 200 milliseconds are generally considered physiologically impossible and, therefore, represent the smallest no-reaction envelope possible. So, in a sense, the existence of this no-reaction envelope means your aircraft occupies more volume (its own "personal space," if you will) the faster it flies.

And that, my friends, is how to expand your aircraft without really trying. ✈

Distance Traveled Vs Aircraft Velocity (knots) and Reaction Time (milliseconds)

Knots	200 ms	250 ms	300 ms	350 ms	400 ms	500 ms	1000 ms
100	33.8 Feet	42.2 Feet	50.6 Feet	59.1 Feet	67.5 Feet	84.4 Feet	168.8 Feet
200	67.5 Feet	84.4 Feet	101.3 Feet	118.1 Feet	135.0 Feet	168.8 Feet	337.6 Feet
300	101.3 Feet	126.6 Feet	151.9 Feet	177.2 Feet	202.5 Feet	253.2 Feet	506.3 Feet
400	135.0 Feet	168.8 Feet	202.5 Feet	236.3 Feet	270.0 Feet	337.6 Feet	675.1 Feet
500	168.8 Feet	211.0 Feet	253.2 Feet	295.4 Feet	337.6 Feet	422.0 Feet	843.9 Feet
600	202.5 Feet	253.2 Feet	303.8 Feet	354.4 Feet	405.1 Feet	506.3 Feet	1012.7 Feet
700	236.3 Feet	295.4 Feet	354.4 Feet	413.5 Feet	472.6 Feet	590.7 Feet	1181.5 Feet
800	270.0 Feet	337.6 Feet	405.1 Feet	472.6 Feet	540.1 Feet	675.1 Feet	1350.2 Feet
900	303.8 Feet	379.8 Feet	455.7 Feet	531.7 Feet	607.6 Feet	759.5 Feet	1519.0 Feet
1000	337.6 Feet	422.0 Feet	506.3 Feet	590.7 Feet	675.1 Feet	843.9 Feet	1687.8 Feet
1100	371.3 Feet	464.1 Feet	557.0 Feet	649.8 Feet	742.6 Feet	928.3 Feet	1856.6 Feet
1200	405.1 Feet	506.3 Feet	607.6 Feet	708.9 Feet	810.1 Feet	1012.7 Feet	2025.4 Feet

It Picked Me Up!

IT PICKED ME UP!

Jet-age adage: "If you never walk through an intake danger zone, you'll never get sucked into an intake."

LCDR TOM GANSE
Courtesy *Approach/Mech*, Mar-Apr 96

January in Lemoore—cold, damp, foggy, dark, and dreary. Post-holiday letdown. Operations and maintenance are routine and mundane until one of your mechs gets pulled through a turn screen (engine intake screen) during a high-power turn (maintenance engine run).

Most of the squadron had already begun a 3-day weekend while night check finished up a few tasks, one of which required a high-power turn with afterburner shots. I had just settled in at home, ready to pop a cold one, when the phone rang. Information was sketchy—something about a mech losing his flashlight down an intake during a high-power turn and getting hurt. It was time to earn some of that 24-hours-a-day pay.

The mech, whose job was to watch for ice building up on the inlet screen, had gotten too close and was pulled up through the nylon mesh. As his flashlight, arm, and cranial (with his head still in it) tore through the mesh, he let go of the flashlight. The subsequent FOD noises alerted the turn-up operator, who saved his shipmate's life by immediately shutting down the engine. The turn-up operator relates his story.

"Two of my squadronmates and I were out to do a post-maintenance, high-power turn. I did a pre-turn after accounting for tools and equipment and instructed my ground observer on ICS to let me know if he saw ice forming on the inlet screens. The cold and fog made this a real possibility.

"He took up a spot by the outboard-wing pylon, aft of the intake. I double-checked to see him standing there, then told him over the ICS that I was going to military power. He told me the screens were still clear of ice.

"After stabilizing at military power, I told him I was going to afterburner. Approaching maximum afterburner, I heard a loud bang and saw a ball of flame shoot out of the tailpipe area. I could no longer see my observer. I quickly retarded the throttle, but even as I was doing that, I heard a second bang and saw another ball of fire before I could get the engine shut down. As the engine slowed down below idle, I felt and heard a third bang and saw flames shooting out of the exhaust and the intake. At this point, I regained sight of the observer, who was disoriented and staggering forward.

"He was bleeding and yelled over the ICS, 'It picked me up! It picked me up! I lost my flashlight!' The starboard engine was still idling, so I made a quick call to maintenance control to ask for an ambulance, then shut the engine down. I climbed down from the cockpit and, together with the fire watch, tried to calm the observer and administer first aid. He was bleeding from a cut above his eye and was still very disoriented when the ambulance arrived. I can't find the words to describe what went through my mind when I realized what had happened.

"I guess what I did in the cockpit this night was an instinctive reaction because of an earlier experience. About 8 years ago, on the flight deck of the *USS Enterprise* during launch, the flight-deck crew was breaking down an A-7 behind me. Off to one side, a "yellow-shirt" directed the A-7 out, then gave it a hard turn, which swung the intake right across my back. Next thing I knew, I was off my feet and in the intake.

"I don't know if the pilot saw it happening or if one of the flight-deck crew saw it coming. All I know is the engine started winding down as I held on for my life. That memory isn't likely to go away."

This near catastrophe revealed some conflicting and confusing information in our publications. We submitted Technical Publication Deficiency Reports (TPDRs) and design changes to fix the problems. We also recommended making the inlet screen stronger. The material fixes were straightforward and simple. The harder fix was changing peoples' attitudes. Oh sure, everyone was on their toes after showing them the torn screen and letting them talk to the victim. But when we took our show on the road, the message didn't stick. As I looked at some of our own people, many of them new, I saw the sense of danger was long gone.

Intakes are a stealthy and unforgiving danger. They aren't an exhaust; you can't see how fast the air is moving. They look the same with the engine shut down as they do at military thrust. With a cranial on, you get no audible clue. The adage "If you never walk through a prop arc, you'll never get hit by a prop," has a jet-age equivalent: "If you never walk through an intake danger zone, you'll never get sucked into an intake." ✈

Step by Step

It was during this review we discovered we had been skipping a step.

Official US NAVY Photo courtesy MECH magazine

ATC(AW) PATRICK LUETH
Courtesy *Mech*, Jul-Sep 97

Anyone visiting the flight deck between midnight and 1700 that summer day in the Arabian gulf would have seen all our electricians feverishly working on two Hornets with identical problems in their air data computers (ADC). We had replaced the two ADCs on recovery because each aircraft had "ADC Fail" fault codes. There was nothing new or unusual about the procedure, but when we did the leak and functional tests on the pitot and static system and related instruments, both aircraft failed. We told maintenance control both aircraft were still down and started troubleshooting.

The leak test ran flawlessly, but when we ran operational checks of the primary and secondary flight instruments, we got abnormal readings. We had run the TTU 205 C/E test altitude up to 40,000 feet and the airspeed up to 600 knots to verify the vertical speed indicator (VSI), airspeed indicator, altimeter, and the primary indications in the heads-up display (HUD). The VSI, airspeed, and altimeter read within limits, but the altitude reading in the HUD on both aircraft read about 900 feet lower than the limits. The MIMs said it should read 40,000 plus-or-minus 10 feet.

There are no troubleshooting procedures in the MIMs for this discrepancy, so the work center put its 70 years of collective experience to work. First, we lowered door No. 4 to inspect all the pitot and static fittings and moisture traps. Afterward we did another functional test—no joy. Then we tried swapping the two air data computers—still no joy. With maintenance control's permission, we cannibalized a working ADC and *still* had the discrepancy!

We began to doubt our test equipment. We borrowed another TTU 205, and doublechecked all switch positions before running it up to 40,000 feet and 600 knots. Still no change. The squadron had recently installed a new software package in the aircraft, so we thought that might have something to do with the problem. We reloaded mission computer No. 1, the air data computer, and the signal data computer and did yet another functional test with the same results. We then reloaded mission computer No. 2 and the control signal converter and tried again. We had the same out-of-limits reading on the HUD.

We had invested 86 man-hours and still missed a sortie. In the past year, the work center had leak-and-function tested at least 80 pitot and static systems and their related instruments. We always got acceptable results. This one had us stumped.

Returning to the book, we reviewed the test procedures to see where the manual was in error. *During this review, we discovered we had been skipping a step*. According to the MIMs, before you could check the altitude reading in the HUD, the airspeed had to read 50 knots. It didn't make sense to us because the altitude should read correctly no matter what the airspeed was indicating. Besides, we'd never done this step before, and all our other ADCs had checked good.

We had no other clues, so we gave it a shot. Sure enough, when the airspeed reached 50 knots, the altitude reading in the HUD was within 10 feet of 40,000.

All our AEs (aviation electricians) are competent and thorough, yet the entire work center had become accustomed to doing the test procedure in a certain way. We had the pubs on the job, but we'd become so conditioned to the routine of the test we didn't realize we were dropping the ball. There was nothing wrong with the aircraft, the publication, the test equipment, or AIMD's work.

We were the broken link in the QA chain. Unfortunately, it took us 86 man-hours and a lost sortie to learn that the pubs can't help if we don't read and follow them step by step. This mistake cost us a sortie and some egg on our faces. What will the steps you skip cost? ✈

Thunderstorms: A Quick Review

- The safest course is away from the thunderstorm area. Go a few miles out of your way or land and wait it out if the shortest and most direct route is through the storm area.

- Lowering ceilings and rain showers may indicate thunderstorm activity.

- Don't be fooled by gentle winds and rain; you could be flying into the teeth of a thunderstorm.

- Excessive radio static is a sure sign of a thunderstorm in the area.

- Don't land or take off in the face of an approaching thunderstorm. A sudden gust front and associated low-level turbulence and wind shear could cause loss of control.

- Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.

- Destructive hail can be tossed from thunderstorms into adjacent clear areas. Bear this in mind if you're ever tempted to sneak between thunderstorms.

- Don't trust appearance to be a reliable indicator of the degree of turbulence inside a thunderstorm.

- Avoid by at least 20 miles any thunderstorm identified as severe.

When in doubt, turn about.

Flightfax, Mar 98

Top 10 Signs You're About to Bust Your Butt

Official USAF Photo

LT COL JAMES A. JIMENEZ
Commander, 50th Flying Training Squadron
Columbus AFB, Mississippi

As an aviator and commander, I've tried to absorb everything I can about operational risk management (ORM) and assimilate it into our unit's daily business. One of the key conclusions I've reached is that just like there are two types of operational planning, there are two types of ORM. There is deliberate planning ORM and crisis action planning ORM.

The majority of the ORM material I've read has dealt with deliberate planning, and I like the fact it starts with the mission or task, then works through a process of enhancing mission success by managing the risks. It makes sense and correlates very well with what operational planners have been doing for years. In short, deliberate planning ORM is simply defining the objective, identifying the hazards, and then planning and executing accordingly.

However, all the deliberate planning in the world doesn't alleviate the need for sound judgment during execution. The fog of war, the dynamics of aviation, and the spontaneity of everyday life continually put us in situations we haven't fully considered. This is where crisis action planning ORM comes into play.

In my opinion, crisis action planning ORM comes down to one simple idea. All of us, in everything or every activity we do, need to continually ask ourselves, "Am I about to bust my butt?" If the answer is yes, **STOP WHAT YOU'RE ABOUT TO DO!** If the answer is no, continue. Sounds simple, but how do we know when we're about to bust our butts? From the school of hard knocks both at work and home, I've come up with what I call the **"Top Ten Signs You're About to Bust your Butt."**

⇨ **No. 10. Use the *Force*.** The *Force* cost Luke Skywalker a hand and a lot of good Jedis. I'll take proper training and preparation over luck any day. If you're not current or ready for an activity, don't rely on good looks and cunning to get you through. The annals of mishap reports are full of aviators whose cunning let them down when they attempted something they really weren't prepared to do.

⇨ **No. 9. You lost the instructions.** Anyone who's stayed up Christmas Eve assembling a child's bicycle or Barbi house can relate. As aviators, we generally leave the instructions behind, but we still need to use them. Poor procedural or technical knowledge is an incident waiting to happen. I'm reminded of numerous single-engine pilots who've misapplied airstart procedures, airlifters who've unknowingly put their aircraft out of CG, and backyard mechanics who've dropped transmissions onto their chests. Poor systems knowledge can turn a minor malfunction into a major catastrophe in a heartbeat.

⇨ **No. 8. You can hear your heart beat.** If you've ever pushed your gas or the weather too close, you know what I mean. When things get hairy, things get quiet. Crew communication and coordination breaks down, and our "fight or flight" syndrome kicks in. Our hearts start beating like a rabbit, and time compresses. It's not a good feeling, but our bodies are trying to tell us something—we're about to bust our butts!

ORM

⇨ **No. 7. "Watch this!"** Anytime someone says, "Watch this!" step back and get away from the frag. Something bad is very likely about to happen. From the poor slob attempting a double-twisting soufflé from the high dive for his girlfriend, to the fighter pilot trying to impress his WSO, showing off is a temptation we all must resist. I hate "fini" flights for this very reason. Professional warriors know when they have to "hang it out." Scenic jaunts down unbriefed canyons, front-quarter missile shots inside 9,000 feet, near departures in the overhead break, and dangerously tight final turns aren't some of those times. Back in the Jurassic period of ATC, we used to do "team" rides during T-38 UPT. Junior student pilots would fly in the trunk during a senior student's contact ride. We stopped doing them for a good reason—there were too many disasters immediately following "Watch this!"

⇨ **No. 6 You've never tried it before with an IP.** Unlike our single-celled ancestors, humans generally don't learn much through osmosis. The entire spectrum of Air Force pilot training is centered around a simple theorem, "Demo-Do." A particular skill or technique is first demonstrated to a student, then practiced with an instructor before being "signed off." Until being signed off, don't try it at home or alone in an airplane.

⇨ **No. 5. Reminds you of an old article in *Approach* Magazine.** Hats off to our sister service and the folks at the Naval Safety Center. I think they put out a terrific product, and I look forward to reading it every month, cover to cover. I also thoroughly enjoy *Flying Safety* and *Weapons Review, Aviation Week,* and *Private Pilot.* The point is, all the flying and safety publications are outstanding and invaluable to our professional development. There is an excellent quote *Approach* puts on the back page of every issue: "There are two ways to get smart. One is through experience—we call this 'the hard way.' The other is to learn through others' experiences. The second method is much easier on our machines and bodies."

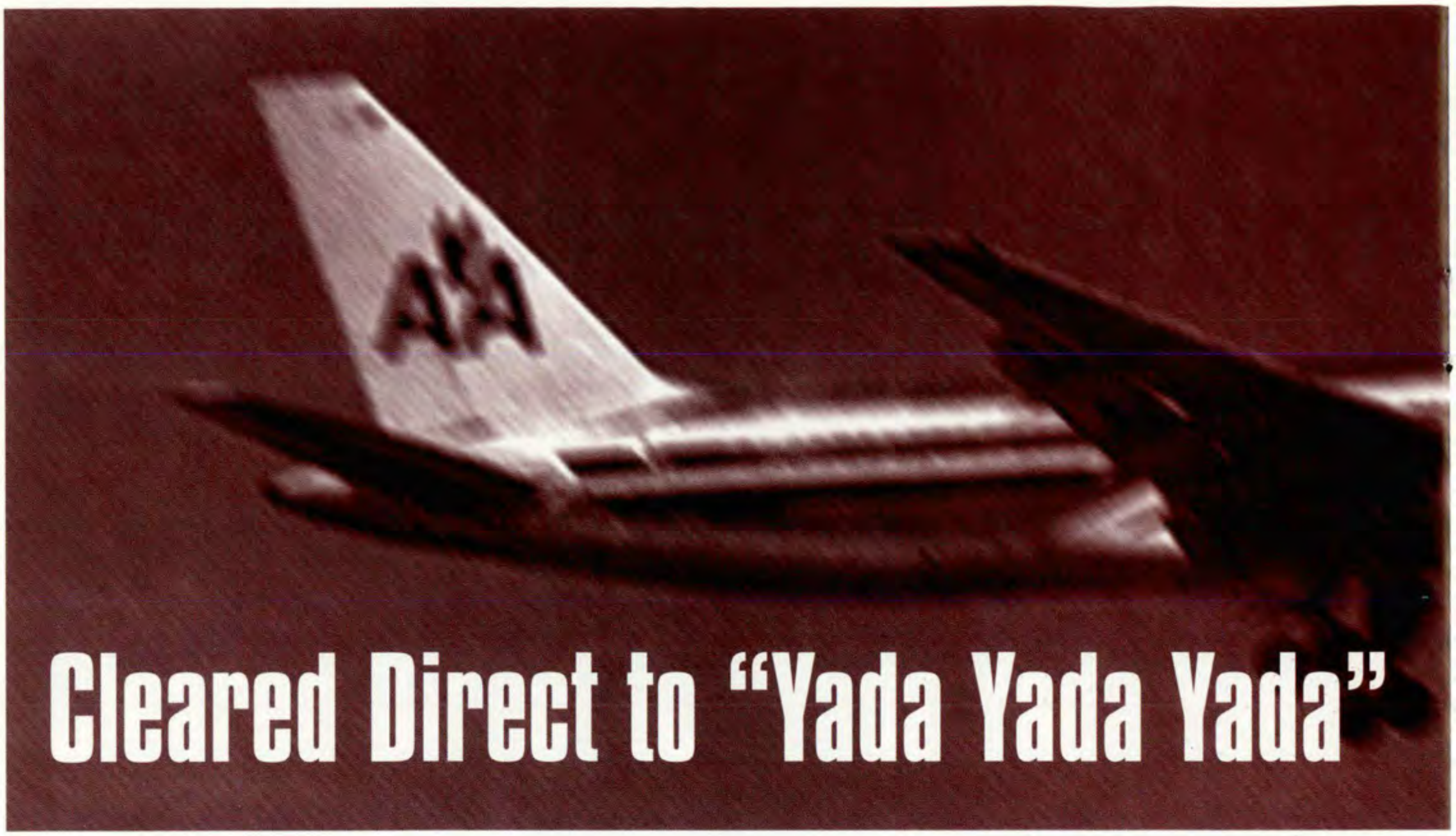
⇨ **No. 4. Open flame is involved.** Call me Neanderthal. Fire bad! It amazes me why so many of us take explosive compounds for granted when we've been so painstakingly trained to safely strap on thousands of pounds of JP-8. Do the laws of thermodynamics not apply to our water heaters or barbecues? We perform preflights as an opportunity to discover catastrophes before they happen. A simple preflight before exposing your match to your butane bomb could save your self-respect and your skin.

⇨ **No. 3. Electricity is involved.** Nothing good has ever come from me fooling around with electricity. I have flatly written it off as an activity for the professionals—or my wife. Life is too short to go through it with hair like Kramer.

⇨ **No. 2. Cutlery is involved.** Amputation devices have my total respect. Yeah, I could build my own furniture. Just two things are stopping me—the skill and knives. DANGER! DANGER! DANGER!

And the No. 1 sign you're about to bust your butt?

Your wife wants to watch what you're doing. Generally, as long as I'm not watching football, my wife thinks my time is being well spent and could care less about what I'm actually doing. But occasionally, for some unexplainable reason, she feels compelled to check on her breadwinner. On one such occasion, I was stringing Christmas lights during the Thanksgiving holiday. As I perched between the ledge of the upstairs window and the top of a 30-foot ladder, my wife came out to see what I was doing. In a voice that would have frozen a hot spring, she yelled, "Don't move! Are you nuts? You're going to break your neck!" Before I could explain I was perfectly safe and needed to silhouette the top of the roof line with lights, the ladder wobbled and fell. Suddenly, I was doing the Spiderman on the top window to our bedroom. Luckily, my wife was there, and it was a happy ending. But I don't string lights above the first floor of the house anymore, and I ask for my wife's opinion before doing anything remotely questionable. Not married? No problem. Significant others, neighbors, firemen, and paramedics work well too. But before doing something exciting or out of the ordinary, get a second opinion. ✈



Cleared Direct to "Yada Yada Yada"

MAJ FRANCISCO GONZALES
New Mexico Air National Guard
Kirtland AFB, New Mexico

"Every thirty seconds, Fabien bent down into the cockpit to check the gyroscope and compass. He dared not light the dim red lamps which would have dazzled his eyes for some moments, but the luminous dial hands were ceaselessly emitting their pale and starry radiance. And in all those needles and printed figures the pilot found an illusive reassurance, as in the cabin of a ship swept by waves. For, like a very sea of strange fatality, the night was rolling up against him with all its rocks and reefs and wreckage."

Night Flight, *Antoine de Saint-Exupéry*

The above passage, written by pilot Antoine de Saint-Exupéry over 65 years ago, describes the challenges facing a mail carrier pilot flying at night over the perilous landscape of South America and the false reassurance of his aircraft's instruments. It is most interesting that despite the advances of technology such challenges still face pilots as noted most tellingly by the night VFR crash of a Boeing 757, American Airlines Flight 965, flying from Miami to Cali, Colombia.

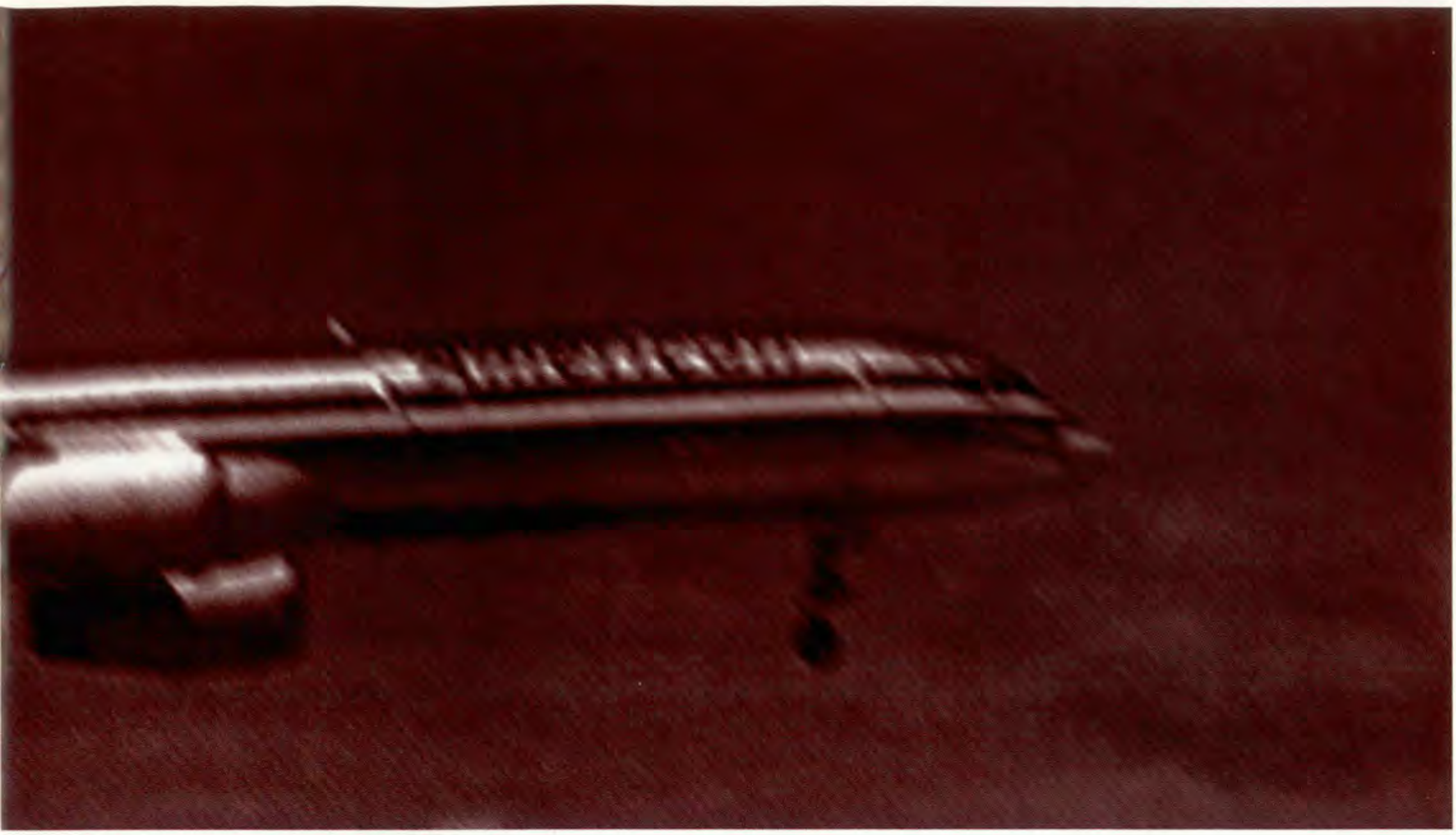
There are many lessons which can be gleaned from the tragic loss of Flight 965. To name a few: situational awareness, adherence to checklists, and more specifically, a healthy vigilance over flight management systems (FMS), also known as flight management computers, and the respective databases that underlie them.

Flight 965 was cleared the ROZO 1 Arrival into Cali. The ROZO 1 Arrival starts at the Tulua (ULQ) non-DME VOR and proceeds out on the 202 degree radial for 22 nautical miles, intercepts the ROZO (R) NDB 013 radial for a total of 9 nautical miles, with the final approach fix located at 4.3 nautical miles from the ROZO NDB at 5,000 feet.

Like any accident, this one had proverbial chains that led to the crash of Flight 965. There was a long-term radar outage in Cali and confusion over the new clearance the flight received. The first officer who was flying had not been into Cali before—the captain had flown into Cali numerous times. Furthermore, the crew was issued a last-minute runway change, so they were rushed in trying to descend, find the right approach plate, study the approach, and all the while still unsure of their clearance. Yet what truly aided the investigators in analyzing the crash, and key to the purposes of this article, was the recovery of the aircraft's flight management computer (FMC).

Fortunately, investigators were able to power up Flight 965's recovered FMC. Apparently, things went bad when the crew either entered direct to ROZO, identified as "R" on the approach plate, or the aircraft's passing of Tulua shifted the next waypoint to "R."

Regardless, ROZO's waypoint in the FMC's database was not "R." Rather, it was "ROZO." As a result, there was a discrepancy with Flight 965's FMC database, approach plates, and the arrival chart's identifier. In analyzing the mishap flight's FMC when "R" was selected,



12 Rs popped up. Those who have flown with an FMS probably think this still shouldn't have been a problem—just simply look at the waypoint's detailed information, e.g., lat/long or navaid frequency.

In this mishap, the first "R" choice was *ROMEO,* which was the same frequency as ROZO, yet it is located 130 nautical miles away in Bogota, Colombia. Investigators suspect the errant waypoint steered the aircraft 93 degrees east of course.

Even more compelling, the ROZO and *ROMEO* NDB's respective lat/long differed by only 1 to 2 degrees. This fatal discrepancy was due to Aeronautical Radio Inc.'s (ARINC) procedures for identifying navaids in the same geographic area that possess the same identifier. In this case, ARINC decided to identify ROZO as "ROZO" in the database and not "R." In 1993, ARINC issued an advisory 424.13 which called for creating "terminal files," smaller areas that allow both navaids to be listed by their identifiers. Unfortunately, the advisory had no deadline and had not been implemented at the time of the mishap.

If Flight 965's gremlin waypoint was way off, then why did the crew not catch it? Obviously, there are many inferences. Still, the strongest one is they placed too much faith in their FMC's waypoints nor were they certain as to where they were at in relation to the initial waypoint of the arrival, Tulua.

The captain was fixated throughout the tragic descent on acquiring Tulua and was confused that the position of the navaid did not mesh with his own situational awareness (SA). Still, the captain urged the first officer to go direct, to which the first officer's chilling response was, "Direct to where?" as the flight continued to descend for over a minute into known rising terrain.

More importantly, the crew did not brief the new approach. A cursory review could have increased their SA, plus it would have illuminated the high terrain east of their planned and expected route of flight. The MSA on the approach plate to the Cali VOR Runway 19 is 14,900 feet, and it reveals spot elevations in the doomed aircraft's sector of 12,900 feet, 12,630 feet, and 8,030 feet. Flight 965 impacted a mountain at 8,900 feet, approximately 10 miles east of the Tulua VOR and 33 miles northeast of the Cali VOR.

In the final analysis, we, as crewmembers, are the arbiters of using all the technology available to us. Solely relying on one piece of the "information mosaic" is a recipe for disaster. Equally important is ensuring crewmembers cross-check each other and clarify confusion. Assertiveness with tactfulness is always inherent in what we do. Finally, we can sit back and allow these computers to run the whole show or we can back up flight management systems, not only by "staying in the loop," but staying ahead of them as well. The choice is ours. Yet the ultimate challenge is to ensure that despite the technological advances, we recognize the danger, as Antoine de Saint-Exupéry so eloquently stated, of pilots having an "illusive reassurance" in their instruments. ✈

Hazardous Materials (HAZMAT) Management Help

USAF Photo by MSgt Perry J. Heimer

CMSGT MIKE BAKER
Technical Editor

The days of "pour it down the drain" and "just throw the rest in the dumpster" have long since passed. In accordance with AFPD 32-70, *Environmental Quality,* "Achieving and maintaining environmental quality is an essential part of the Air Force mission." And even though federal, state, and local ordinances make improper use and disposal of hazardous materials a criminal offense—usually with stiff penalties—we all accept that it's our moral obligation to exercise responsible environmental stewardship. But to whom do we go with HAZMAT questions? Assistance and information on properties, handling, use, and disposal of hazardous materials may be closer than you think.

The first stop should be your unit Hazardous Waste Monitor. Also, each installation has a Hazardous Materials Pharmacy (HAZMART) that stocks, stores, issues, and distributes those substances identified as HAZMAT, so the HAZMART is also a good source of information. Per AFI 32-7086, *Hazardous Materials Management,* each installation establishes a HAZMAT Management Process (HMMP) Team, which is led by CE. Since one of the primary functions of the HMMP Team is to provide oversight of the HAZMART, CE's Environmental Flight can also help with questions.

And computers are found nearly *everywhere.* If your unit's computers are connected to the LAN, and at least one of them is equipped with a CD-ROM drive, anyone with LAN access may view Material Safety Data Sheets (MSDS) for materials, products, and chemicals used throughout the Air Force and DoD. AFMC's Human Systems Center, Det 1, Occupational and Environmental Health Directorate, Industrial Hygiene Division, maintains and updates a data base with all of this information, compiling it into Hazardous Materials Information System (HMIS) CD-ROM sets that are distributed quarterly. If your unit isn't currently receiving this information, and you'd like to be placed on distribution, E-Mail a request for the HMIS CD-ROMs to anna.willis@guardian.brooks. af.mil. The DoD owns unlimited HMIS software licenses, so the CD-ROMs may be installed on your LAN to provide maximum access for users. Remember that one set per unit should be sufficient.

Although not yet operational, within the next year, those with Internet access may go directly to Defense Logistics Agency's (DLA) HMIS homepage at www.dscr.dla.mil/htis/htis.htm. Its goal is to assist the DoD community with a Helpline Answer Service, as well as with a Technical Bulletin concerning the compliant management of hazardous materials and wastes.

Final note: The well-intentioned maintainer is always looking for information on how to do the job more safely and effectively. DLA's web site, referenced above, provides tons of information and links to "environmentally benign" products and materials, but beware! While one may be inclined to believe that products listed in a catalog supplied by DLA are approved for use nearly everywhere, this isn't necessarily true. ***Only*** those products specified in applicable tech data—either by name or MIL SPEC number—are authorized for use. ✈

The Lt Gen Gordon A. Blake Aircraft Save Award

MSGT JAMEY WILLIAMS
HQ Air Force Flight Standards Agency

Two months ago I became the new Program Manager for the Lt Gen Gordon A. Blake Aircraft Save Award. I would like to take a moment of your time to talk about the history of the Aircraft Save Award and definition of an aircraft "save."

Maj Gordon A. Blake was working as the base operations officer at Hickam Field, Hawaii, when on 7 December 1941 Pearl Harbor came under attack by Japanese bombers. While awaiting the arrival of a flight of B-17 aircraft, he heard a series of loud explosions, rushed to the tower cab, and took charge of the tower while the airfield was being attacked. Although the destruction from the Japanese bombers was devastating the surrounding buildings and structures on the field, Maj Blake never showed concern for his own life during the attack. He was able to establish radio contact with the B-17 pilots and tried to direct them to Wheeler Field, Hawaii, but they were unable to divert, leaving Hickam Airfield as their only option. Maj Blake calmly directed one aircraft at a time in between attacks. He was able to provide the pilots with up-to-date airfield conditions and reports on the enemy. After all 12 aircraft recovered safely, the pilots stated that if it weren't for his calm demeanor and accurate information, they wouldn't have had a chance for a safe recovery. Because of his heroic action, he was awarded the Silver Star and received the first, what would become known as, "Lt Gen Gordon A. Blake Aircraft Save Award."

An Air Force Communications Command (AFCC) (now, the Air Force Communications Agency) Intercom article, dated 25 November 1988, states, "Although Major Blake was assigned to the Army, he was serving as a base operations officer in the Airways and Air Communications Service (AACS). He served as the regional control officer of the 7th AACS Region as a colonel. Col Blake was the AACS deputy commander from 3 January 1946 to 9 March 1947. He later attended the Air War College and served the rest of his career in the Air Force." To add prestige to the Aircraft Save Award and connect the award to its proud past, in 1988, AFCC renamed the award after now Lieutenant General Gordon A. Blake.

The following individuals received the Lt Gen Gordon A. Blake Aircraft Save Award for the first quarter of calendar year 1998:

MSgt Michael R. King (Tower, Local Controller) and SrA Carrie L. Dembroski (Tower, Coordinator), 75th Operations Support Squadron, Hill AFB, Utah. During an extremely busy period in the control tower, SrA Dembroski observed no landing lights on an F-16 that was established on final and advised MSgt King of the situation. He gave repeated advisories to the F-16 of "negative landing light" while the aircraft was on final, even though the gear appeared down to the pilot. When the aircraft started to flare over the runway threshold, the controller could visually see the aircraft's landing gear was retracted and immediately initiated go-around instructions. SrA Dembroski's situational awareness and MSgt King's immediate reaction to a hazardous situation for pilot and aircraft prevented a potentially fatal Class A mishap. ✈

How Close Is Too Close?

CMSGT ROBERT T. HOLRITZ
Technical Editor
Flying Safety, Jan 92

Aircraft were stacked up at EOR as they usually were on surge days. To save time, when the engine specialist arrived to check on an oil fluctuation problem on one of the fighters, the EOR team continued checking the jet. Just as the specialist told the pilot to bring the problem engine up to 85 percent, the crew chief came out from under the aircraft, and a headset went down the No. 1 intake.

When questioned by the safety folks, the crew chief stated he checked the aircraft exactly as he was trained and came out from under the aircraft the same place he had for the past several months. He could not understand why his headset was pulled from his head.

But this occasion was different. His headset was ingested this time because the No. 1 engine was cranked up to 85 percent instead of idle. The crew chief was under the potentially deadly misconception the safe distance from an engine intake is the same under all conditions. The fact is, there are many factors which have bearing on the safe distance from an operating aircraft engine.

Power Setting

As this crew chief discovered, the engine power setting has a significant effect on the size of the danger area. It doesn't take a propulsion engineer to figure out the higher the power setting the greater the danger area.

But many flightline folks are misled by the danger area diagrams found in the Dash One or Dash Two technical manuals. The problem with these diagrams is they usually depict the danger area only at one power setting, whether it be idle, mil, or AB, leaving it up to the ground personnel (and flightcrews) to estimate the hazard area at other settings.

Unfortunately, it is extremely difficult to estimate the safe distance from an intake during different power settings because the pulling power of a jet engine does not increase gradually as the distance from the intake de-

USAF Photo by Sgt Sarah Steele

creases. Instead, the suction force increases rapidly in an insidious curve, depicted in the figure. This can lead a maintainer to a false sense of security. As the chart indicates, a person may not even feel a hint of suction yet be only inches away from being snatched into the intake by the full force.

Area of Influence

The area of influence is also a major factor on the safety zone. For example, the pulling force increases dramatically as the area of a body opposing the suction increases. To put it in wrenchbender's terms, merely turning 90 degrees from profile and facing the inlet can double the pulling force, and standing from a crouch can triple the force!

An engine specialist learned this the hard way. During an engine run, he came from under the F-4 just in front of the inside right leading edge slat. As he stood up, he was immediately ingested up to his waist, his eardrums bursting and eyeballs tugging in the sockets. Fortunately, his presence in the intake caused a compressor stall which alerted the operator who shut the engine down. The specialist escaped with only minor injuries.

Ballooning Effect

Clothing can also be an important consideration. Garments such as parkas and rain gear tend to balloon or inflate from the low pressure caused by the flow of air in front of, and around, the intake. This, in effect, increases the person's area of influence, multiplying the pulling force of the engine's suction. This effect on the hood of a field jacket can easily pull a person into the inlet. Clothing has been a major factor in many of the ingestion mishaps which have occurred over the years.

Prevention

In spite of the complexity of evaluating the danger, there are a few simple commonsense ways to minimize the hazard. For example, engine screens or personnel guards virtually eliminate the possibility of an individual being ingested. While they cannot always be installed, using them whenever possible can greatly reduce the hazard.

If possible, avoid wearing bulky clothing, especially parkas and jackets with hoods, when working around jet engines. Most of all, stay clear of the danger areas published on the aircraft technical publications and maintain situational awareness. Since 1975, there have been three fatalities and two serious injuries due to personnel being ingested into jet engines. At a conservative rate of one every 5 years, a mishap is overdue. Don't become a statistic. ✈

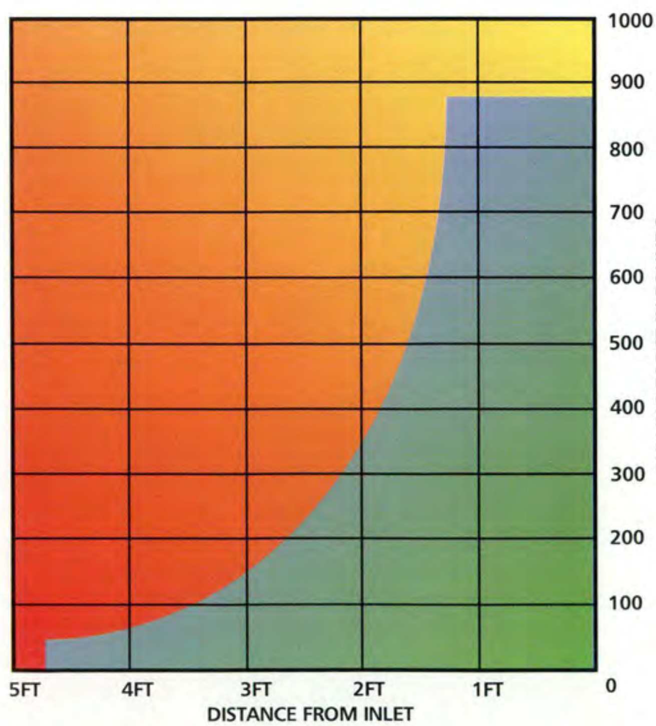


Figure 1. Pulling force (suction) surrounding the inlet of a KC-10 engine operating at takeoff power.

Air Force Flight Standards Agency: Instrument Quiz

MAJ SCOTT T. TAYLOR
HQ AFFSA/XOI

The USAF *General Flight Rules* were republished as AFI 11-202, Vol 3, 1 June 1998. The "Publication formerly known as 60-16" has grown over the years to keep pace with the Air Force mission, Federal Aviation Regulations, and emerging aviation technology. In February 1953, General Hoyt S. Vandenberg approved publication of a 12-page AFR 60-16. Today's guidance is posted on the Internet and totals 50 pages. Let's see if you've picked up on some of the changes affecting the way we fly today. Remember—these questions and answers concern overarching Air Force policy; MAJCOM guidance may be more restrictive.

1. While en route from KMCF to KCOF, you shut down an engine due to a loss of oil pressure. Melbourne approach control, acknowledging your declared emergency, grants traffic priority. What post-flight actions, if any, are required?

a. The PIC will verbally report the incident to the immediate supervisor and commander within 24 hours of the incident.

b. No actions are required if there were no deviations from AFI 11-202, Vol 3.

c. The PIC shall make a detailed written record of the incident. The unit will keep the record for 1 year from the date of the incident.

d. a and c.

2. Your crew is transporting a general officer to a meeting at Offutt AFB. The general's aide is busy on his cellular phone coordinating final meeting arrangements. What are the rules for cellular telephone use aboard USAF aircraft?

a. Cellular telephone use is prohibited aboard USAF aircraft.

b. The PIC will ensure cellular phones are turned off and stowed from the time the aircraft leaves its parking spot for departure until clear of the runway after landing.

c. Cellular telephone use in flight is authorized while in VMC.

d. b and c.

3. GPS approaches may be flown with an expired database only after the PIC manually enters and validates each required waypoint using current FLIP.

a. True.

b. False

4. The PIC will not take off with ice, snow, or frost adhering to the wings, control surfaces, propellers, engine inlets, or other critical surfaces of the aircraft, unless authorized by the aircraft single manager or flight manual.

a. True.

b. False.

5. While participating in an exercise in Thailand, you are directed to fly into an airfield to which there are no published DoD or NOAA instrument approaches. A host-nation instrument approach is provided for your use. What rules apply to this non-DoD/NOAA procedure?

a. The MAJCOM TERPS office must have reviewed the procedure IAW AFMAN 11-230, *Instrument Procedures*.

b. Based on a MAJCOM TERPS review, the host-nation procedure must be specifically approved by the MAJCOM for your use.

c. If the requirement to fly the procedure is based on an urgent, short notice, high priority mission, the applicable MAJCOM/DO may waive the TERPS review requirement.

d. All of the above.

6. After requesting a preflight weather briefing for a flight to Middle-o-Nowhere Muni, the briefer informs you there is no weather reporting capability at this destination. How does this affect your flight?

a. You are required to file an alternate.

b. You are required to complete the flight under VFR.

c. You are required to refile to a destination with weather reporting capability.

7. You have just flown an instrument approach into Middle-o-Nowhere Muni and are now on the ground planning for your IFR departure. There is no SID, there are no ▼ IFR Takeoff Minimums and Departure Procedures, and the airfield is located in a nonradar environment. Can you depart IFR?

a. No. Weather at takeoff must permit a VFR climb to an IFR MEA.

b. Yes. Depart the field, climb to 400 feet above the departure end of the runway elevation, turn to the first point in your route of flight, and maintain a minimum climb gradient of 200 feet per nautical mile.

c. No. Sell the aircraft, buy a house, and run for mayor.

8. You are planning an IFR departure from Carl A. Spaatz Field, Pennsylvania, following an airshow. Your departure runway will be 31. There is a ▼ on the approach plate. You reference the IFR Takeoff Minimums and Departure Procedures in the front of FLIP and see the following entry:

CARL A. SPAATZ FIELD PA.... Rwy 13, 1000-1*
Rwy 31, 400-1**
Rwy 36, 400-1***

* Or std with min climb 370/NM to 1500
** Or std with min climb 350/NM to 800
*** Or std with min climb 260/NM to 800

Rwy 18 climb to 1400 before turning on course.
Rwys 31, 36 climb to 800 before turning on course.

a. As long as the weather is no lower than 400-1, you may depart IFR providing you climb to 800 before turning on course.

b. As long as the weather is no lower than that authorized by your MAJCOM, you may depart providing you climb to 800 before turning on course.

c. As long as the weather is no lower than that authorized by your MAJCOM, you may depart providing you maintain a climb gradient of at least 350 feet per NM to 800, then turn on course.

9. On departure from Carl A. Spaatz Field, Reading Approach states that you are in "radar contact" but does not issue a vector. This means:

a. You are radar identified on the controller's scope.

b. You are responsible for terrain and obstruction clearance.

c. The controller now shares responsibility for terrain and obstruction clearance.

d. a and b.

e. a and c.

10. Guidance concerning crew rest and flight duty limitations is contained in AFI 11-401, *Flight Management*.

a. True.

b. False

Answers

1. **d**/para 1.4.2.
2. **b**/para 2.5.1.4.
3. **b**/para 5.8.3.2.1.1. and 5.8.3.2.1.2.
4. **a**/para 5.27.
5. **d**/para 8.3.1.1. and 8.3.1.1.1.
6. **a**/para 8.4.2.2.
7. **b**/para 8.7.1 This is the definition of a diverse departure.
8. **c**/para 8.7.2.
9. **d**/para 8.7.2.4.
10. **b**/Chapter 9.

Maintenan

With a Naval

I Do It My Way!

CWO5 TED GREGORY
Courtesy *Mech*, Jan-Mar 98

■ A technician decided to deviate from standard procedures for changing a tail-rotor blade and do it his way. He intended to fold the tail pylon to facilitate the change. After an unsuccessful attempt to position the rotor head and fold the tail pylon with APP power, he manually positioned the head with No. 5 blade over the fuselage. He then reengaged the rotor brake, selected the blade pylon's master-power switch to "on," and disconnected the blade/pylon's fold-relay-panel connector to prevent the tail rotor actuator from extending and locking the tail hub. He learned the technique from other, more experienced mechanics.

The technique isn't listed in the maintenance manual.

In fact, a warning in the manual directs you to *not* disconnect that cannon plug because you may get an inadvertent blade fold. Immediately after he disconnected the plug, the main rotor head began to fold. Because the head was not in the correct position for blade fold, two of the rotor blades hit the ground, and the No. 2 blade hit the No. 2 engine's air particle-separator barrels, damaging four pockets. In the process, the lateral bell crank was also damaged. A flightline mechanic saw the head folding, went inside the cockpit, and secured the master power switch on the fold-control panel.

This is just one example of human failure that occurs in most of our mishaps. Each mechanic we injure and every asset we damage reduces our state of readiness. Don't ignore maintenance instruction manuals (MIMs).

(Chief Warrant Officer Gregory is a maintenance analyst at the Naval Safety Center.)

Read the Book

AME2 DONNIE ESPINOSA
Courtesy *Mech*, Jan-Mar 98

■ Everyone says, "Read the book, read the book." Do you *really* know what it means to read the book? I've learned first hand.

Maintenance jobs were unusually light for aviation survival equipment mechanics (AMEs) that evening. The only maintenance action form (MAF) to work off was to remove and replace an electrical load control unit (ELCU) in one of the squadron's E-6s. A fellow AME2 and I gathered tools and set out to conquer that easy task. We were unaware we would shake hands with the Grim Reaper in our haste to get the job done.

Knowing that the ELCU has six large nuts, I briefly skimmed the MIMs in search of a torque value. That's all we really needed for a quick R&R. The night was looking good; a routine swap, and the rest of the night could be dedicated to studying for an upcoming rating exam. After returning the manual to the shelf, I met up with my fellow AME who asked if I had checked the MIMs. I assured him that all we needed was the torque values, which I had just looked up.

Approaching the aircraft, I could see electrical power had been already hooked up to it. I thought, "This is great! We won't have to work in the dark."

My partner grabbed a ratchet and started on the ELCU nuts. The first two tried our patience when they and their washers fell into a bundle

ce Matters

slant, part 2

of wires in the belly of the aircraft. Despite his frustration, my partner kept working. He was in mid swing with the third nut when his ratchet touched a component-containment screen. The place lit up like a Christmas tree and sparks flew everywhere! It looked as though we were in a dark room and somebody was flicking the lights on and off.

He felt a shock through the ratchet and instinctively let go. I immediately grabbed a nearby portable fire extinguisher and stood by in case of fire. Shaken, but alive, we accounted for all the tools and headed back to the shop. "What went wrong out there?" I asked myself. The sick feeling in the pit of my stomach was a telltale sign of what I already knew—I hadn't read the book!

I reported the incident, sent my fellow AME to medical for evaluation, and headed back to the shop to contemplate what had taken place. I grabbed the MIMs to review the procedure, and not much to my surprise, there it was, in the very first step: "Remove electrical power from the aircraft..." How could I be so careless? I consider myself a professional, yet I had completely overlooked the safety precautions related to the job. I was concerned only with torque values.

Fortunately, the damaged aircraft and tools were the only victims of my shortcut—28 volts at 395 amps has been less forgiving. Stay in the MIMs; don't get lazy no matter how familiar you are with a system. You may think that things like this happen only to the other guy. I used to think like that, too, but then death is only a word until you shake hands with it.

(Petty Officer Espinosa is assigned to VQ-3.)

Hmmm...Where's That Tool Pouch?

LT JOHN BREAST
Courtesy *Mech*, Jan-Mar 98

■ The squadron hadn't missed a launch during the entire exercise, and our last launch of the night looked easy. The last thing anyone expected was a tool control problem.

During the launch, one of the aircrew members called for an avionics troubleshooter to replace a bad computer box. He troubleshot the gripe and decided to leave his tool pouch in the aircraft while he ran to get the replacement box. After a quick swap, the flight deck coordinator had the AT (Aviation Technician) troubleshoot another bird preparing for launch. The AT responded to the order, running to the second bird and assuming that a second AT, who had been helping him, had grabbed his tool pouch. Both jets launched, and the flight-deck crew went below, satisfied that they'd met the flight schedule and kept their streak alive.

After returning to his shop, the AT discovered his buddy didn't have the tool pouch. Panic set in as he realized that it must have been left on the floorboard below the Senso's ejection seat. But he did the right thing. He immediately explained his error to the Maintenance Master Chief (not an easy task for anyone), who told the SDO, who radioed the aircrew about the missing pouch. When the aircraft returned, the aircrew had the pouch in hand.

When the tempo of operations is so intense that people take shortcuts, the probability of mistakes increases. Supervisors, Flight Deck Coordinators, and QA must set and maintain a safe pace. The AT did the right thing by reporting his mistake immediately. Our scare ended without incident, but the lesson made us review our procedures for flight deck maintenance and tool control. ✈

(Lt Breast was with VS-30 when this incident happened.)

They Do Care

We received this "Dear Chief" letter from a pilot who just had a crew chief find one of those "soon to be catastrophic" hydraulic leaks. The pilot went through a fast aircraft swap, launched and flew a successful mission. By the time the aircraft recovered, the crew chief had gone off shift, and the pilot realized he hadn't thanked him. The pilot did find the chief the next day and thanked him, but also wrote us a letter. We're passing it on because we think some maintenance folks lose sight of their part in the mission and feel "unappreciated" by the flightcrews. ***They do care!***

Dear Chief

Thanks for saving my tail! In these days of personnel turnovers, detached organizations, and quick turns, I may never get to meet you and thank you personally, but I want you to know I appreciate what you're doing. I'm talking about all the folks from the "in-view" crew chief or his assistant, to the "behind-the-scenes" shop technician or POL truck driver. You are responsible, as much or more than I, for the bombs on target, the missile up the opponent's tailpipe, the completed air refueling, or the on-time critical resupply cargo mission. Unfortunately, in most cases, you are like the doctor after the patient's recovery—you never get to see the product of your labors—the mission accomplished.

Anyway, I want to again tell you I appreciate your efforts. I will probably show up at the airplane in a rush and seem totally preoccupied with getting off the ground. Nevertheless, when you tell me about the aircraft or put something in the 781s, I do pay attention and care, because you know more about the condition of the patient than I. Don't be intimidated by mission "pressitis," or "on-time" fever, or rank, or anything. Write it up or tell me what I need to know before "your machine" becomes my life! I like to talk about nothing more than flying your aircraft.

Let me tell you a little about myself. I may fly four times a week or only once a month. I may have 8,000 hours of flying time or only a few hundred. I can be a full-time flier or maybe the staff type who can get out of the office only occasionally to keep my hand in. Like you, I come in all ages, sizes, shapes, colors, sexes, educational backgrounds, and experience levels. I am married, single, divorced, or separated and have most of the same problems as you. I may not be exactly where I want to be or doing exactly what I want to be doing.

We are not that different, and we share the desire to put the safest possible aircraft in the air to accomplish the mission. I guess "mission responsibility" is what keeps most of us on board.

I ranted and raved a bit, but my bottom line is "thanks." Despite all of the above, you do good work, and I wanted to let you know I care. Hang in there! We need you to keep 'em flying.

Appreciative Crewmember

Adapted from *Maintenance* magazine, Summer, 1980

We'd Like to Publish Your Story!!

We know there are some great experiences out there just waiting to be told, so how about jotting them down. We'd like to hear from you—how you are accomplishing your mission safely, or some first-person lessons learned, or some new technological advances, or anything you think will interest the *Flying Safety* magazine audience. Your articles can help us "get the word out" about what's happening in the Air Force.

We accept any length. Double-spaced draft hard copy is fine. Any supporting color slides, color photos, or graphics you can contribute are preferred and much appreciated.

You can reach us by mail at HQ AFSC/SEMM, 9700 "G" Avenue S.E., Kirtland AFB, New Mexico 87117-5670, or call commercial (505) 846-0950 or DSN 246-0950. You can also fax to DSN 246-0931 or E-Mail to hodgep@kafb.saia.af.mil.

We look forward to hearing from you and reading your story!

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WELL DONE AWARD
UNITED STATES AIR FORCE

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.

MAJOR ROBERT C. MOHR
325th Fighter Wing
Tyndall AFB, Florida

■ Maj Robert C. Mohr was flying as an F-15C mission commander of a 51-aircraft RED FLAG close air support mission. During the heavy-weight takeoff roll, with two external fuel tanks and 107-degree outside air temperature, Maj Mohr experienced engine anomalies in both engines resulting in a significant loss of thrust. The left engine anomaly required deselection of afterburner, while the right engine rolled back to idle power at 150 KIAS.

Well past abort speed, Maj Mohr lowered the aircraft's nose to gain sufficient airspeed to continue the takeoff. Using exceptional airmanship, situational awareness, and recognizing the potential for loss of life, Maj Mohr coaxed the aircraft into the air. He considered jettisoning his external fuel tanks, but lunch-hour traffic and a residential area appeared beneath him. Still, he was able to maintain a 1-degree nose high climb. After climbing to a safe altitude, Maj Mohr orchestrated the split-up of his four-ship formation, coordinated the emergency situation with approach control, and successfully cleared the inhabited areas in preparation for fuel-dumping procedures.

An additional malfunction in the aircraft fuel system prevented fuel dumping, requiring Maj Mohr to continue the mission significantly longer than normal in a thrust-limited situation. Upon reaching an acceptable landing fuel weight, Maj Mohr flew a flawless approach. After landing, Maj Mohr encountered an additional problem when the right engine wouldn't respond to throttle movement, necessitating an engine shutdown on the landing roll.

Maj Mohr's superior airmanship, systems knowledge, and flight leadership averted the potential loss of life and prevented a serious compound emergency from becoming an aircraft mishap.

WELL DONE! ✈

ALL IT TAKES IS A