Flying Safety

OCTOBER 1996

Weather!

Whether we like it or not

STOP AND THINK!

Do It Right, or Don't Do It at All!

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■ "Today's mission is a priority 1A1, so I want to make sure that *nothing* goes wrong." Statements like this by aircraft commanders and/or flight leads are intended to make a high visibility mission happen. However, it can also put an undue amount of pressure on an aircrew to accomplish the mission at almost *any* cost — even to the point of forsaking safety. It could cause an aircrew not to address a minor or potentially major malfunction in the interest of making the mission happen. Are peacetime missions and training requirements of such importance that we neglect safety in order to accomplish them? Here are a few thoughts to get you thinking about the big picture in military aviation.

We are trained to exacting standards, and as aviation professionals, we are proud of our ability to get the job done — on time. How many times have we been in that dubious position where we've been pressed to rush the checklist to make the on-time departure? Have you ever taken an aircraft with degraded yet *acceptable* capability? "What's a couple inop generators? We have two more. The minimum equipment list says it's okay as long as the APU is operating, so what's the problem? LET'S PRESS ON! WE'RE RUNNING LATE!" Are calls like this recipes for disaster, or the sign of a crack aircrew ready to make it happen?

In these circumstances, it can be tough for a crew to break the link in the chain of a potential mishap. Sometimes it's a matter of pride. No one wants to let on that they're not quite where they want to be on the situational awareness curve. We tend to avoid these embarrassing admissions of human frailty. However, it is those very things that are so often causal in mishaps. As aviators, we all need to be able to recognize when a bad situation is developing. We need to be able to stop, think, and turn the problem around.

An old adage goes, "An on-time takeoff won't matter if your jet never comes home." Many of us constantly deal with the seemingly overwhelming pressures of maintaining or improving something called *departure reliability.* This is a measure of the on-time takeoff rate for aircraft departing from home station. Departure reliability gets command-wide attention, and if your wing's rate isn't as high as desired, you may feel the pressure from above to help improve it.

This is where some crews may run into problems. It is incumbent upon aircrews to recognize the additional pressures to make takeoff times and plan ahead for contingencies. No aircrew should ever feel compelled to

continued on page 27

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OCTOBER 1996
VOLUME 52, NUMBER 9

page 6

page 10

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page 28

SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS

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THERE I WAS

Official USAF Photo

■ I have always enjoyed reading "There I Was" stories, and now, unfortunately, I have a "There I Was" experience for pilots and aircrew like me to read.

It was a typical day on lovely Okinawa — scattered rainshowers, isolated thunderstorms, and some low ceilings. We were tasked to fly a local pilot pro/tac mission in the mighty MC-130/P Combat Shadow. I was looking forward to this mission because I needed some approach work for those semiannual requirements, and I always liked giving helos gas to help out their missions.

The profile called for 2.5 hours of pro work followed by a trip to the warning area to punch out some chaff and flares. After the flares, we were scheduled for a short NVG low-level to the helo air refueling. Sounded like fun to me.

The mission didn't start out so smoothly. During engine start, we experienced a fire light on the No. 2 engine. We stopped the start and checked it out. It was as I suspected. Due to all the rain, these lights sometimes come on while on the ground. It happens quite often when we taxi the aircraft through the "bird bath" after flying low over salt water.

After we resolved that, we finished the starting engines checklist and pressed on. During the engine runup checklist, my trusty flight engineer and I noticed that in order to keep all engine instrument indications on the No. 3 engine the same as all the other engines, we had to pull the No. 3 throttle back a full inch. Is this a big problem? Not really. But a quick flash from the Colorado Springs Reserve accident came to mind. The engineer and I decided to keep an eye on No. 3 and continue.

After an uneventful takeoff into the local radar pattern, we set up for our first approach. On final, the engineer pointed out that No. 3's rpm was fluxing out of limits. We decided to make it a full stop to let maintenance check it out. After about 2 hours on the ground, maintenance had re-indexed No. 3 and said it looked good for flight. Off we went again for some more pro work.

Due to noise abatement at night on our home station field, we had to do our pro work at our neighboring field about 4 miles to the south. I flew the first approach. No problem. The copilot flew the second approach. No problem. I flew the third approach. No problem until we were on climbout when the engineer informed me that No. 3 was once again fluxing out of limits.

At about this point, I was getting a little frustrated with this 30-year-old aircraft. At the same time, approach was calling to inform us that some thunderstorms were about 20 to 30 minutes away from our home station. As I was trying to come up with a game plan, things only got worse. The nacelle overheat light came on for (you guessed it) No. 3 engine. (And yes, the Colorado Springs Reserves accident came to mind once again.)

I called for the Bold Face for emergency engine shutdown on No. 3. The engine shut down nicely, but the light did not extinguish. The copilot pulled the fire handle — the light was still on. We shot the first fire bottle — the light was still on. We isolated the wing bleed air — the light was still on. This sucked! Okay, we shot the second fire bottle — the light stayed on!! Was there a fire inside my engine nacelle? It was nighttime, and we couldn't see any smoke. Was this a faulty light, or was our wing about to burn off? I was not a happy aircraft commander at this time.

While the copilot and engineer were running the Bold Face, I was declaring an emergency with approach, asking for immediate vectors to our home station. (Home station and our neighboring field share the same radar pattern. We were downwind for either field.) When we could not extinguish the nacelle overheat light, I told approach to clear all traffic and that we would be setting ourselves up for a short TACAN final to our home field.

What we didn't realize was how fast that thunderstorm was working its way to the field. We established ourselves on about an 8-mile TACAN final in the weather, configured and ready to land. From about 7- to 3-mile final, I went through some of the worst weather I have ever flown through. It was the kind of wind shear that was horizontal, not vertical, taking that huge C-130 rudder and yawing us all about. I had to fight to keep coordinated flight, as well as keeping my head straight.

At least three times the aircraft tried to abruptly roll to the right, and it took lots of left rudder and aileron to correct to wings level. I then thought of the Evansville mishap. I had to force my hand to push the controls forward. Descending in that kind of weather was mentally impossible. We broke out of the weather at about 600 feet over the threshold. I called for 100 percent flaps and landed about halfway down the 12,000 runway. It felt so nice to feel those wheels hit the pavement! We then cleared the runway and did an emergency ground egress because the light was still on.

Lessons learned? Should I have elected to go to our neighboring field instead of home station? Probably yes. The time difference between the two was completely negligible, but I did know the weather at the neighboring field since I just did a touch-and-go there.

Should I have queried maintenance more about the problems with No. 3? Probably not. They did their job to correct our writeup, and the nacelle overheat, to my knowledge at this point, was unrelated. However, No. 3 engine was different than all the rest. Was it the TD system? Were there burned-out thermocouples? I don't know. I should have checked into it more thoroughly.

Finally, the last lesson/advice I can give to my fellow C-130 and other multiengine heavy drivers is to take full advantage of your annual simulator refreshers. Make sure your sim instructors put in the weather for all your engine-out asymmetric power EPs. It makes a world of difference flying asymmetric power in undesirable weather. My sim training at aircraft commander school a year and a half ago was loaded with weather asymmetric power EPs, but my last sim 5 months ago was not. I firmly believe that my AC simulator training saved my behind on this particular ill-fated night. Ask your sim instructors for the worst weather. It saved me! ✈

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WHEN WE GET COLD, WHAT HAPPENS?

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Now that cold weather is nearly upon us, you're probably wondering again why nature didn't endow us humans with fur, feathers, or blubber. I can't answer that one, but it's obvious that the average naked human is extremely vulnerable to cold. As a matter of fact, humans have only a very narrow range of temperatures we can operate in efficiently. The naked human could survive only in a temperature range from 82° to 86°F (28° to 30°C). Outside those ranges, both our mental and physical skills deteriorate quite rapidly.

The Human Body Is a Leaky Radiator

Think of the human body as a leaky radiator. It's pretty good at throwing off unwanted heat, but it's inefficient at retaining it. Only about 30 percent of the energy we convert from food is usable. The rest is discarded as excess heat. Unfortunately, that discarded heat isn't retained very well. The body is *not* a reversible heat pump. That is, we don't stay warm merely by throwing our heat-generating mechanisms into reverse. The heating and cooling systems are quite different.

Take human skin. In the words of the physicist, it's a "black body" — that is, it both radiates and accepts heat well. As an insulator, in the colorful words of our former Vice President, "Cactus Jack" Garner, "It ain't worth a bucket of warm spit." Skin both freezes and burns readily, so it must be protected.

Skin color is immaterial to retaining heat. Dark-skinned people get just as hot and just as cold as light-skinned people. Don't ever think that just because you're of Scandinavian ancestry (like yours truly) you have a natural immunity to the cold. The body does have a few tricks which enables it to resist cold, but they are very few when compared to its ability to withstand heat. I'll describe some of them.

Acclimatization

When the body is exposed to cold, its first rule of survival is to shift heat production to the internal organs and maintain them at the well-known core temperature of 98.6°F (or 37°C). We're all aware that even brief exposure to cold makes us urinate more frequently. That's because blood is shunted to the kidneys, thereby increasing the production of urine. Ears, fingers, toes, and noses are the first to suffer effects of cold — nature considers them expendable.

When the body's core temperature drops below 95°F (35°C), apathy (*especially* apathy), disorientation, hallucinations, aggression, or even euphoria may develop. Imagine the multiplier effects of cold plus hypoxia on aircrew behavior. Drop the body core temperature further, and cardiac arrhythmia and heart stoppage may result.

When we shiver, body metabolism may jump two to four times normal. Shivering is nothing more than nature's way of making the body involuntarily burn up more energy. By this time, you're probably way ahead of me and have guessed that shivering for an hour or more can be muscularly *very* fatiguing, eventually reducing alertness and powers of concentration. Of course, vigorous physical activity can increase metabolism 20 to 30 times, but you're going to find jogging or weight lifting very difficult to accomplish either while sitting in an aircraft or while driving a truck. Either way, using physical activity just to boost metabolism and heat production is going to be fatiguing. Better you should just dress warmly.

Most people take about 1 to 2 weeks to adjust their metabolism from cold climates to hot climates. This is why those first few days of hot weather seem so unbearable. But after the second week, hot weather isn't so noticeable. Unfortunately, the reverse isn't true. The reasons aren't clear, but many of us who have moved from hot climates to cold may take weeks or even months to acclimatize. Some people acclimatize only certain parts of their bodies, such as the hands or feet. Some unlucky misfits never adjust to the cold. It seems (at least physiologically) easier for a Northerner to adjust to the South than the other way around.

Physical Performance Deteriorates

Everybody knows manual dexterity and grip strength drop off with exposure to cold, especially the poor football quarterback who fumbles the crucial snap. Hands are naturally about 10°F cooler than body core temperature. Some folks (as their complaining spouses will vouch) have naturally cooler hand temperatures — up to 20° or 30°F! Hand temperature may even go down to 40°F (5°C) without any long-lasting permanent physical effects (although the feeling is quite painful).

Physical dexterity may deteriorate as much as 25 to 35 percent within 5 minutes of exposure to extreme wind chill. At this low hand temperature of around 40°F (5°C), a mechanic can no longer feel the difference between a wrench and a screwdriver. The pilot can no longer feel the difference between a flap and a brake handle. This is when big-time mistakes can happen.

It's a fact that most injuries occur outside during the winter. The bulk of those outside wintertime injuries occur with drivers who have disabled vehicles. Ever try to change a tire or refuel an aircraft in a blizzard at night and without proper gloves? I can't recommend strongly enough having the proper cold-weather clothing, equipment, and survival gear packed and ready inside the vehicle or airplane. (I personally witnessed a security policeman who got frostbitten toes because he insisted on wearing fashionable jungle boots outside in the winter on a northern tier base.)

Odd Mental Performance Effects

Cold does not affect simple mental decisions, but it does slow down muscle movement time significantly. Therefore, if all a crewmember had to do was watch a light and make a decision to flip a switch, we could conceivably save on heating bills and let him or her slowly freeze. But since flying is reputedly more complex than that, I also need to state that the prolonged cold effects on judgment are quite strange — one of those good news/bad news things. Decision time is actually speeded up, but the errors increase. In other words, results of several experiments historically show that in freezing conditions, subjects actually make more errors, but they make them faster! Clearly, therefore, extreme cold affects our higher-order judgment skills. And, of course, apathy and disorientation are part of those judgment impairments. Most people do quite poorly when they are both cold and attempting to make complex decisions.

Age, Alcohol, and Tobacco (Again)

It's, of course, well known that alcohol and nicotine lower resistance to cold by restricting peripheral blood circulation. Drinking and smoking will numb your fingers and toes. And the effects are especially hard on older people. Older people naturally have lower metabolism, tend to lose heat faster, and are, therefore, more subject to cold stress. The good news is that the effects of cold stress can be partially countered by physical conditioning. Physical fitness seems to increase both the body's metabolism and its ability to acclimatize. If you're both old and cold, I recommend you throw away those cigarettes and pick up those barbells.

Recommendations for Cold Protection

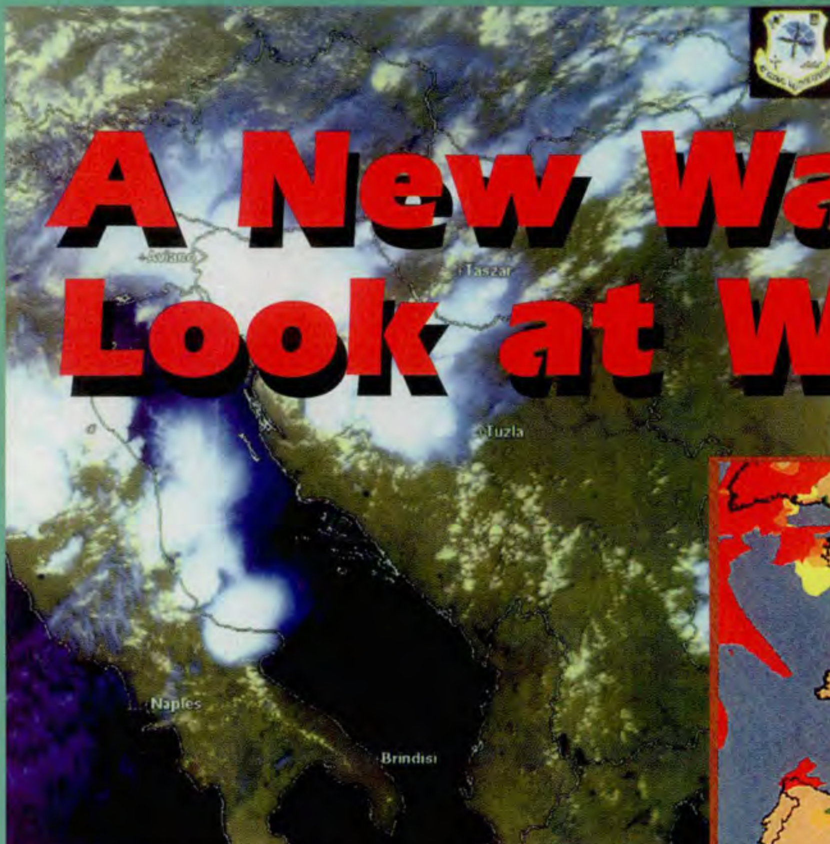
1. Dress warmly to begin with, and be especially prepared with proper gloves and socks. Use several layers of clothing you can quickly don or shed. A good rule of thumb for cold protection: Below 20°F (-5°C), you need to add another layer of clothing for every 10°F (5°C) drop in temperature.

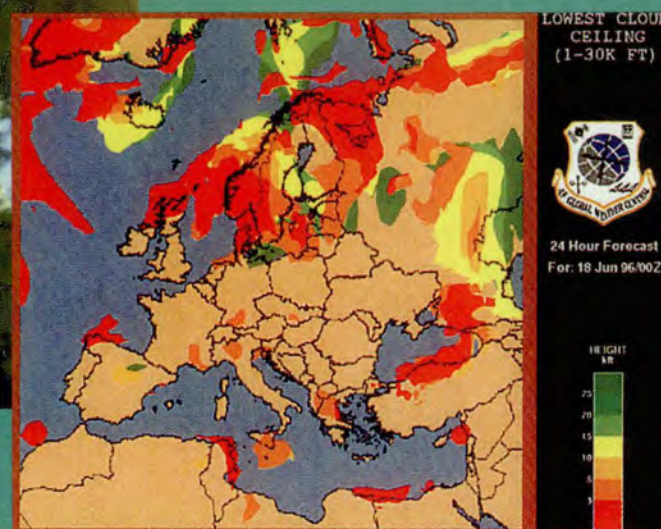
2. Be especially protective of fingers and toes. Most accidents happen outside during cold weather, often because of the natural clumsiness of cold fingers and toes. If you don't wear protective gloves and boots, nature will automatically sacrifice your fingers, toes, and ears to save your internal body core temperature.

3. Keep in good physical condition. Stop smoking altogether and curtail your alcohol. Healthy, fit people acclimatize to cold weather faster and better.

4. Don't put yourself in the position where you must make complex decisions during cold stress. Judgment skills deteriorate rapidly when you're both distracted and fatigued by cold. ✈

A New Way to Look at Weather





LT COL AL BELCHER
Air Force Global Weather Center
Offutt AFB, Nebraska

Ever wished you had listened better at the weather brief and decided not to fly when the weather was forecast for less than optimal flight conditions? We've all been there at least once. I was there one night on a TAC EVAL sortie, flying F-111s out of RAF Lakenheath. We were attacking a command bunker (whisky distillery) just west of Aberdeen, Scotland. It was a typical exercise sortie where you were just happy to get airborne with the "alarm red" and gas mask drills behind you.

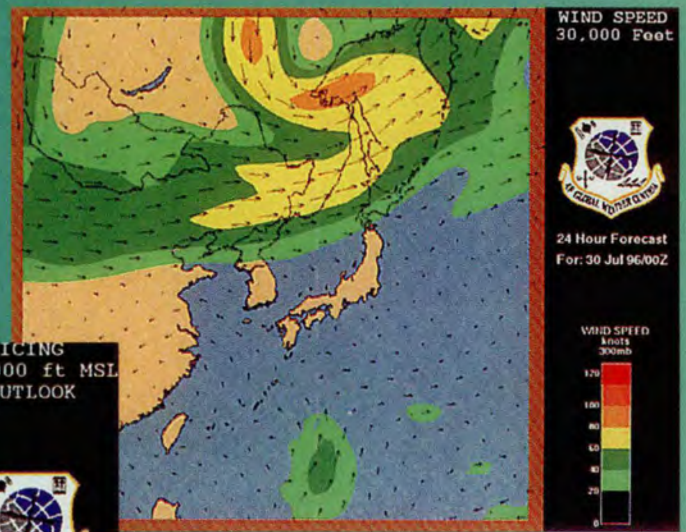
As we cruised north to Scotland, we had about 30 minutes of drone time before our letdown to low level. As part of good crew coordination, we briefed the target details one more time. The possibility of weather impacting our mission wasn't even considered. It was night, we had Terrain Following Radar (TFR), we were in a TAC EVAL, and the thought of failing to hit our target wasn't even a remote possibility. We were set up for failure!

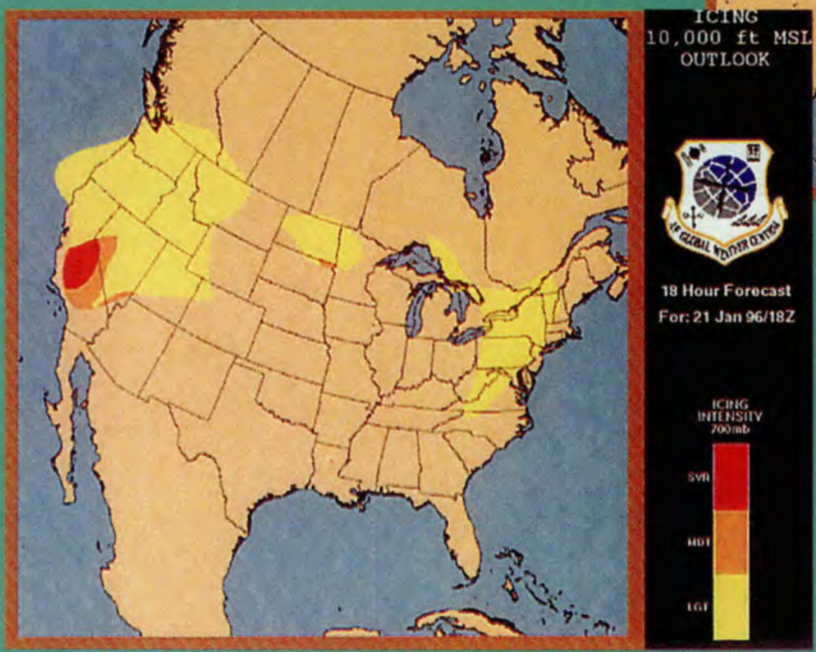
As we let down to TFR altitudes, we started to get the first hint that this wasn't going to be an easy run. The INS had the winds pegged at 30 knots coming directly across the nose (and perpendicular to the Scottish hills). However, this was an important mission, and a few bumps wouldn't deter us from a "successful" in-flight report.

As we continued, the bumps turned into almost constant jolts and vibrations. Reading the instrument panel under the night cockpit lighting became extremely difficult, and my ability to remain "in the scope" for those last critical updates became more and more challenging. After finding the target and executing a modified delivery, we noticed the winds had increased to over 50 knots. *Enough!* We leveled off at medium altitude and headed for home.

Although not paying attention to the weather brief may not always be life-threatening, it can have a major impact on your mission. If we had paid better attention to the weather briefing, or if the format had been easier to ingest we could have formulated a plan to cope with the higher-than-normal winds rather than just reacting to them.

In my new job as Chief of Aircrew Weather Products at Air Force Global Weather Central (AFGWC), I'm tasked with developing easy-to-understand, self-explanatory ways to display weather for the flying customer. Using work stations and a sophisticated graphical programming language, we have developed and disseminated new "warfighter" visualizations to the base/post weather stations. These products are primarily based on AFGWC's Relocatable Window Model, a regional model





New customer-oriented weather visualizations are easier to digest and retain.

of the atmosphere that provides a more detailed and accurate picture of the weather than the hemispheric models of the past. Presently, we produce visualizations predicting the weather for 24- and 36-hour time periods, updated twice a day, for CONUS, Europe, SW Asia, and Korea.

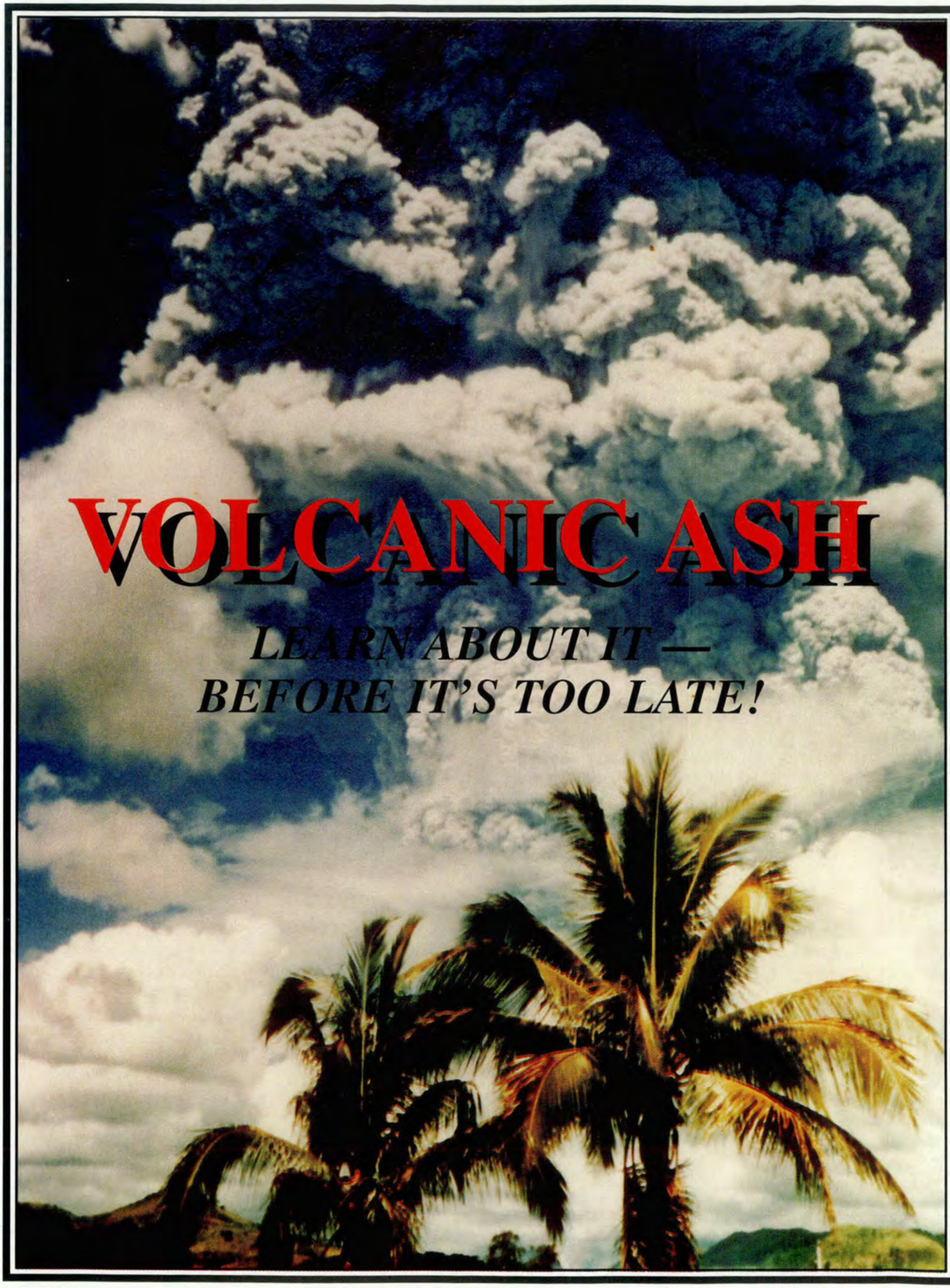
All visualizations are automated, based solely on computer predictions. They are designed for planning purposes, are in vivid colors (making them quicker to digest), and focus on "hot spots" or problem areas. Eventually, we will introduce even more accurate products that employ a man-machine mix, capitalizing on the expertise of weather professionals.

Our current suite of visualizations include flight level winds at 10K, 24K, and 30K feet MSL, icing at 10K feet, thunderstorm probabilities, jet stream, surface temperatures, 24-hour temperature change, low and middle cloud ceilings, low-level wind shear, heat index, wind chill, winter precipitation, snow accumulation, and 12-hour precipitation. In the future, we'll add cloud top, cloud base, freezing level, turbulence, D-value, and surface visibility information. These products are designed to supplement the DD Form 175-1 briefings (Dash One briefings are still required before flight), and can also be used as stand-alone products during weather briefings.

These products are available two ways. First, Air Force base weather facilities have access via the Air Force Dial-in System; just ask your weather flight. Second, AFGWC has started a weather home page on the World Wide Web (WWW) accessible via the MILNET. The Air Force Weather Information Network (AFWIN), designed for nonweather customers, is available for aircrew use at WWW address, http://afwin.offutt.af.mil:443. It contains the new products I've discussed plus a variety of other weather products and services. Once connected, you can receive information on how to obtain an account and password.

If you'd like more information about this new weather product line or the AFWIN system, please contact your MAJCOM weather officer, HQ AFGWC/DOO (DSN 271-1626), HQ AFGWC/DON (DSN 271-1690), or me at HQ AFGWC/OAR (DSN 271-9644). We need your feedback on the quality and usefulness of these products. We're also very interested in your ideas and will do our best to design future products that satisfy your needs. Give us a try! ✈

Courtesy *The Mobility Forum,* May-Jun 96



VOLCANIC ASH

LEARN ABOUT IT — BEFORE IT'S TOO LATE!

Official USAF Photos

CAPT STEVE DICKEY
(The Weather Guy)
HQ AFFSA/XOFD
Andrews AFB, Maryland

■ *Do you know what to look for, and would you know what to do if you had the misfortune of flying into a volcanic ash cloud? Can you see an ash cloud? Can your radar detect volcanic ash? If you're unsure of the answers, you'd better read on. Your life could depend on it.*

A Brief History

Volcanic activity was not generally considered a severe threat to aircraft until the beginning of the 1980s. However, the first recorded volcanic eruption which had any appreciable impact on aviation occurred 22 March 1944 when Mount Vesuvius in Italy did more damage on an Allied airfield than would have likely happened from an enemy raid.

The American 340th Bombardment Group's entire fleet of 88 North American B-25 Mitchells had their fabric control surfaces burned off and all Plexiglas pitted. The weight of the ash which fell on the aircraft at their field near Naples tipped them onto their tails. All 88 were severely damaged.

This Stuff Is Dangerous

Since the early 1980s, there have been several major volcanic eruptions around the world. These eruptions have given aircraft manufacturers and aviators more than they bargained for. Beginning in 1980 with the eruption of Mount Saint Helens in Washington state, a new chapter began in the story of **"aviation versus volcanoes."** The decade held at least two major aviation encounters with volcanic ash which almost resulted in loss of life near Indonesia and adversely affected numerous flying operations in Alaska. Here's just one account.

It Really Happens

In early summer of 1982, a British Airways B-747 with 247 passengers and 16 crewmembers was en route from Kuala Lumpur, Malaysia, to Perth, Australia. It was cruising at 37,000 feet. Nothing unusual was being painted by the onboard radar. The captain had left the flight deck.

An eerie blue glow of St. Elmo's fire on the windscreen and engine nacelles was the first sign of trouble. The crew turned on anti-ice and ignitors on all engines and switched on the seat belt lights in the passenger compartment as a precaution. Turning on the landing lights, the first officer peered out into the darkness. It seemed to him the plane was passing through a continuous, thin cloud.

The captain was called to return to the cockpit. Soon the crew noticed what seemed to be a bluish smoke on the flight deck and the acrid smell of ozone. A thin shaft of light projecting forward of the plane's four engines appeared, somewhat similar to a flashlight's beam. Passengers began noticing the blue smoke in their cabin and became uneasy. Back in the cockpit, a light glowed on the flight engineer's panel indicating the No. 4 engine's air supply was down. Within a short time, the engine's rpm and pressure ratio began to drop, and it wound to a halt. The crew began the engine fire checklist, but as it was completed, the No. 2 engine began to run down the same way. The remaining two engines then did the same thing. Now, all four engines were out! The plane was 80 nautical miles from land, 180 miles from a suitable runway.

The effects of falling ash can clearly be seen in this photograph of a Philippine village after the June 12-15, 1991 eruptions of Mount Pinatubo.

All of aviation is based on redundancy of systems. If one system fails, another should be available to take its place. The odds against all four engines failing at the same time in a modern commercial aircraft are astronomical. For all practical purposes, losing all four engines just never happens. But now it had. Jakarta air traffic control also found this situation hard to grasp, and it took a second radio message from the crew before controllers there understood the plane was powerless.

To attempt to restart the engines would require the crew to maintain an indicated airspeed of 250 to 270 knots. At the same time, the aircraft was descending at a rate of 2,000 feet per minute. That meant a water landing in 18 minutes, time to glide perhaps halfway to Jakarta, Indonesia. Naturally, the flight engineer worked continuously to restart the engines. By this time, the plane was vibrating vigorously, and flames were issuing from the tailpipes due to the restart attempts. In the cabin, passengers were listening to emergency ditching instructions.

Eight minutes after the first engine failure, as the plane descended through 13,000 feet, the No. 4 engine relit. That saved the day because if that engine could stay operational, the plane would likely be able to maintain its altitude. Over the next 5 minutes, the crew was able to get the remaining three engines relit, and a climb was started. At 15,000 feet, however, the St. Elmo's fire was again observed, and the crew began another descent. The No. 2 engine surged again and was shut down. The plane proceeded on to Jakarta on three engines and made a successful landing. The front windshields were so badly scratched and the landing lights rendered so useless that the crew requested the plane be towed off the runway after landing.

This incident was the result of a

continued on next page

Mount Pinatubo's deadly ash cloud looms over Clark Air Base. If you see a volcanic eruption and have not been previously notified of it, you may be the first person to observe it — especially in remote locations. In this case, immediately contact ATC personnel and alert them to the hazard.

cloud of volcanic ash from Java's Galunggung volcano which had erupted about an hour before the B-747 left Kuala Lumpur. Analyzing the flight data recorders, engineers learned the four engines had begun to lose power imperceptibly about 5 minutes before the shutdowns began. Inspection of the engines revealed light erosion of the cowl leading edges and pieces of fused volcanic ash debris in the tailpipes. After being torn down, the engines were found to have various degrees of erosion. In the hot sections, fused volcanic dust had built up on the walls and blades. Outside the plane, sandblasting (ash-blasting) had eroded the central portions of the windshields and frosted over the landing lights. This harrowing experience is a good example of hazards faced by aircrews resulting from unreported volcanic events and from resulting ash clouds which often cannot be detected.

Flight Operations in Volcanic Ash (from AIM/FAR, 1996)

Most important is to avoid any encounter with volcanic ash. The ash plume may not be visible, especially in instrument conditions or at night. And even if visible, it is difficult to distinguish between ash cloud and ordinary weather cloud. Volcanic ash clouds are not displayed on airborne or Air Traffic Control (ATC) radar. In fact, radar reflectivity of volcanic ash is roughly a million times less than that of a cumuliform cloud. Pilots must rely on reports from controllers and other pilots to determine the location of the ash cloud and use that information to remain well clear of the area. You should make every attempt to remain on the upwind side of the volcano. Flightcrews who have encountered volcanic ash clouds provided the following indicators to help you recognize this hazard.

◆ Smoke or dust appearing in the cockpit.

◆ An acrid odor similar to electrical smoke.

◆ At night, St. Elmo's fire or other static discharges accompanied by a bright orange glow in the engine inlets.

◆ At night, or in dark clouds, landing lights cast dark, distinct shadows in ash clouds, unlike the fuzzy, indistinct shadows cast against weather clouds.

◆ Multiple engine malfunctions, such as compressor stalls, increasing exhaust gas temperatures, torching from tailpipes and flameouts.

◆ A fire warning in forward cargo areas.

Recommended Actions

It is recommended pilots encountering an ash cloud immediately reduce thrust to idle (altitude permitting) and reverse course in order to escape from the cloud. Ash clouds may extend for hundreds of miles, so pilots should not attempt to fly through or climb out of the cloud. The following procedures are recommended. Some of these may not apply to your particular aircraft.

◆ Disengage the autothrottle if engaged. This will prevent the autothrottle from increasing engine thrust.

◆ Turn on continuous ignition.

◆ Turn on all accessory airbleeds including all air conditioning packs, nacelles, and wing anti-ice. This will provide an additional engine stall margin by reducing engine pressure.

◆ It may become necessary to shut down and then restart engines to prevent exceeding engine temperature limits. Also, volcanic ash may block the pitot system resulting in unreliable airspeed indications.

Reporting

If you see a volcanic eruption and have not been previously notified of it, you may be the first person to observe it — especially in remote locations. In this case, immediately contact ATC personnel and alert them to the hazard. Remember, you are the most important link in volcano observation and warning programs for aviators. If it has been previously reported, you should see information in NOTAMs, on Significant Meteorological Phenomena Reports (SIGMET), or hear it from ATC specialists.

Don't be caught off guard by this deadly act of nature. If you know about it, you can avoid it. If you have the misfortune of encountering it, now you know the right moves to increase your odds of survival. ✈

GET OUT, SIR! Your jet's on fire!

CMSGT DON A. BENNETT
Technical Editor

These could've been the recovery crew chief's words when alerting the mishap F-16 pilot on the gear well fire. Fortunately, the fire was quickly extinguished, and nobody was injured or killed. Hopefully, the positive corrective steps the mishap unit initiated will help prevent other Viper pilots from hearing those same stirring words.

Hot Taxiing in the "SEC" Engine Mode

A P-1 (Deutsch) cannon plug came off the engine data unit (EDU) on a Pratt & Whitney 229 engine, which caused the engine to kick into its secondary (SEC) mode. With the F-16's engine throttle at idle, this condition equates to 1,000 pounds of additional thrust.

The mishap F-16 Viper pilot's approach, landing, and de-arm went all right, but the real excitement began during taxiing. Because of the extra thrust, the pilot had to use the brakes quite a bit to slow the jet down to a safe taxi speed. After taxiing for about a mile and a half to the parking ramp, the brakes will, and did, heat up — **big time!**

When a recovering crew chief saw the jet's brakes smoking, he marshaled the pilot on through the normal parking ramp to keep the mishap jet away from other aircraft and personnel (**atta boy — keep 'em safe**). The pilot went ahead and taxied the smoking jet to a nearby arming area. There he was promptly alerted to do an emergency egress from his jet after maintenance notified him a main wheel brake was on fire. The on-scene maintenance folks simultaneously began fire-fighting efforts with flightline fire bottles until the fire department arrived and completely extinguished the fire.

The main wheel well fire was caused by a ruptured hydraulic line that failed due to the extreme heat from the hot brakes. Besides the damage to the landing gear, an electronic countermeasure pod radome was fire damaged. The mishap results could have been far more destructive if not for the quick reactions of the folks from maintenance and the fire department — **great job y'all!!**

Suggestions for F-16 Pilots

For the Viper pilots out there, the next time you are faced with landing and/or taxiing in the SEC engine mode, we would suggest you might want to fully stop at the first opportunity after clearing the runway, shut the jet down, and have maintenance tow your jet back to the parking ramp. No sense in risking hot brakes or a fire when you taxi (e.g., over long distances) with your engine in the SEC mode. There's no formal written actions or guidance on ground operations under this condition in your Dash One right now, but the mishap unit has initiated an AF Form 847 to plug up that hole. In the meantime, either be prepared for a "hot" ride or call your friends at maintenance for a tow tug and stick — the latter being safer.

An AFTO Form 22 Is in the Mail

As for the maintenance side of this mishap, this ain't the first time the P-1 cannon plug has inadvertently disconnected. Seems there are times that congested, confined spaces make it hard to get (or observe) a positive lock on the lock mechanism. Of course, a mechanic or task inspector **not** paying close attention to details and/or in a rush **might not** catch the faulty connection. Over time, the connector/cannon plug could conceivably separate due to the normal engine and aircraft vibrations.

The mishap unit thinks safety wiring the cannon plug after it's been connected to the EDU will prevent recurrences. They have submitted their idea on an AFTO Form 22 to the depot engineers for possible inclusion in the applicable tech data.

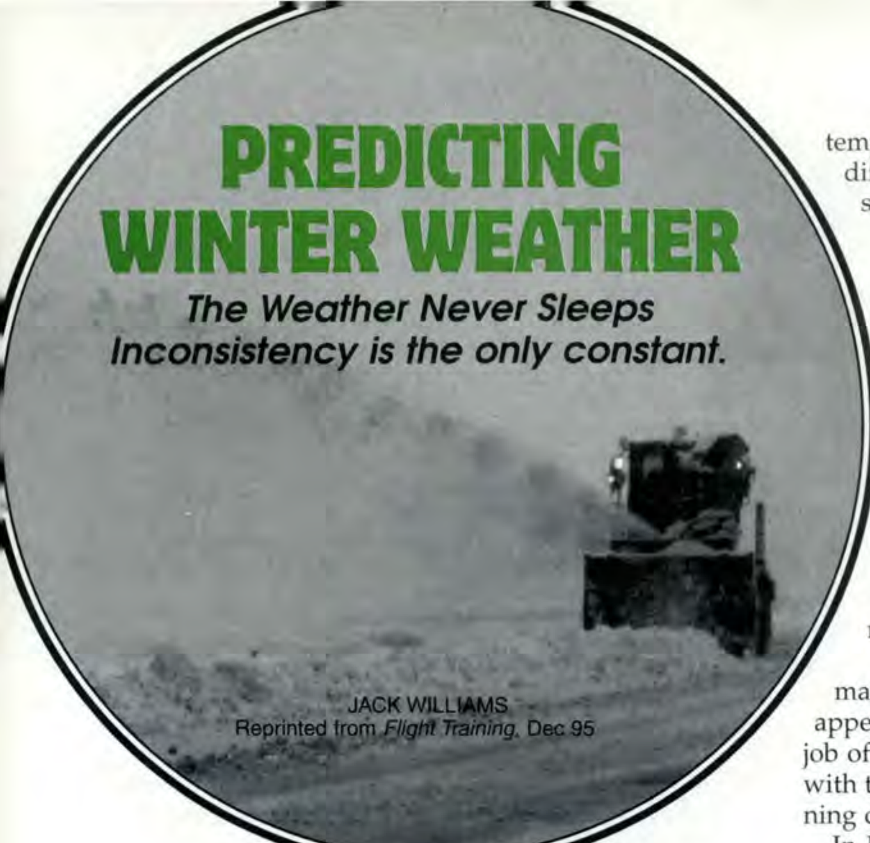
Don't Forget the Depot System/Item Managers!

An active dialogue (e.g., product feedback) from the field is another tool the depots use to detect the potential for component failure-caused mishaps. No, maybe not you individually, but combined with many other same-product users and the mishap prevention picture becomes clearer. There's no need to continue "making do" with a difficult component ... even if it wasn't involved in a mishap. So make the call today ... they're there to serve you. Besides, it's a flight safety teamwork-network you can't ignore.

In the meantime, remember this: Like a seat belt, the quick disconnect-type electrical or electronic cannon plugs and connectors aren't properly fastened unless you hear or *feel* them "click"! If they don't, investigate further. Don't assume the cannon plug or connector is "down and locked"! ✈

PREDICTING WINTER WEATHER

The Weather Never Sleeps
Inconsistency is the only constant.



JACK WILLIAMS
Reprinted from *Flight Training*, Dec 95

Pilots from Boston, Massachusetts, to Birmingham, Alabama, had no problem making go/no-go weather decisions 13 March 1993. For the first time since commercial aviation began, a blizzard had closed every airport from the Southeast to New England. Called the "Storm of the Century," it dumped more than a normal decade's worth of snow — 17 inches — in Birmingham, Alabama. It gave Syracuse, New York, 43 inches. Snowfall rates of 2 to 3 inches an hour were common.

While some larger airports were closed less than a day, others needed days to clear the snow. Even if pilots had been able to get to a clear runway, they wouldn't have wanted to take off. The weather station atop Mount Washington, New Hampshire, at 6,200 feet above sea level, recorded a gust of 144 mph. The wind at New York City's La Guardia Airport was gusting to 71 mph.

The "Storm of the Century" also included "thundersnow." Anyone in the air would have faced the hazards of thunderstorms hidden in the clouds and snow. Aircraft also would have encountered heavy airframe ice. Central New Jersey reported 2.5 inches of sleet on the ground. Sleet on the ground means supercooled raindrops, or freezing rain, is somewhere above, and freezing rain creates the most dangerous kind of airframe icing.

While a storm of the century is rare, ordinary winter storms make life harder for pilots in many ways. While some weaker storms make it clear that flying isn't a good idea, most require pilots to make difficult choices without clear-cut information. Winter brings the strongest and biggest storms, because mid-latitude storms, those that form outside the tropics, draw their energy from temperature contrasts. The greater the temperature differences between large air masses, the stronger a storm is likely to be.

Arctic temperatures begin plunging as the days grow shorter during fall and into winter. The tropics, however, stay warm because the days stay nearly the same length all year. Most of the contiguous 48 states become winter's battleground between frigid Arctic air and the balmy air of the tropics. The resulting weather can range from mild systems that cloud the skies and produce a little rain or snow to full-fledged blizzards. A blizzard, by the way, is a storm with snow falling while the wind blows at sustained speeds of 35 mph or faster near the ground and the visibility stays at or below .25 miles for an extended time.

As with any kind of dangerous weather, information is the pilot's first defense. Big storms don't appear by magic. Today's forecasts do a generally good job of saying when something big is brewing. But even with the best technology, forecasters have difficulty pinning down the details of winter storms.

In March 1993, the computerized forecast models in the U.S. and Europe pointed to a major East Coast storm 6 days before it began. Two days before the storm began, the computer forecasts agreed totally, and the National Weather Service began issuing storm warnings. The forecasts did not, however, point to some important details, such as snow as far south as the Florida Panhandle. The lesson for pilots? Stay abreast of the general weather picture even when you aren't flying.

The "Storm of the Century" was an extratropical storm with a low-pressure center and warm and cold fronts, as shown in figure 1. Such storms account for a good share of the nation's bad winter weather, but not all of it. Many storms track across the U.S. from the Pacific to the Atlantic with their characteristics changing on the way. The storm's exact path also makes a big difference in the weather it causes.

Figure 2 shows some of the most common storm tracks. A storm that moved across the United States from 13-16 February 1990 is a good example. It's one of the best-documented cross-country storms because it moved across regions, each with different scientific groups studying winter weather. Effects of the 1990 storm included:

• Heavy snow in the West, northern Plains, and New England, including snow that shut down Chicago's O'Hare Airport.

• Freezing rain from Oklahoma to New England.

• Severe thunderstorms with tornadoes and flooding in the South and along the Ohio River.

• Frost damage to citrus in California and Arizona.

• Damaging winds in California, New Mexico, Texas, and Wyoming.

• Aircraft icing over much of the U.S. east of the Rockies, and north of the Ohio River and North Carolina.

Scientists are still studying the detailed observations made by researchers in Denver, Kansas City, Missouri, Champaign, Illinois, and western New York. The observations show that winter storms are complex and composed of layers of air at different temperatures. Bands of precipitation will bury some areas in snow and deposit freezing rain, rain, or almost nothing on nearby areas. Here's a very general picture of what to expect from winter storms in different parts of the country.

The West Coast to the Rockies. As storms move inland from the Pacific Ocean, they normally bring heavy rain to low-elevation coastal areas and snow to the mountains. Pilots used to Eastern or Midwestern weather must be prepared for huge differences over short distances. For example: Sacramento, California, averages a trace of snow in a year. South Lake Tahoe, California, less than 100 miles away in the mountains, averages 58 inches in January alone. Heavy snow also falls eastward to the Rockies. Another danger is turbulence as high winds flow through valleys and canyons and over mountains.

The Plains and the Midwest. The mountains break up low-level wind circulation in storms, but the storms tend to reform just east of the Rockies. As they grow, storms pull in cold air from the north and warm, humid air from the Gulf of Mexico. These contrasting air masses add energy. As a storm moves farther east, it taps more humid Gulf air, increasing the possibility for heavy snow. Slow-moving storms can bring hour after hour of wind and heavy snow.

The Southeast and the Gulf Coast. While winter weather isn't as common here as it is farther north, it can cause serious problems. Major ice storms hit Dallas and Atlanta every few years. Southern snow is often wet and heavy, and airports aren't as well equipped to clear away snow and ice as those farther north.

Figure 1
A typical extratropical cyclone that causes wintry weather. The low pressure center in this case is over Illinois, the L.
Area 1 is where northwest winds are bringing in cold air. The cold front from Illinois southwest into Texas is the cold-warm dividing line and the location of a lot of weather action, such as thunderstorms.
Area 2 is the warm sector with generally southwest winds bringing in warm, humid air.
3 is the warm front dividing the warm air from the cooler air to the north over the northeastern states. The area north of the warm front typically has widespread rain, snow, sleet or freezing rain in winter - often all four.

Figure 2
Storms like those in Figure 1 typically track west to east across the U.S. The arrows here show the tracks of the storm's center, the low-pressure area. The warm and cold fronts often affect almost all of the the lower 48 states.
1. Pacific storms hit the west coast more often in the north but moving south during the winter.
2. "Alberta Clippers" form just east of the Rockies in Alberta, Canada, and move quickly across the northern U.S. Since they move quickly, their bad weather usually ends quickly.
3. Storms from the Pacific normally break up in the Rockies and re-form just east of the mountains, often over Colorado.The path here, across the Great Lakes is one of many. Sometimes these storms dip southward to the Gulf of Mexico.
4. A Gulf of Mexico storm that stays west of the Appalachians is an "inside runner" and normally brings rain to the East Coast, snow to the Midwest.
5. "Outside runners" that go east of the mountains can bring the East its heaviest snow. The blizzard of 1993 was such a storm.
6. Storms following a path like number 3 can often weaken west of the Appalachians but their upper energy moves east to form "secondary" storms over the Atlantic. These can bring heavy snow to the Northwest.

Figure 3
This is the radar summary chart for Feb. 5, 1989. No big storms are on the weather map, but the two bands of showers and thunderstorms detected on radar caused heavy snow as well as the usual thunderstorm hazards.

The Mid-Atlantic and the Northeast. Storms move into the eastern part of the country both from the Midwest and from the Southeast. Some of the worst are the storms that form or strengthen over the Gulf of Mexico — such as the March 1993 blizzard — and move up the Atlantic Coast, drawing in warm, humid ocean air. Midwestern storms often will weaken west of the Appalachians, but their upper-level circulation will move eastward and stir up "secondary" storms just off the Atlantic coast. These "secondary" storms sometimes can be stronger than the original storm west of the mountains.

With a big picture of what storms can do, and the latest forecasts, pilots can begin assessing the dangers of a particular winter trip. The ideal time to fly is after a storm has passed through, bringing in cold, stable air and clear skies, but before the next storm begins stirring things up. The key to safe flying is knowing when the next storm is likely. Don't assume the 8 a.m. forecast is going to be good by 2 p.m., and don't assume that all bad winter weather comes with big, extratropical storms.

Figure 3 is a simplified radar summary chart showing two bands of precipitation that aren't associated with a large-scale storm. The northern band moved slowly across Illinois, dumping more than 6 inches of snow. The lesson: A good briefing includes looking at maps and charts and asking what's going on in such areas as bands of precipitation.

A group of University of Illinois scientists who studied winter storms summed up forecasting problems in the 1991 *Bulletin of the American Meteorological Society.* The 26 storm systems they studied over 3 years had precipitation that lasted from 30 minutes to 28 hours. The precipitation included heavy snow with 5- to 10-inch accumulations accompanied by lightning and heavy freezing rain, some storms that were very cold, and some that were very warm with rain.

Such variability, they said, means "the prediction of the onset, duration, intensity, location, and type of precipitation often proves to be difficult and continues to be one of the most challenging problems in meteorology."

A lesson for pilots is that what is going on in one part of a storm is not a good guide to what is happening a few miles away. The current weather can quickly change as a winter storm, or even a band of clouds that is not part of a storm, moves along. Pilots need to be mentally prepared for conditions that are worse, or better, than forecast. ✈

BLUE RIBBON PANEL ON AVIATION SAFETY — A ONE-YEAR LOOK-BACK

Editor's note: *In the October 1995 issue of* Flying Safety, *we published an article on the Air Force Blue Ribbon Panel on Aviation Safety which summarized the recommendations of the panel. We promised you an update on the status of the recommendations. Here it is.*

■ On 23 June 1995, the Air Force Chief of Staff, General Ronald Fogleman, established a Blue Ribbon Panel to review Air Force aviation safety to include organization, manning, and mishap investigation procedures. The panel members were Vice Admiral Donald D. Engen, USN (Ret), Chairman, Dr. Hans Mark, former Secretary of the Air Force, member, General Robert C. Oaks, USAF (Ret), member, and Brigadier General Joel T. Hall, USAF (Ret), member.

In completing its work in slightly over 60 days, the panel visited 20 Air Force organizations and compiled data from questionnaires received from 600 personnel who had been involved in safety mishap investigations. The results of their extensive review were outbriefed to the Chief of Staff on 31 August 1995 and published in a formal report dated 5 September 1995.

There were two major conclusions which emerged from the review:

1. The organizational structure of the Air Force safety effort, both in the prevention and in the investigation of mishaps, is appropriate for a military organization.

2. The Safety Investigation Board (SIB) process must be strengthened to ensure that the report of the Board reflects precisely the results of the investigation and cannot be changed by the people in the chain of command.

The final report contained a number of recommendations designed to enhance the Air Force's Mishap Prevention Program. The current status of each recommendation was recently briefed to the Chief of Staff by Brig Gen Orin L. Godsey, Air Force Chief of Safety with General Oaks and Brig Gen Hall in attendance. A recap of each recommendation follows.

1. Make mandatory Air Force Safety Center (AFSC) training courses for SIB presidents and members.

The Air Force Safety Center conducted its first SIB President's Course in late January 1996 and to date has trained nearly 150 colonels representing every major command (MAJCOM). By the end of FY97, over 350 board presidents will have been trained. To satisfy MAJCOM requests for additional training quotas for other board members, AFSC added two more classes each for the Flying Safety Officer (FSO) and Aircraft Mishap Investigation courses (AMIC) and will have trained 550 students by the end of FY96.

2. Designate the MAJCOM/CC as the Class A mishap SIB convening authority.

The recommendation was implemented almost immediately via a HQ USAF/CV message, DTG 191700 Sep 95 which stated that delegation below the MAJCOM level was not authorized effective 1 October 1995. This change was incorporated in the April 1996 rewrite of AFI 91-204, Safety Investigations and Reports.

3. Require an experienced AFSC representative to serve as a voting member on each Class A SIB for aircraft, missile, explosive, and space mishaps.

This recommendation was also implemented by the same HQ USAF/CV message mentioned in recommendation 2 and was incorporated in the April 1996 rewrite of AFI 91-204.

4. Require the SIB report reflect precisely the results of the investigation to preserve the integrity of the process.

When the SIB completes their investigation, the results are briefed to the MAJCOM/CC. The convening authority has three options available at that time: (1) concur and accept the report as written, (2) non-concur and provide comments within 7 days, or (3) reconvene the SIB to further investigate areas which the MAJCOM/CC feels were not adequately addressed.

Once the SIB's final message on findings and recommendations is complete, it becomes a permanent part of the final report and is mailed to all affected addressees. It cannot be altered in any way unless the entire SIB is reconvened and all members concur with any proposed change.

These procedures were incorporated in the April 1996 rewrite of AFI 91-204.

5. Establish an open comment and endorsement process for those in the chain of command above the squadron or wing level.

This process was implemented via the HQ USAF/CV message, DTG 191700Z and incorporated in the April 1996 rewrite of AFI 91-204. Within 2 weeks of the SIB's transmission of their final message to the field, the Air Force Safety Center (AFSC) sends a message to the same addressees, requesting their endorsements and comments on the board's findings and recommendations. A response is required within 30 days. All traffic going to and from the MAJCOMs is conducted via the open message system so that all affected parties benefit from seeing everyone else's position on the final findings and recommendations. After receipt of the command endorsements, AFSC begins work on the Memorandum of Final Evaluation (MOFE).

6. Establish a centralized Air Staff Office responsible for the integration of the CRM program in the Air Force.

The AF/XO has a full-time OPR to administer the Air Force's CRM program, which is covered by AFI 36-2243.

7. Review the safety impact of reduced manning and

aircraft numbers while there has been no change in the operational requirements (Ops Tempo).

The AF/XO conducted a mishap analysis in May 1996 which resulted in four recommendations to MAJCOMS:

- Establish guidelines for return to pre-deployment skills.
- Review additional workload to eliminate or reschedule.
- Review Guard and Reserve support equipment levels.
- Look for innovative ideas to improve safety.

In addition, Ops Tempo concerns will be addressed in the next Quality of Life Survey.

8. Provide means and accountability for ensuring human factors integration into the acquisition process.

A conference was held in June 1996 with representation from AF/XO, AF/SG, and AF/SE to focus on the acquisition process from cradle to grave. Numerous recommendations resulted which identified human performance challenges and how they might be addressed through system design.

9. Update AFI 91-204 mishap definitions and classification to (1) reflect 1995 aircraft, labor, and component cost data, and (2) redefine mishap classification criteria to eliminate ambiguity on aircraft damage/repair criteria.

Since all services are bound by the cost criteria established in DODI 6055.7, a memo from AF/CV was forwarded to the Undersecretary of Defense for Environmental Security requesting an update of the criteria. While the memo covered a number of repair cost issues, the main thrust was to update the mishap cost thresholds for each classification based on inflation rates since the last update back in 1988. This issue, which has the full support of the Air Force Chief of Staff but requires concurrence from all services, is still being actively pursued.

10. Continue to vigorously protect privileged information as applied to the SIB process.

AFI 91-204 is being rewritten to bring the practical application of privilege within the Air Force more closely in line with DODI 6055.7 and that of the other services. Specifically, a promise of confidentiality will be given only to those who need it. Not every witness (the farmer in the field or the child in the schoolyard) requires a promise of confidentiality to relate a factual matter. Those involved in the mishap sequence may. The regulation will provide that a promise of confidentiality will not be given on a blanket basis, but will be offered to witnesses at the discretion of the SIB president. Additionally, the witness will be given the opportunity to waive the promise if they wish.

Similarly, the SIB president has the discretion to place a contractor's technical analysis in Tab J of Part I of the SIB report (the releasable portion), or put it into Tab W of Part II, depending on the circumstances and the needs of the contractor. This will allow a contractor to be treated the same as an Air Logistics Center for purposes of a technical report which will allow the contractor use of the report for product improvement.

These changes, in coordination with aggressive protection of that information which is compiled under the privilege umbrella, will ensure privilege is applied where it is needed and that it will stick.

11. Combine and collocate AF/SE and the Air Force Safety Agency (AFSA).

This was accomplished in January 1996 when the Air Force Chief of Safety and his staff moved to Kirtland AFB, New Mexico, and merged with AFSA to form the Air Force Safety Center. The Air Force Chief of Safety is dual-hatted, retaining his position on the Air Staff, as well as becoming the Director, AFSC. A copy of the organizational chart for AFSC can be found in the Feb-Mar 96 issue of *Flying Safety*.

There are a number of corollary recommendations that came out of the Blue Ribbon Panel report, that while they did not get a great deal of visibility initially, they are important to our overall mishap prevention efforts. An update of the most significant ones follows.

1. Implement an Operational Risk Management (ORM) Program. AFSC has developed an ORM program and incorporated it into AFI 91-213 which has been coordinated through the MAJCOMs and recently approved by the Air Force Chief of Staff. The instruction provides broad guidance and provides MAJCOMs/FOAs/ DRUs the latitude to develop and tailor their own ORM program to meet their specific needs. AFSC is currently working on a training course which will be used to educate key MAJCOM/ FOA/DRU personnel who will, in turn, be responsible for training their own personnel. There are currently 12 classes scheduled through the end of FY97, and MAJCOMs/FOAs/DRUs will soon be receiving their training quotas. The ultimate goal is to educate all Air Force personnel, military and civilian alike, and provide them the tools to integrate risk management into their daily lives.

2. Enhance tracking and trend analysis of Class B and C mishaps and High Accident Potential (HAP) reports.

AFSC is in the process of developing programs to more adequately monitor Class B, C, and HAP trends. A three-member Operations Research Branch will be established in the very near future whose primary purpose will be to analyze these trends and provide meaningful data to the field to help focus mishap prevention efforts in the most critical areas.

3. Mishap Review Program (MRP) — strengthen followup of SIB corrective action recommendations.

While almost every MAJCOM had some type of program to monitor mishap recommendations, there wasn't a formal program established to track recommendations and apprise senior Air Force leadership on the overall status of the MRP. This problem has been resolved with the April 1996 rewrite of AFI 91-204 which tasks AFSC to monitor the program and gather information from affected MAJCOMs to provide an annual briefing to AF/CC or AF/CV on the status of open mishap recommendations. ✈

USAF Photo by MSgt Perry J. Heimer

Ice and Wings Don't Mix

Aircraft operations in icing conditions continue to result in incidents and accidents more than 90 years after the Wright Brothers first flew. No aircraft type, size, or configuration has been immune.

Extracted from a special study prepared by
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Within the Air Force's flight operations community, there exists differences in the understanding and interpretation of published holdover times after deicing/anti-icing. Some tech orders specify a holdover time, while others say takeoff should be ASAP (a vague, unspecified time frame), and still others give the freedom of an unlimited, unspecified holdover time. The following information and alternatives to existing ground deicing and anti-icing procedures are offered to the flight operations and ground servicing communities to provide greater flight safety.

Wind tunnel and flight tests indicate that ice, frost, or snow formations on the leading edges, upper, and lower surfaces of the wing and horizontal stabilizer, having a thickness and surface roughness similar to medium or coarse sandpaper, can reduce lift by as much as 30 percent **and increase drag by 40 percent.** These changes in lift and drag will *significantly* increase stall speed, reduce controllability, and alter aircraft flight characteristics. Thicker or rougher ice accumulations in the form of frost, snow, or ice deposits can have increasing effects on lift, drag, stall speed, stability, and control, but the primary influence is surface roughness critical to lift generation.

Improved deicing/anti-icing procedures, better fluids, and an increased awareness of the problems concerning ground and flight operations during periods of frozen precipitation will help us to avoid serious problems this winter season.

Frozen Contaminants — Their Causes and Effects

Frozen contaminants can form and accumulate on exterior aircraft surfaces on the ground during inclement weather. This accumulation can also occur during ground operational conditions conducive to icing. In either case, atmospheric conditions vary the type of accumulation, the amount, etc. Icing conditions occur during both flight and ground operations, and ice protection systems or procedures should be activated when the outside air temperature (OAT) is below 50 degrees F (10 degrees C) and visible moisture is present or when there is standing water, ice, or snow on runways or taxiways.

Aircraft in flight experience a variety of atmospheric conditions which alone or together can produce ice formations on the aircraft and its components. These conditions include:

• **Supercooled Clouds.** These are clouds containing water droplets that have remained in the liquid state even though the ambient temperature may be below 32 degrees F. These droplets are very small (5 to 100 microns), and they freeze on impact with another object. Water droplets have remained liquid even at temperatures as low as -40 degrees F. Cloud liquid water content, ambient temperature, droplet size, and the aircraft's size, shape, and velocity all contribute to the rate of accretion and the shape of the ice formed. (One micrometer or micron is one millionth of one meter or .00003937 inches.)

• **Ice Crystal Clouds.** These clouds exist at very cold temperatures where their moisture has frozen to the solid or crystal state.

• **Mixed Conditions.** These clouds have an ambient temperature below 32 degrees F and contain a mixture of ice crystals and supercooled water droplets.

• **Freezing Rain and Drizzle.** These are precipitation that exist within or below clouds at ambient temperatures below 32 degrees F. Rain droplets remain in a supercooled liquid state. Freezing rain is different from freezing drizzle only by virtue of droplet size. (Rain droplets range in size from 500 to 2,000 microns, and freezing drizzle droplets are less than 500 microns.)

Aircraft on the ground are susceptible to many of the same conditions as in flight even when they are parked or when they are operating on the ground. There are also conditions specific to ground operations. On the ground, the aircraft are exposed to:

• Frozen precipitation — snow or sleet.

• Residual ice from a previous flight — usually on the leading edges of wings, the empennage, training edge flaps, etc.

• Moisture, slush, or snow on ramps, taxiways, and runways — which can remain in place on the aircraft if the temperature is low enough; particularly susceptible to this kind of frozen contamination are wheel wells, landing gear components, flaps, under surfaces of wings, horizontal stabilizers, etc.

• Supercooled ground fog and ice fog — much like supercooled clouds and caused by advection or nighttime cooling.

• Snow blown by ambient winds, other aircraft, or ground support equipment — the source can be snowdrifts, other aircraft, buildings, etc.

• Recirculated snow — whipped up into the air by engine, propeller, or rotor wash.

• High relative humidity with temperatures below the dew or frost point can cause frost. This is common during overnight storage after descending from higher altitudes, especially on lower wing surfaces in the vicinity of cold soaked fuel cells.

• Frost — a crystallized deposit formed from water vapor on surfaces at or below 32 degrees F.

• Clear ice — usually around integral fuel tanks, difficult to see, and usually detectable only by touch or ice detector.

Other Locations of Frozen Contamination

There are areas of the aircraft other than the ones we've mentioned where frozen contamination can accumulate and not be detected except by careful, visual inspection. Anti-icing fluids may not reach areas under leading edge slats and portions of trailing edge flaps. Without a protective film of anti-icing fluid, these areas may be exposed to icing during precipitation or high relative humidity when taxiing, waiting for takeoff, or

USAF Photo by SrA Jeffery Allen

continued on next page

when in a takeoff configuration.

Residual ice, in particular, from previous flights can "hide" on the leading edges of wings, on the empennage, in slotted flaps, engine air inlets, etc., of arriving or parked aircraft. If not discovered and removed, residual ice can then affect aircraft performance and handling characteristics on takeoff after turnaround.

During ground operations, propellers and other rotating components are exposed to icing-forming conditions similar to those in forward flight. Some aircraft require operation of in-flight ice protection equipment when operating on the ground.

Effects of Contamination

Changes in lift and drag can greatly increase stall speed, reduce controllability, and can even alter flight handling characteristics. As the frozen contamination gets thicker and rougher, the adverse effects also increase, and, in addition to the stated effects on lift, drag, stall speed, and performance, the aircraft's inherent stability and control can be lost. Without warning, the aircraft can depart from the commanded flightpath. Consequently, it is essential that the pilot not attempt takeoff unless the aircraft commander has made certain these critical surfaces and components are free of frozen contaminants.

Without warning, the aircraft can depart from the commanded flightpath. Consequently, it is essential that the pilot not attempt takeoff unless the aircraft commander has made certain these critical surfaces and components are free of frozen contaminants.

Snow, frost, slush, and other ice formations can cause undesirable airflow disturbances and can restrict air and fluid vents. Mechanical interference can also occur, resulting in restricted movement of flight controls, flap and slat operations, landing gear mechanisms, etc. Ice formation on turbine engine and carburetor air intakes can cause power loss. If the ice dislodges, a turbine engine may ingest it, and engine damage or failure can occur. Ice on external instrumentation sensors (pitot/static ports, angle of attack sensors) can result in improper indications on cockpit instrumentation and improper operations of certain systems.

Our Deicing Fluids

There are presently two types of deicing fluids for our use. They are MIL-A-4823D Type I — propylene glycol base with a corrosion inhibitor and MIL-A-4823D Type II — ethylene and propylene glycol mix with a corrosion inhibitor. The differences and similarities between the military and the commercial fluids are as follows:

Differences — The Mil Spec for ground deicing fluids (MIL-A-8243D, dated 26 October 1985) is a triservice spec, first developed by the Navy, adopted by other services, and ***is obsolete.*** The Navy is still the OPR on the spec, even though the USAF is the largest user of the fluids. The civilian aviation community calls their fluids Type I and Type II, although the chemistry may be different (Propylene and/or diethylene glycol). The commercial fluids ***meet performance specs*** and are approved by the International Standards Organization (ISO) and the Society of Automotive Engineers (SAE)-Aerospace Material Specification (AMS), and are used around the world.

Similarities — For the last 30 years, the commercial fluids have contained an anticorrosion additive. Historically, the early Mil Spec Type I fluid **did not** contain an anticorrosion additive. Now **both** the DOD Mil Spec (Mil A 4823D) fluids and the commercial ISO/SAE-AMS Type I and II fluids **contain an anticorrosion additive.** The reason for the corrosion additive is to prevent steel storage tanks and deicing trucks from having a corrosion problem with long-term exposure. There is a residual benefit in that aircraft aluminum and other metals are also protected by the additive, although the time of fluid exposure to aircraft metals is of short duration and is diluted by being mixed with water before application, as well as being diluted by melting snow, ice, etc.

Performance Spec — Suppliers are not required to requalify each batch of fluid produced. They are required to show their products meet a performance spec. Suppliers of both the Mil Spec and SAE-AMS fluids have shown their fluids meet or exceed the corrosion resistance requirements as well as other performance standards. **In these fluids, there is no difference between the commercial and the military fluids as far as performing their function.**

Some Recommendations

An end-of-runway check (ERC) is critical and should be accomplished by a supervisor of flying (SOF) or other knowledgeable and properly trained ground or aircrew member. After the aircraft has been deiced and/or anti-iced, it is important to assure that ice has not reformed on the treated areas and hasn't created a problem in another area. As per the aircraft type and the manufacturer's recommendations, check the following areas and equipment for damage and for refreezing:

- Wing leading edges, upper and lower surfaces
- Vertical and horizontal stabilizers, leading edges, upper and lower surfaces, side panels
- High-lift devices — leading edge slats and leading or trailing edge flaps
- All control surfaces and control balance bays
- Engine inlets, particle separators, and screens

The end-of-runway check should not be limited to the above-listed areas, but may involve other system/subsystem checks and inspections as necessary.

Over the years, there have been winter-related mishaps in both civilian and military aviation. The Air Force has a good record, but we continue to have mishaps as a result of cold weather operations. We cannot afford to become complacent about winter flying.

KEEP YOUR AIRCRAFT CLEAN! ✈

VALUJET FLIGHT 595
Is There a Lesson?

SSGT JOSEPH E. STRAUB
7 ACCS, 55 WG
Offutt AFB, Nebraska
Courtesy *The Combat Edge*, Aug 96

This article should be mandatory reading by everyone who turns a wrench, or supervises those who do, in the entire Air Force aircraft maintenance community. It's short and sweet, but SSgt Straub's message is emotionally impacting and crystal clear — complacency kills. He simply drives home the never-ending life and death responsibility our Air Force maintainers have to bear every time they perform even their most routine duties. His compassion for the health and well-being of our aircrews and their passengers, as well as for his own profession, is convincingly heartfelt. From this perspective, I invite you to personally embrace this article from whence it was certainly composed — from the heart. --Technical Editor

We all saw the headlines, heard the news reports, and witnessed the aftermath, but did we really share in the horror of it? One hundred and ten people tragically lost their lives in the marshy muck of the Everglades. No one will truly know what they experienced in the last few minutes — the fire, the smoke, the fear of certain death. We can only try to find out what caused this horrific end to so many lives. What were the mistakes, the oversights? We may never know for sure, but investigators continue to search for clues. The news media has cited unauthorized cargo, faulty circuit breakers, and improperly performed inspections as possible factors leading to this disaster.

So, you ask, how does this relate to us? It does because we are aircraft maintainers — we inspect and repair those circuit breakers. At times we load cargo that, if improperly done, can spell the difference between a safe sortie or a disaster.

When was the last time you did a repair and, although it wasn't quite right, it ops checked good so you signed it off? How about when you changed that part requiring an in-flight ops check and the aircraft returned with the same malfunction? Or that inspection you signed off that you knew wasn't really as thorough as it should have been?

In our job, we carry an awesome responsibility, and there is no room for complacency. Unlike ValuJet 595, we know the people flying our aircraft. We work with them daily as we carry out our mission. When their lives are lost, it affects us personally. Remember the jet that ran off the runway at Pope? We all were on the edge of our seats until we found out about our friend's or relative's fate.

Our decisions carry a weight that is measured in people's lives. When we carry out lax maintenance practices, we are playing Russian roulette with a life, someone else's. Each aircrew member, INT, radio operator, and battle staff member depends on our integrity, placing their very lives in our hands every time they step aboard that aircraft. It isn't a responsibility we can take lightly. Life isn't a responsibility we can take lightly. Life isn't something we can give back. Once lost, there is no returning it.

Everyone has their "war" stories, and I want to share one experience I had that will stay with me for the rest of my life. It was a beautiful summer morning in Texas as we prepared for our morning launch. I was strapping in a pilot who was flying his last solo mission before graduation. He was filled with excitement. His long stay in pilot training was just about over. He was eagerly awaiting the arrival of his wife and 2-month-old daughter for the graduation ceremony. He shared his excitement with me. Well, he never came back from that flight. During his final approach, entering a dogleg left, he failed to put down the flaps, lost lift, and crashed. We all knew an aircraft had crashed. We saw the unmistakable plume of black smoke. Rescue workers found the pilot, hands burned around the ejection seat handles. It was a somber day on the flightline. Everyone felt the loss. Knowing I was the last one to talk with him face-to-face became an experience I will never forget. Talking with his wife, telling her of the expectations he shared, was an almost unbearable task I wouldn't want to do again.

Although we could have done nothing to prevent this or the ValuJet crash, we can take a lesson from them. We can ensure our maintenance procedures are those methods outlined in the technical data, TCTOs, and other regulations. When we sign off inspections, we can ensure that they are done thoroughly and by the book. We can ensure that we troubleshoot comprehensively and be confident that when the job is completed, there is no doubt that it's done right. We can ensure followup of critical tasks and sign off those Red X conditions knowing we ourselves couldn't have done it better. We can identify those who need training, get them trained, and put a stop to any maintenance practices that could cause problems to develop. If we all work as a team and watch each other, only then can we catch and correct any mistakes before they turn into fatal ones.

So, next time you sign off that Red X, that job, or certify the aircraft is ready for flight, I hope you take a moment to reflect on the awesome responsibility you are undertaking. Remember, every flier who steps aboard the aircraft is staking their life on your integrity.

Their lives depend on you, so don't let them down. *You might not get a second chance.* ✈

FSO'S CORNER

FATIGUE COUNTERMEASURES — BENCHMARKING BENEFITS ALL

MAJ DALE T. PIERCE
919th Special Operations Wing/SEF
Eglin AFB, Florida

Is Fatigue a Problem?

Do your aircrew members come back from missions looking like the walking dead? When you return from a mission, do you feel like you're ready to be entombed? Let's face it — fatigue and aviation have been close and personal since the first Army observer was hoisted up in a balloon to observe the battlefield for what seemed like an eternity.

Since that time, things haven't changed much. Over the years, the majority of those who have managed aviators haven't given fatigue countermeasures much more than a passing thought until something went wrong. In the flying business, that usually meant a lost aircraft and crew. In fact, as long as the desired management action was allowed by published directives, the action was most often assumed to meet the minimum needs of aircrews for rest. With this mind-set, aircrew members who complained of being "tired" were often labeled "whiners" or worse. Does this sound like your organization?

Anyone, whether or not they fly, who works in this type of environment for any length of time begins to believe they are "supposed" to be tired all the time. Feeling lousy is just part of the job. It's macho. Without knowing any better, they "hack the mission." Sometimes this mission hacking leads to their demise or the demise of others.

Has your wing king stood up in a wing-wide flight safety meeting and announced he will support any aircrew member who, for any reason, believes they are not fit to fly and takes themself off the schedule? Ours did.

Have you formally (in a staff meeting) identified aircrew fatigue as a significant risk factor in your organization? "I couldn't do that — the wing king might think I'm a wimp." Have you informally (at the break area) identified aircrew fatigue as a significant risk factor in your organization? "I can't believe this schedule. Are those schedulers brain dead or what?" We did some of both and decided to do something about it.

What Did We Do About It?

One action was to attend a NASA train-the-trainer program on aircrew fatigue at NAS Moffett Field. During the training, NASA personnel summarized pertinent research conducted over the past 10 to 15 years. They identified what works and doesn't work today in the real world to counter fatigue. Based on current research, they also briefly showed what they hope to develop for the future.

As a risk management effort, I adapted the NASA/FAA Fatigue Countermeasures Education and Training Module to military operations. The NASA/FAA training module is based on years of cockpit and laboratory research and focused on training civilian flight crews. However, I found it easy to adapt the material for military aircrews and even for aircraft maintenance personnel. When I was done, all wing-assigned aircrew members received the briefing as mandatory training as part of our annual block training program.

Management Personnel, Too!

It's easy to think of fatigue countermeasures as an aircrew responsibility, but it's for management and staff personnel, too (i.e., commanders, operations officers, and schedulers). There are policies, personnel utilization strategies, and procedures available to help counter fatigue in today's flying operations. These must be implemented by management and staff personnel. Most are fairly easy to implement. Some may require a slight shift in paradigm.

Sharing the Wealth

Last year, I took the Fatigue Countermeasures briefing to Coast Guard Air Station Clearwater. I gave the briefing to a standing-room-only crowd numbering in the hundreds. Aircrews and maintenance personnel were called together with the Station Commander and his staff for their annual safety down-day. It was a great time for all of us. (The Lockheed briefing team was there, too.)

The enthusiastic response from Coast Guard fliers and maintenance personnel was the same as for Air Force audiences I'd briefed in the past. Afterward, throughout the remainder of the day, attendees told me their been-there-done-that stories, horror stories, and asked questions. Even the Station Commander took his turn.

If you've guessed that I enjoy giving the briefing, you're right. It's great fun. But it's more than that. It's an opportunity to share information to help fellow fliers make informed decisions leading to improved judgment and performance in the air and on the job. I'm talking about sharing things real people can do right now in the real world to counter fatigue, not just a lot of pie-in-the-sky ideas on what might be available in the future.

What About Your Program?

What are you doing in your program that would help others if they knew about it? In our current environment of reduced funding and limited operational assets, sharing what you learn while addressing problems in your organization is essential. This sharing saves other units from having to spend scarce defense dollars to reinvent the wheel to solve the same problem in their unit.

This exchange of information is a shared responsibility. Each of us must be willing to both share and seek sharing. What are you doing to find out what other units have done to address problems similar to yours so you can save, too?

Adapting What You Learn

Most of the time, you can't adopt someone else's program. But given the information, you can adapt someone else's program to fit your needs for a lot less cost and effort than you could do from scratch. In traditional management circles, this is called being cost-effective. In the vernacular of "Quality," this is called benchmarking.

Whatever you call it, whether your interest is in safely conducting aircraft operations, safely performing aircraft maintenance, or safety program management, we in the Air Force need to do a lot of it. If we don't, we can expect the current budget constraints to increase operational risks at a time when we can least afford it.

Harvest More Than You Sow

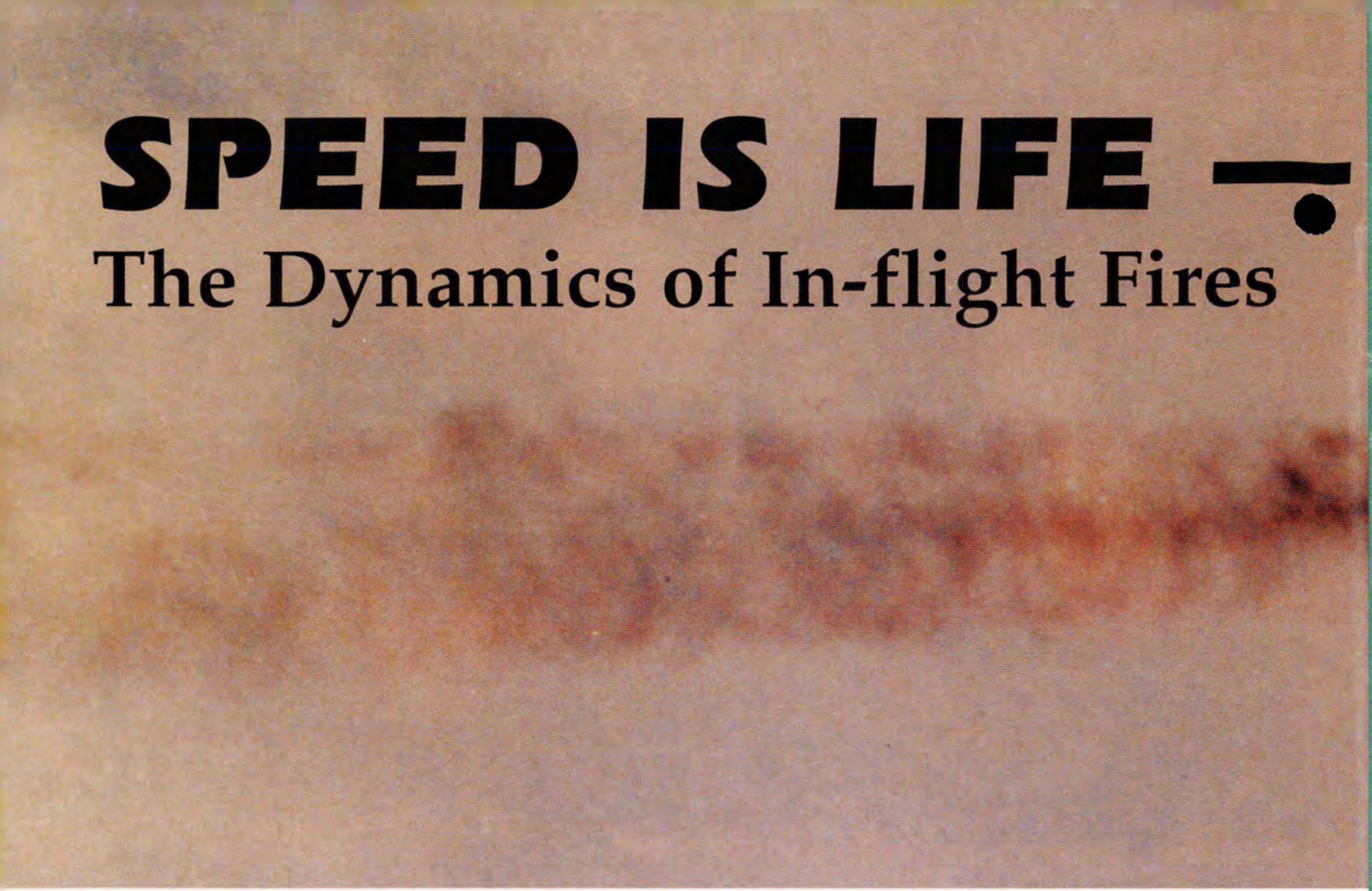
Actively seeking to share what you've learned is as logical as actively seeking to learn from others. In the long run, you will gain more from those to whom you give than from those from whom you only take. Trust me on this. I seldom go anywhere to share ideas with people that I don't come home with an even bigger pile of resources in return.

Getting Started

The Fatigue Countermeasures briefing is just an example. What is your example? Contact me at DSN 872-5378; my e-mail address is pierced@wg53.eglin.af.mil, or fax me at 872-5212. Together we can crosstell ideas with FSOs around the world.

Has your wing king stood up in a wing-wide flight safety meeting and announced he will support any aircrew member who, for any reason, believes they are not fit to fly and takes themself off the schedule? Ours did.

SPEED IS LIFE —
The Dynamics of In-flight Fires



MAJ DAVE WOOD
HQ AFSC/SEFE

We've all heard the axiom that speed is life. Sometimes it's true. But when it comes to in-flight fires, the best course of action is rarely to push the nose over. That's because an aircraft on fire is not like a match or candle. It can't always be put out by a good puff of wind. This article explains the dynamics of in-flight fires and how combustion is maintained, as well as provides practical suggestions for the pilot when faced with such an emergency.

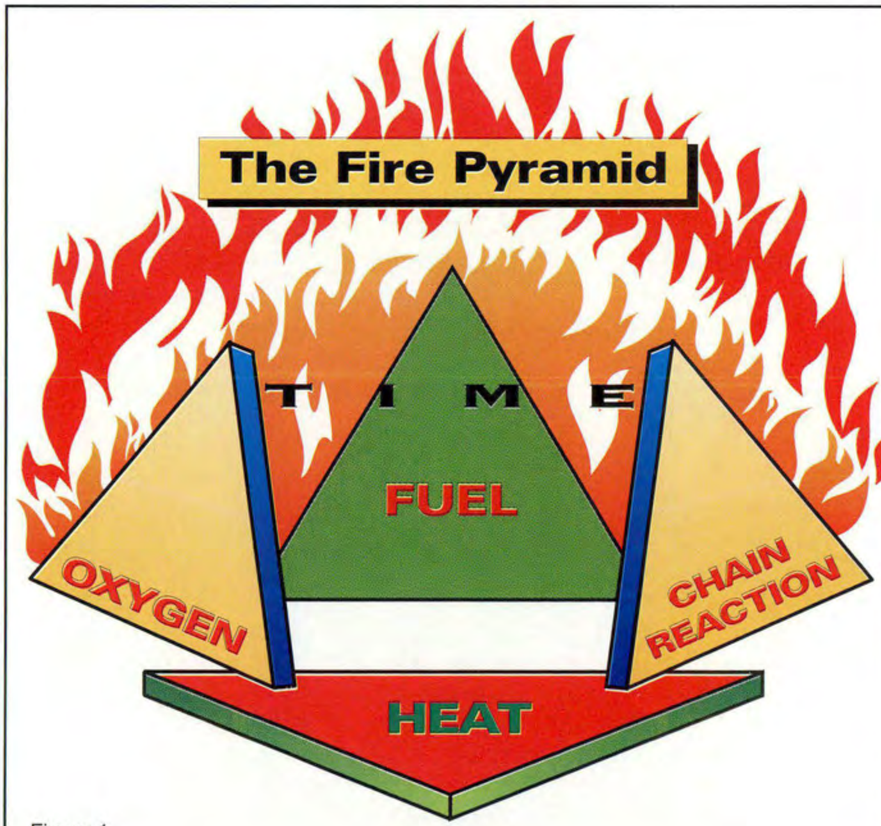


Figure 1

Fire Theory

Let's start with the basics. The fire pyramid (figure 1) shows the ingredients needed to start and sustain a fire: fuel, oxygen, heat, and a chemical chain reaction.

Most people realize you need fuel, oxygen, and an ignition source to

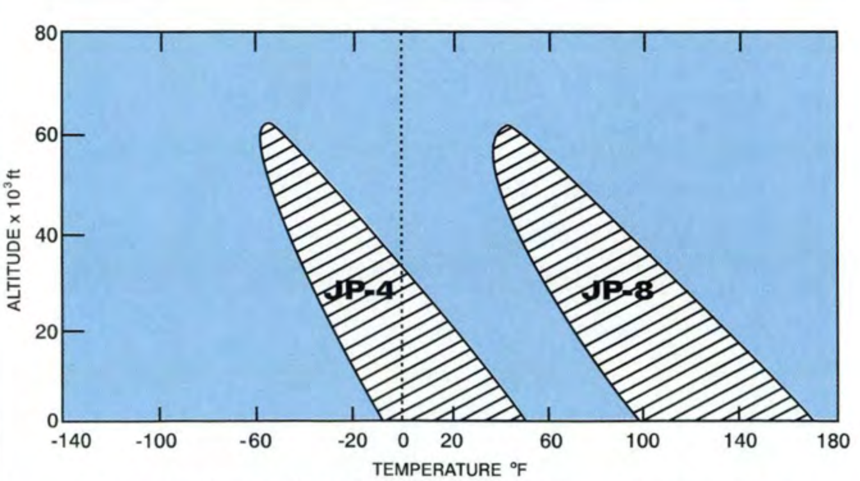
SOMETIMES!

start a fire, but unless the fuel and oxygen are in the right proportion, fires won't happen. If the fuel-air ratio is too low or too high, combustion cannot be sustained. Figure 2 shows the flammability limits of typical jet fuels. To the left of the shaded region, the fuel-air mixture is too lean. That is, there's too much oxygen present for the given amount of fuel. To the right, it's too rich. In other words, there's not enough oxygen. In either case, lean or rich, combustion is not sustainable.

Heat, in the form of an ignition source, is needed to start a fire. But heat is also required to maintain the combustion process. The heat is required to vaporize the fuel before it can be burned. Fuels do not burn in their solid or liquid state.

As seen in figure 2, temperature affects the range of fuel-air ratios which can sustain combustion. That's because as the temperature is lowered, it becomes more difficult to vaporize fuel. If the fuel cannot vaporize (in other words, mix with the oxygen present in the air), you don't get a flammable mixture. That's why heat is included in the fire pyramid.

Lastly, if the fuel, air, and heat aren't brought together for a sufficient length of time, the chemical chain reaction, or burning, won't start. Most aircraft use this principle as a means of fire protection within their engine bays. Air flowing through the nacelle takes with it any flammable vapors which might be present in the nacelle. The fuel and air don't



Flammability Limits at Various Temperatures and Pressures

From AFAPL-TR-85-2057

Figure 2

continued on next page

have the time to mix in the presence of an ignition source, such as hot surfaces near the turbine cases. Conversely, afterburning jet engines have to employ flameholders in order to give the fuel time to mix with the high speed air exiting the turbine. Without the time necessary for the fuel to vaporize into a flammable mixture, ignition can't occur.

In-flight fires in modern jet aircraft present a unique environment as far as combustion is concerned. Not only are there plenty of liquid fuels present (jet fuel, oil, hydraulic fluid, and coolants), these substances have very high energy contents. Therefore, when they burn, they generate plenty of heat to keep the combustion process going.

In-Flight Fires

In-flight fires in modern jet aircraft present a unique environment as far as combustion is concerned. Not only are there plenty of liquid fuels present (jet fuel, oil, hydraulic fluid, and coolants), these substances have very high energy contents. Therefore, when they burn, they generate plenty of heat to keep the combustion process going.

Besides the flammable liquids, some of the materials used in the manufacture of aircraft, chosen for their light weight and strength, can become fuel sources as well. For example, many engines use magnesium housings for gear boxes and other accessories. Titanium is used extensively in jet engines and as structural members in high-speed aircraft. These metals not only can burn, but when they do, they do so at extremely high temperatures.

And, of course, there's plenty of high pressure oxygen, heat, and ignition sources present on aircraft. So we have all the fire pyramid ingredients onboard aircraft.

The perception, or perhaps misperception, that increasing airspeed will put the fire out is based upon the belief the fuel-to-air ratio can be lowered below the flammability limit. Unfortunately, this will not work in most cases. In fact, it may even aggravate the situation. Like a blacksmith using a bellows to make the coals burn brighter, increasing airspeed will probably force feed a fire the oxygen it wants. Another potential negative consequence of increasing airspeed is structural failure. If a major load-bearing member has been damaged or weakened by the fire, increasing airspeed may cause it to fail.

Without knowing the nature of the fire, or the collateral damage it may cause, increasing airspeed could actually be the worst course of action. For example, a bearing compartment in one of the aircraft's engines becomes flooded with oil. The oil blows past the carbon seals and enters the bore area of the turbine where hot gases ignite the oil. The fire is contained within the engine. In this case, slowing down may put the fire out! Slowing down would reduce the airflow through the engine and, therefore, the supply of oxygen to the fire.

Slowing down might also stop the flow of oil to the fire. The engine would spool down faster (reduced windmilling action) and may even stop rotating. Since the oil pump is driven by the gearbox, which is driven by the compressor, slowing the engine sufficiently, the flow of oil would stop.

Extinguishing In-Flight Fires

Most in-flight fires are of a nature similar to the scenario above. Figure 3 illustrates this point. As you can see, the majority of fires are caused by engine failures or flammable fluid leaks. These types of fires usually spread rapidly, generate a lot of heat, and are difficult to extinguish, especially if they're not detected immediately.

Airborne extinguishing systems use effective agents, typically Halon. A large volume of agent is discharged in an extremely short period of time. The Halon interferes chemically with the fire, breaking the chain reaction which was sustaining the burning. However, if the fire has been burning long enough to have heated the surrounding structure, the fire may re-ignite if the fuel is still present.

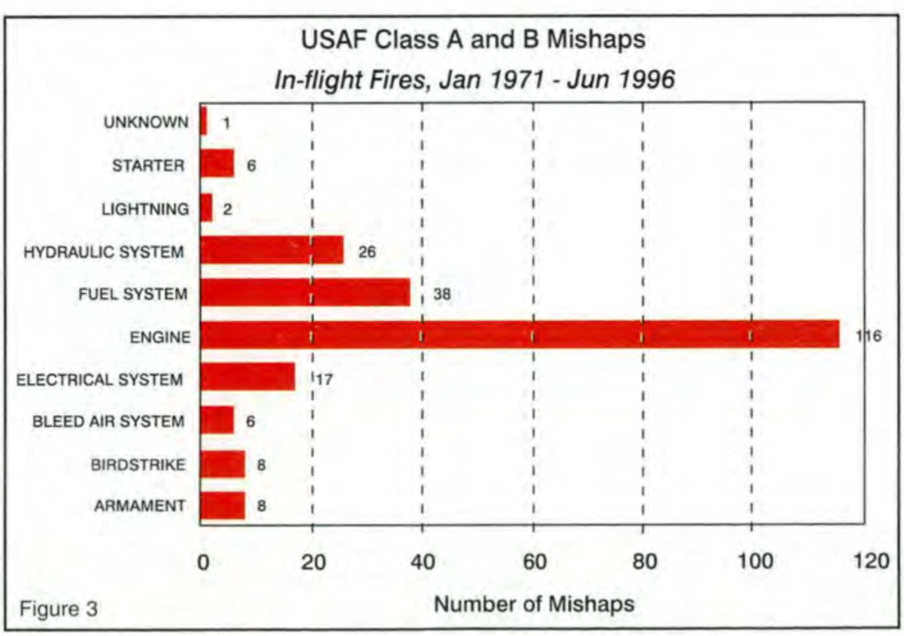


Figure 3

Coping With In-Flight Fires

So what's the best course of

action when faced with an in-flight fire? Usually, increased airspeed is not the answer. Here's a checklist of sorts;

• First, follow your flight manual's emergency procedures.

• If you have an engine or engine bay fire, shut down the engine and close any fuel and hydraulic shutoff valves that go to that engine. Of course, make sure you don't shut down the wrong engine in the heat (sorry, I couldn't resist) of the moment. Ceasing the flow of flammable fluids to the fire may increase the chances of putting the fire out.

• If you have an on-board extinguishing system, deploy it. If the fire is not given a lot of time to burn, the heat buildup may be minimal and, therefore, chances of the fire staying out increases. It also minimizes the amount of collateral damage to structural members, flight controls, and other aircraft subsystems.

• If the fire persists, or your aircraft is not equipped with an extinguishing system, your flight manual will usually advise you to eject. If there's no compelling reason to delay ejection, do it! It's unlikely the situation will get better.

• If circumstances preclude ejection and you decide to attempt a landing, fly your approach at the airspeeds recommended for your gross weight and configuration (flaps, spoilers, speedbrakes, etc.).

• Do not, under any circumstances, try to blow the fire out through diving or accelerating the aircraft. It probably won't work and may even create more problems.

Summary

Hopefully, you have a better appreciation for how fires start and what keeps them alive. You've also seen that in-flight fires present truly unique difficulties given the nature of modern jet aircraft. Finally, and perhaps most importantly, you've learned what you should and should not do when faced with this deadly situation.

So next time you're watching one of those World War II movies, remember Hollywood is in the business of fantasy. Have a good laugh when the hero puts his plane in a steep dive to put out the fire on No. 3. That's entertainment. But it's not good technique in the real world, and it could make your already rotten day even worse. ✈

STOP and THINK! *Do It Right or Don't Do It at All.* continued from page 2

accept other than safe and properly configured aircraft. However, we all want to make the mission happen. Too often, we want it at too high a price. Crews must stand firm in their resolve to ensure the benefit of accepting risk is worth the cost. Make the mission happen, and get that on-time takeoff if safely feasible.

Operational Risk Management (ORM) plays an important role here in a wing commander's hand. The ultimate goal should always be a departure reliability rate of 100 percent. However, an emphasis on sound judgment and safety must be made very clear to aircraft commanders and other aircrew members alike to help the wing achieve that goal. Aircrews must feel confident they will not face retribution if, in the interest of safety, they delay or cancel a mission of even the highest priority. Peacetime versus wartime operations should also enter into commanders' ORM assessments.

Wartime operational urgency poses special considerations with respect to aviation and the air war itself. Wartime tactical requirements may require higher risk missions. However, in peacetime, is there any need to compromise safety of aircrews or risk losing extremely valuable national assets in the name of practice? Is it right to continue a sortie with a known and potentially serious malfunction just to complete a checkride? Is it so important to get off on time that we rush procedures and/or overlook a "slight" malfunction?

Where is the line drawn? This is a question that can be answered only by the aircrew itself. It can be best answered on the ground, well prior to the flight. Abnormal situations must be identified and assessed by crewmembers prior to the flight so that when they arise, risks can be managed and a possible mishap avoided. The stage must be set in the crew brief so that everyone understands if something goes wrong, it will be addressed and resolved in a timely and safe manner. If a maintenance problem can't be fixed and involves a component not required for the mission, press on in accordance with current directives and known procedures. If a maintenance issue can't be resolved, don't blow it off! Fix it right, even if it means delay or cancellation. Do not just press on with the intention to fix it later. That's how people get hurt or killed.

What's the bottom line? USE YOUR HEAD, GANG! Don't lose sight of the big picture when you get in the seat or strap in at your station. Skipping things and rushing to make on-time takeoffs can result in a mishap, and it certainly isn't worth your life. If a mission has a higher priority, plan ahead and adjust your sequence of events accordingly. You may be showing at base ops or at the jet a bit earlier, but if it means having the time to solve unforeseen problems and not racing the clock, you'll avoid mistakes and be back to fly another day.

But sometimes, regardless of your best efforts, you're going to find yourself rushed or in some other situation that makes the hair rise on the back of your neck. Remember, if something doesn't seem right, STOP AND THINK because it probably isn't. Take the time to DO IT RIGHT, OR DON'T DO IT AT ALL! ✈

ONE PILOT'S

MAJ JOHN GALLETTE
USAFR Intelligence Individual Mobilization Augmentee
49th FW
Holloman AFB NM

I grew up on the outskirts of Santa Fe, New Mexico. Our ranch had a small dirt airstrip. My earliest memory of flying was trying to see over the instrument panel in some old airplane. I also remember flying in the grain hopper of an old Stearman biplane with the open exhaust stacks and with oil blasting my face.

My father was a WW II B-26 Marauder veteran, so there were multiple "war" stories to be heard. His pilot friends were always flying to and from our ranch. Needless to say, I was hooked on aviation from the very beginning and eventually bought and restored my own 1946 Taylorcraft. I never thought, even in my wildest dreams, my love for flying would someday almost take my life in a terrible weather-related mishap.

On 27 May 1988, at 5:15 p.m., I lost control of this aircraft and crashed while attempting to take off in weather that was far beyond the limitations of myself and the plane, which was destroyed. My passenger and I suffered near fatal injuries. The medical bills exceeded $250,000.

The sad part of the story is this mishap could have been avoided just by making better decisions concerning the weather. When the FAA and NTSB finished investigating, it was interesting to read between the lines about what *really* caused the mishap. To understand their findings, some perspective is required.

I had been working in a stressful, high-overtime environment for several months prior to the mishap. Memorial Day weekend was coming up, and since I was planning to take my boat out waterskiing, I stayed up late several nights trying to get my boat ready for the holiday. During work Thursday, a friend asked me if I would take him flying early Friday morning before working hours. He wanted to get some flight time in a taildragger. I made arrangements to meet him at 6 a.m. at Coronado Airport, located in Albuquerque, New Mexico, to go flying. I stayed up late Thursday night to finish packing for the trip.

After about 5 hours of sleep, I got up around 5 a.m. and drove to the airport. I waited for my friend to show up, but he never arrived. I decided to go flying anyway. I flew to Double Eagle II Airport, did several touch-and-go's, flew back to Coronado Airport, landed, and went to work. My friend later apologized for oversleeping. You know the saying, "If you want to soar with the eagles in the morning, you can't hoot with the owls at night." I told him it was okay but he owed me a beer, and we both went to work for the day.

Late in the afternoon, my friend and I talked again, and we thought we could squeeze in a flight after work. I told him I would check the weather. To the southwest of Albuquerque, a severe thunderstorm was building. I called him and told him it might be risky, but we could fly north towards Santa Fe and wait for the thunderstorm to pass over the airport. I was planning to be able to fly around and land behind the storm after a couple of hours.

The day was almost over when I was called into a no-notice meeting about some C-17 scheduling problems. A heated argument developed between myself and a pricing analyst about some problems we were having. The argument ended with my adrenaline really flowing — I was upset. I hadn't given the thunderstorm much thought during the afternoon, even though the storm had increased in fury.

When the workday finally ended, my friend and I raced to our cars and headed directly to the airport. Weeds and dirt were blowing across the runways and ramp. My faulty logic was to hurry up, take off, and fly away from the approaching gust front.

STORY

I helped strap my friend into the cockpit, and without a proper takeoff inspection, I started the airplane and immediately proceeded to the active runway. During the brief engine runup, a gust blew the airplane 45 degrees from the runway centerline. I applied full power, rudder, and aileron to straighten the airplane, then began the takeoff roll. In a matter of seconds, we were airborne and climbing at an incredible rate. We were passing approximately 600 feet AGL near the end of the runway. All of a sudden, the airplane rolled left 110 degrees. At the same moment, the airspeed indicator dropped to below stall speed. At that very second, time stood dead still. I knew we were in bad trouble. We were at the mercy of a microburst and in an airplane that was severely underpowered. I had lost control.

For a fraction of a second, I contemplated completing the roll, but I knew I didn't have enough energy to complete it. I also knew that if I couldn't complete the roll, we would crash inverted and would be decapitated. My instinctive reaction was to kick hard left rudder to drop the nose to pick up desperately needed airspeed. I yelled to my friend to hold on — that we were going in.

The nose dropped to a near vertical attitude, and the airplane entered a violent left spin. I pulled the throttle to idle, kicked full right rudder, and tried to neutralize the yoke. The rotation abruptly stopped, but the ground was approaching in the windscreen. I pulled the yoke back to arrest the dive, but it was too late. I was able to turn off the mag switch a microsecond before impact. The airplane impacted almost vertically at approximately 100 mph.

Photos via the author

Shortly after impact, I awoke from unconsciousness. I could smell gasoline everywhere and could hear it dripping on the hot exhaust manifold. The fuel tanks were ripped open. I was soaked with 24 gallons of high octane aviation fuel which caused painful chemical burns.

Shortly after impact, I awoke from unconsciousness. I could smell gasoline everywhere and could hear it dripping on the hot exhaust manifold. The fuel tanks were ripped open. I was soaked with 24 gallons of high octane aviation fuel which caused painful chemical burns. My hands and legs were severely lacerated, as well as the back of my head. My left leg was compound fractured below the knee with exposed bones. My right ankle was fractured and skin was peeled back to my shin. My legs were impaled by structural tubing when the engine compartment caved into the cockpit.

Even though I was bleeding arterially and feeling very cold, my biggest fear was of burning to death. I called to my friend that we needed to get out of the airplane. To my surprise, he had been partially ejected. He was unconscious, being strangled by the shoulder harness which had him pinned against the leading edge of the wing. At the time, I didn't know his neck was broken. He also had severe lacerations on his knees and arms.

Within a few minutes, several airport friends and wit-

continued on next page

nesses arrived at the crash site. One of my friends kept his fire extinguisher near me while another (a former U.S. aerobatic team member who was recently killed when his aircraft suffered a structural failure while practicing) tried to free me from the wreckage. My friend woke up from unconsciousness when someone cut the shoulder harness that had been strangling him. We both were eventually freed from the wreckage while we waited for the medivac helicopter to arrive. The rescue helicopter delivered me to the regional trauma center. Later that night, after 10 hours of surgery, I suffered a pulmonary embolism in ICU and actually faded towards death for a few moments. My friend's head was pinned into a skull cage to brace his neck. I can only thank God he wasn't paralyzed.

In the final prognosis, my left leg has ended up being an inch shorter, my left foot is half paralyzed, and three of my left toes are paralyzed. This new combination allows me to easily compensate for the P factor on takeoff rolls, and I now find myself flying to the right of course.

I won't go into detail about my recovery because that's a story in itself. All I can say is I fought my way back to health over a period of several years. I'm living testimony you can't kill a weed. I cannot say enough to thank the rescue crews, the helicopter pilot, and the trauma crew who risked their own lives to fly in and save us in the same weather that had slammed us into the ground. They also risked a dangerous landing on top of a gusty hospital roof. Their creed is "So Others May Live." Amen to my green-footed friends.

The bottom line is this mishap could have been avoided if I had listened to the many warning signals that were put in my path *not* to fly that afternoon. I made a series of bad choices. Unfortunately, I will always be accountable for them. In an effort to prevent this scenario from happening to any other aviators, I try to talk to others. I have devoted much of my time volunteering to talk about mishap avoidance at Air Force safety days, at squadron safety meetings, in the bar, in the rest room, wherever. One of the best things an old pilot once told me was "Good advice is cheap. Experience can be expensive."

In Air Combat Command, our motto is to "Fly, Fight, and Win." We operate in a high-stakes, deadly environment, but we must all strive to fly as safely as the environment will allow. Never, ever catch yourself saying it will happen to the other person because there is always the real possibility it could happen to you as it happened to me in a brief second. You may think you are the best, but you may be insidiously handicapped by your equipment, maintenance, proficiency, weather, and your health (mental and physical).

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I sincerely wish all of my fellow aviators the best. I still enjoy flying, but I have a hauntingly deep respect for what it takes to be a safe pilot. I live on an airport, I commute in my Piper Cherokee 180 to and from Holloman AFB on training weekends. I have a shiny red biplane I built sitting in the corner of my hangar that is ready to fly. I just haven't summoned the courage to advance the throttle — perhaps someday. I keep waiting for the T-Birds to call me for a ride, but I know they are busy folks. So be safe and heed some good advice. Take a hard look in the mirror and ask yourself some tough questions before your next flight.

Are you fit to fly? ✈

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Airlifter Fire and Teamwork

An airlifter was at an overseas location, just about to be refueled, when the aux power unit (APU) compartment burst into flames. The quick-acting ground crew initiated emergency actions and notifications that definitely helped to minimize the subsequent fire damage.

Once alerted via the aircraft's intercom system to the unfolding dangers outside his aircraft, a preflighting flight engineer in the cockpit also added to the urgent, decisive response to the ground emergency by discharging the first, then second, APU compartment fire extinguishers. After powering down the aircraft, he directed the safe evacuation of the aircraft's occupants. But the episode wasn't over yet.

The ground crew had to use additional hand-held fire extinguishers to finally snuff out the lingering remnants of the APU compartment fire. Good thing, too, because the host nation fire department didn't arrive on the scene until 20 minutes *after* the fire was extinguished!

The aircraft was repaired at the faraway location and returned home almost 2 weeks later. Unfortunately, miscommunications with home station led to the premature shipment of the catastrophically failed (assumed) air turbine motor (ATM) back to depot **without** being identified as an excellent candidate for the product quality deficiency report program. Also, an immediate determination wasn't made on whether or not the incident was reportable through safety channels. Of course, without the benefit of an indepth material deficiency investigation, the mishap unit could only assume the cause for the sudden APU compartment fire was the ATM failure itself.

As far as the mishap reporting program is concerned, it's pretty hard to perform a quality mishap investigation on a 2-week-old mishap that happened thousands of miles away. Too bad, too, because it would've been nice to bring this ground mishap to an accurate final closure so effective measures could prevent recurrences. This is the very foundation for a solid mishap prevention program — high quality, thorough, prompt mishap investigations.

Regardless of the inconclusive investigation on this potentially dangerous mishap, there's one major illuminating factor rising from the smoldering ashes of this aircraft fire incident: Crew resource management works just as well on the ground as it does in the air! Teamwork — Air Force taught, trained, experienced, no-kidding professional teamwork — at its finest and when it really counts!

Way to go, folks! Thanks for the save!

Turning Left Turns Right?

Well, a trainer aircraft maintainer got an opportunity to "rediscover" the reason for our strict mechanics' code of ethics. And he also was again reminded of the absolute life-or-death necessity for uncompromising personal integrity from anyone who ever turns a wrench on Air Force aircraft.

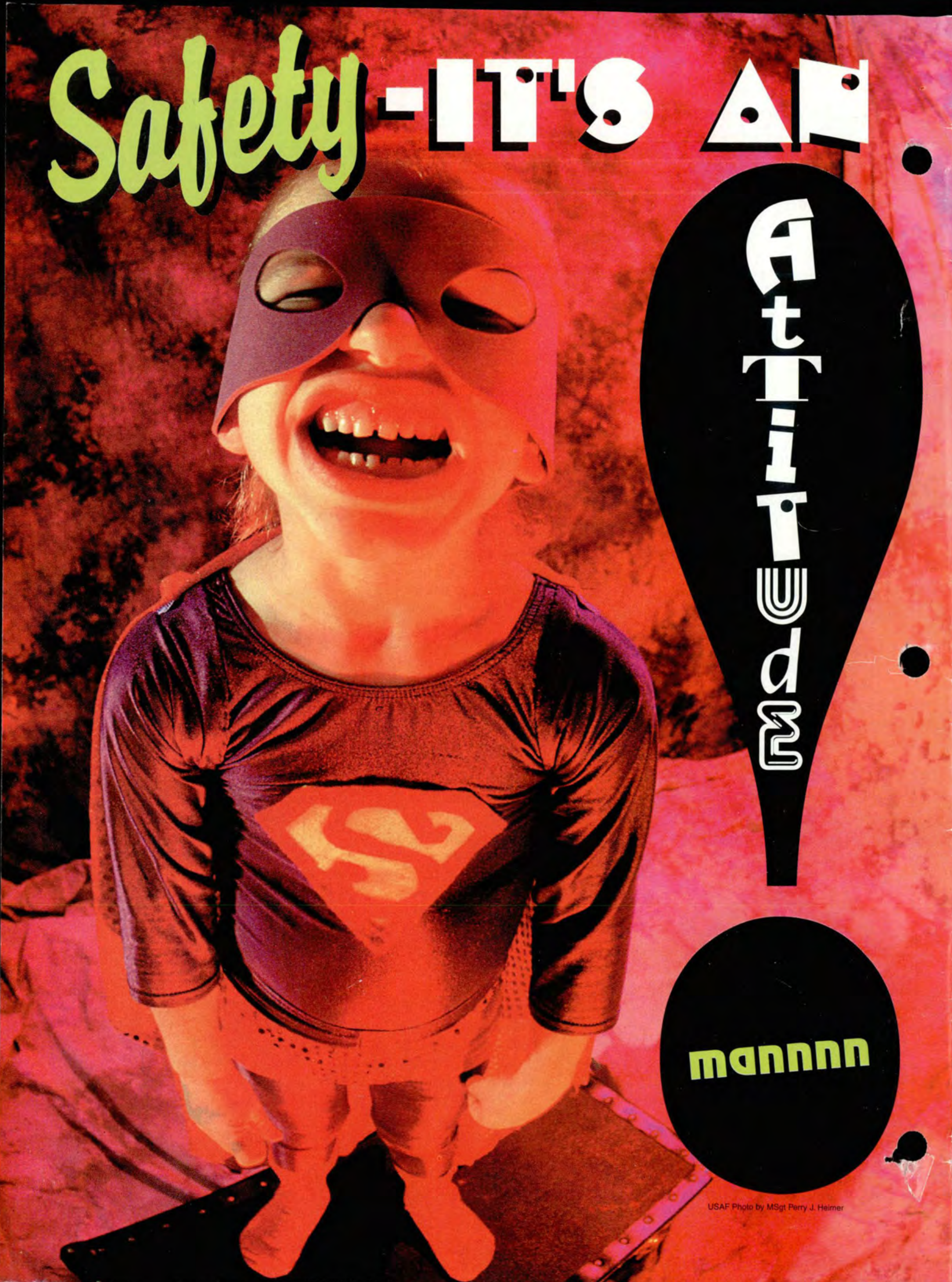
The mechanic was involved in repairing a flight control problem which required him to remove the aircraft's antiskid control valve to facilitate the repair action. The tech data governing the removal of the valve specifically stated to tag the valve's hydraulic lines to prevent confusion during reconnection.

As you can probably assume by now, the mechanic didn't follow the tech data, and the valve's hydraulic lines were crossed during reinstallation. Worse yet is the faulty installation wasn't even caught during the bleeding of the brake system or at the time of the operational ops check.

Two pilots, though, sure found out about those crossed hydraulic lines. During taxi out, they were surprised to learn the aircraft would turn right when the left brake pedal was pressed and vice versa! Not the most preferred method to finally perform a quality system ops check, is it?

Oh well, hope the pilots weren't too disappointed about not being able to fly that day. In fact, they should've felt fortunate there were obvious warning signals their aircraft wasn't fit to fly . . . while still safely on the ground. Surprises such as these can turn disastrous in quick order while flying aloft.

Tech data is still directive by nature. In this instance, it didn't give the mechanic an option. Next time he had better tag those lines to prevent another mishap. His word and honor demand it. ✈



USAF Photo by MSgt Perry J. Heimer