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UNITED STATES AIR FORCE
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SAFETY *sage*

24TH NATIONAL AEROSPACE FOD PREVENTION CONFERENCE

Well, if you weren't lucky enough to attend this year's National FOD Conference, presented by National Aerospace FOD Prevention Inc. (NAFPI), Snap-On and Kelly USA, you missed a great opportunity to improve your processes and reduce your FOD cost. Six hundred-plus of your fellow military members, airfield operators, aircraft manufacturers and depot counterparts were there.

Once again, NAFPI put on a professional and interesting conference from which we could learn, and provided the opportunity to network with our peers, which at times was the most informational. Twenty-six different vendors were there to show (and sell) their products. Some examples of the things that you could learn about were:

- The latest in tool control technology.
- An assortment of hardware control devices, The FOD Boss, and shop vacuums.
- The latest in computer software to track the tools you use every day.
- The newest type of fasteners that can help you eliminate lost rivet heads.
- Magnetic sweepers to pick up FOD or tools to find the missing tool/fastener.
- The strongest and most versatile vacuums available to clean your ramp.
- How technology is making the borescope you use look like Fred Flintstone's car.
- The newest and fanciest tool boxes you can think of.
- How to fix that broken concrete without calling in the Corps of Engineers.
- Even the US Forest Service was there to talk about wildlife control. Birds are FOD, too.

There was a lot to look at, great people to meet and share stories, good and bad, that can help you. As always, the FOD Conference provided a multitude of speakers to inform you about how a company or military unit is improving its processes and including FOD prevention in its daily routine.

The key theme this year was "FOD Prevention is Crucial to Your Success." Why? Because the Air Force has spent $200 million on FOD damage from 1993 to 2002, and we continue to damage aircraft every year due to bad maintenance practices, improper tool control, and lack of cleanliness. Only we, the maintainers, can solve this issue. Let's make 2004 a better year for FOD and reduce the damage. If you didn't get the chance to attend the conference this year, there will be another one next year. You can check out the NAFPI website at NAFPI.com, as well as the Air Force, Army and Navy Safety Center websites. Also, a host of others links from the NAFPI website that can help you improve your FOD program. Hope to see you there next year! ✪

USAF Photo by TSgt Burke Baker

Predicting Winter Weather

The Weather Never Sleeps — Inconsistency Is The Only Constant

Reprinted from *Flight Training*, December 1995

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 two to three 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 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 LaGuardia 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 weather 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 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 six 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 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.

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.

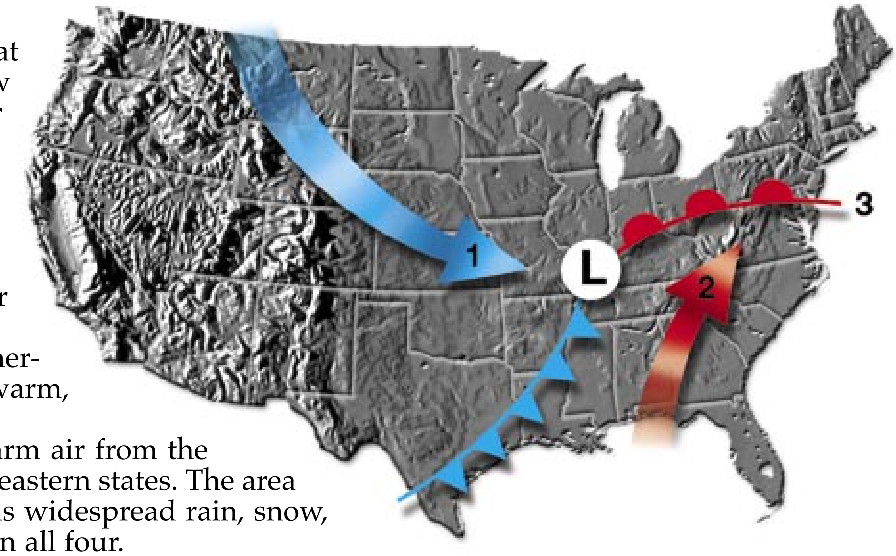
Figure 3 is a simplified radar summary chart showing two bands of precipitation that aren't associated with a large-scale storm. The northern band moved slowly across Illinois, dumping more than six inches of snow. The lesson: A good briefing includes looking at maps and charts and asking what's going 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 three years had precipitation that lasted from 30 minutes to 28 hours. The precipitation included heavy snow with five- to ten-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.

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 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.

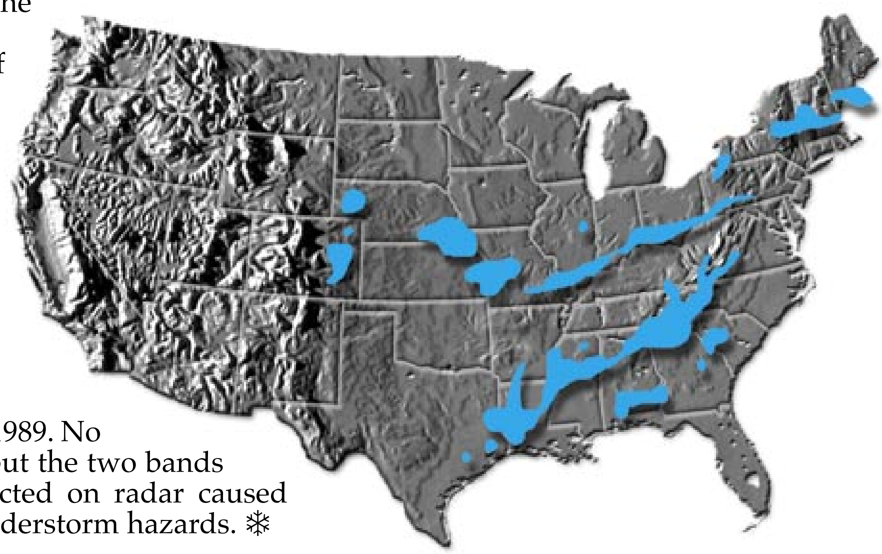
3. Storms from the Pacific normally break up in the Rockies and re-form just east of the mountains, often over Colorado. The path here, across the Great Lakes, is one of many. Sometimes these storms dip southward to the Gulf of Mexico.

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 Northeast.

Figure 3



This is the radar summary 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. ❄

ORM
In The Real World

USAF Photo by William M. Plate Jr.
Photo Illustration by Dan Harman

LT COL JOHN HEIB (RET)
DCMA-AO Deputy Director for Policy and Training

At the Defense Contract Management Agency (DCMA), which oversees contractor aircraft operations for the DoD worldwide, we have embraced the ORM concept, just as have all the military Services. HQ DCMA Aircraft Operations (DCMA-AO) teaches it during our Government Flight Representative (GFR) and Aviation Maintenance Manager (AMM) training courses, and we require all waiver requests to include an ORM analysis. The goal is for our Aviation Program Teams (APTs) to use ORM to the maximum extent practical. This article describes how I used ORM to resolve a deficiency we had with a contractor's Aircraft Rescue and Firefighting (ARFF) capability to protect our aircrews.

Let's start with the ARFF program background. The contractor manufactured heavy aircraft for the Air Force through contracts administered by DCMA and had recently been bought (through merger) by another aircraft manufacturer. The new company inherited a fire department (FD) that was considerably smaller than what they had at their other locations. The primary Air Force instruction that covered contractor facilities and ARFF was AFMCI 91-101 (since replaced by National Aerospace Standard 3306). It was *not* on the contract. What was on contract was AFJI 10-220, a Joint Instruction, which requires the company to operate in a safe and effective manner whenever the Government, by contract, assumes some or all of the risk of loss. The key concept here is contractors meet the standards they are paid to meet. If you try to force a contractor to meet a standard higher than what the contract calls for, you create what we call a "constructive change." This is not a good thing unless you have lots of money.

The company had no indigenous ARFF capabilities, but they had a full-time fire response team on duty during all three shifts and three fire response vehicles available at the plant. None of the vehicles was capable of conducting ARFF operations. The local airport authority did have limited onsite ARFF capability, including one ARFF truck, a quick-response vehicle known as a combined agent vehicle (CAV), and a twin-agent CAV. Reasonable and "safe and effective" may seem like gray, nebulous terms on paper, especially when you consider the cost of obtaining and maintaining an adequate ARFF capability to protect our aircrew, but it is not so. Consider what is the minimum standard from the point of view of the firefighter and the aircrew. Both would probably agree that in the case of, say, a KC-135R fire, a 1690-gallon CAV does not an ARFF vehicle make. That sets up the problem. Now, to the ORM Process.

The ORM Process

To solve our problem, a team was formed consisting of both contractor and DCMA personnel. An effective review of ARFF processes and flight operations would have been extremely difficult were it not for the open and frank cooperation between all team members. I find it is useful to find common ground and common goals whenever dealing with complex (and expensive) safety-related issues. After all, we all want to do things the right way, the safe way. As it turns out, all team members were in agreement concerning ARFF at the facility.

DCMA is a joint agency, so we are not bound by any particular service's ORM process. So, I chose the Marine Corps' program just to try it out "HOO-RAH!" The USMC process can be found at their safety web site, www.hqmc.usmc.mil/safety/. In the case before me, following any of the services' ORM processes would have resulted in identical results.

Except for me, no one on the team had any training in ORM, and this was the very first time I used the process. So, before we began I handed out copies of the Marine Corps Order and gave the team the USAF ORM training course compressed into about 30 minutes, as I quickly covered all the basics. To me, learning ORM is like assembling a bicycle—it gets easier each time you do it, as long as you first read the step-by-step instructions.

ORM is a decision-making tool used by people at all levels to increase operational effectiveness by anticipating hazards and reducing the potential for loss, thereby increasing the probability of a successful mission. That is, it's not just a process for reducing risk, it's a process for analyzing operations and implementing risk controls so that operations can extend into areas that would not be permissible using standard operating procedures.

Identifying Hazards

This is step one in the ORM process. The contractor along with the Aviation Program Team (GFR + AMM + Safety Specialist) had developed a list of hazardous operations prior to the ORM assessment visit; this shortened the ORM process for me considerably. The operations they identified were obviously not the only hazardous operations found around aircraft in general, and the contract aircraft in particular. They were, however, the operations most likely to require an ARFF response, including:

1. Aircraft APU first start or first start after replacement
2. Maintenance that requires any breach of the aircraft fuel system (or any fuel line)
3. Fuel filter installation
4. Open fuel tank operations
5. Fueling/defueling and/or fuel sump draining
6. Engine runs
7. Flights (this includes any movement of the aircraft with engines running)
8. FEDS installation (FEDS is an external flotation device deployment system that includes an explosive shape-charge)
9. LOX servicing or purging
10. Spray painting (exclusive of paint hangar spray painting)
11. Hot work (solder, heat gun, heat lamp, etc.)
12. Operations involving Henways

Assessing The Risk

In step two, for each hazard identified determine the associated degree of risk in terms of probability and severity. One common approach, and the one we used, is to use the risk probability/severity matrix that can be found in each of the services' ORM instructions.

It took the group about 30 minutes to rank the hazards. There was very little disagreement between team members and all hazard rankings were unanimous. All assessed hazards were ranked "2," High Risk, except for FEDS installation and spray painting, which were both ranked "3," Medium Risk.

Normally, the hazards are rank-ordered prior to going on to the next step, but since they were all pretty equally hazardous (based on their ratings) and since they were so similar in nature and would require common risk control options, priority-ordering the hazards wasn't necessary. Why then did we bother to even do step two? First, before we did it we didn't realize they would rank so close together. Second, when using this process for reporting to higher levels of authority for help in reducing risks, providing a detailed analysis of your identified risks will give greater weight to your report.

Make Risk Decision

Step three of the ORM process starts with developing risk control options and then deciding if the benefits of conducting the operations with these options in place outweigh the risks/costs. The control options available include engineering controls (engineering out the risk by redesign, or material substitution), administration controls (policies, training, warning signs, limiting exposure), and personal protective equipment. Here again, before conducting the ORM exercise, the APT and contractor had already instituted risk controls for most of the hazardous operations identified in step one. These include:

1. Prior to conducting any of the identified hazardous operations, the contractor's FD CAV must be manned and *pre-positioned* at the hazardous operation.

2. All personnel conducting hazardous operations must be trained and certified.

3. Only those personnel necessary to conduct the operation are allowed in and around the entire aircraft during the operation.

4. The contractor's FD personnel conduct an aircraft walk-around to spot additional hazards prior to conducting hazardous operations.

5. Appropriate personal protective equipment is donned prior to conducting hazardous operations.

All of these controls have historically proven to be effective in mitigating risk. The most effective one here is the pre-positioning of the CAV. Even though the CAV has limited aircraft firefighting capability, combating a small fire quickly with a small CAV can be far more effective than fighting a large fire later with even the biggest ARFF truck. In the case of an engine fire, it is likely that the airport's FD which is located very close to the contractor's ramp, would respond to the fire before the CAV's extinguishing agents were exhausted.

These risk control options greatly reduce the risk to personnel during most hazardous operations involving the contract aircraft. Unfortunately, they are less effective during flying operations, specifically high-speed taxis, takeoffs and landings. The airport's FD's ARFF capability is insufficient to respond to something as small as a fire caused by a dragging brake, or as large as an aircraft catastrophic crash during takeoff or landing. The contract aircraft carried too much fuel and was just too large for one full-up ARFF vehicle to handle, or even 1 ½ if you counted the CAV.

Implement Controls

The contractor and the APT had instituted the next step in the ORM process, implement controls. The risk decision here had already been made; flight operations were being conducted. The question is, were we accepting too high of a risk? Things are rarely black and white in the contracting world and the answer to that question is… it depends on how you look at it.

If we decided the risks were too high and ceased flight operations, wouldn't it follow that flying large aircraft into any field with only one ARFF vehicle should be discontinued immediately? What about fields with no ARFF capability? Clearly, we'd love to have adequate ARFF everywhere we operate. But it just ain't so, and we cannot stop aircraft operations everywhere there's a shortfall.

On the other hand, these flights aren't just routine delivery missions. They involve new and unproven aircraft. It is because of the inherently high risk involved in acceptance/functional check flights (ACF/FCF) that we hold contractors to a higher ARFF standard than found in the operational world.

Still, our risk level was higher than it should be. The contractor was failing to meet the "reasonableness" standard for ARFF where ACF/FCF missions are conducted. Both the contractor and the program office needed to begin taking steps to further reduce the risk level beyond what the administrative controls could accomplish. The contractor was going to have to get an additional ARFF vehicle.

Supervision

The last step in the ORM process. Conduct follow-up evaluations of the controls to ensure they remain in place and have the desired effect. Monitor for changes, which may require further ORM. Take corrective action when necessary. These are processes the APT does as a matter of routine.

Recommendations

The ORM team came up with the following long-term plan.

1. Continue with the administrative risk controls implemented for the hazardous operations identified earlier.

2. Have the airport FD aircraft familiarization training include aircrew evacuation exercises. These exercises would be conducted as safely as possible, with crewmembers extracted only as far as the cockpit steps.

3. The contractor would purchase an additional ARFF-capable vehicle. They would also train and equip their firefighters for ARFF response. The ARFF vehicle they planned to buy would still leave them about 1000 gallons short of the AFMCI 91-101 recommended level. But remember, 91-101 was not actually on contract. We were using it as guidance, not policy. Yet here they were, spending an awful lot of money and still missing the mark. AFMCI 91-101 may not be on contract now, but what about the future? We suggested the contractor submit a package for GFR review that would include:

• Detailed specifications of the ARFF and CAV trucks, including capacities, throw distances, and flow rates.
• ARFF manning and training.
• Response times.

And, this is extremely important…

• Implement ORM Risk Control Measures to mitigate the increased risk incurred by being 1000 gallons shy of the 91-101 recommendations.

The package could be forwarded to AFMC for the purpose of "getting a ruling" on whether or not a 91-101 waiver would be granted on future contracts based on the additional vehicle and risk control options. This is the other part of ORM, allowing organizations to operate in an envelope beyond that which is normally acceptable without incurring greater risks.

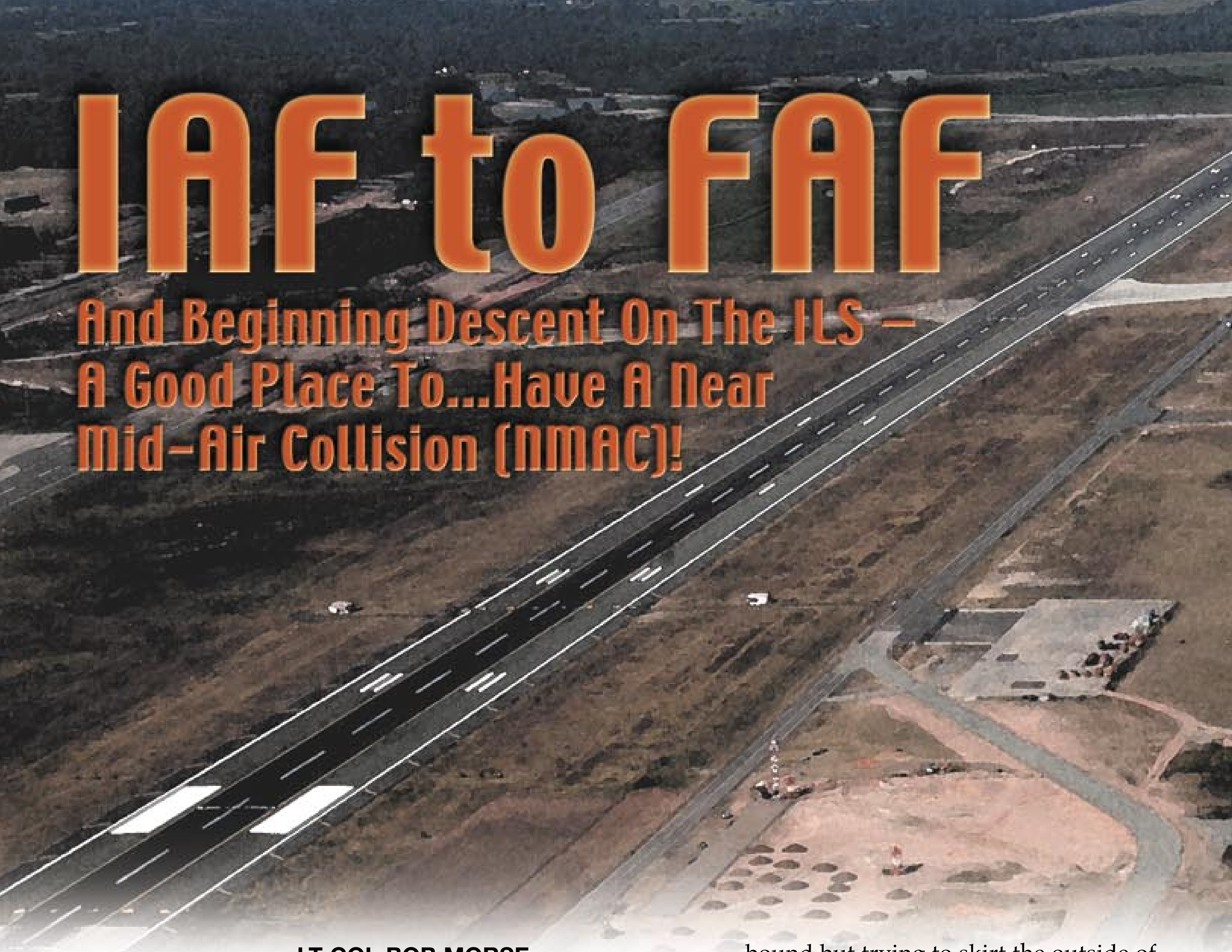
Conclusion

The ORM process described in OPNAVINST 3500.39 was very easy to follow. What made this test case particularly easy was all the advanced research done by the team members. Virtually every fact needed to complete the hazard analysis was available at the start of the team's deliberations. ORM isn't something new to most aircrews. We use ORM techniques in our risk decisions every day. The process we went through for this exercise was just a little more formal and provided a commonality that all personnel will be able to recognize. ■

Editor's Note: The USAF ORM process is available at https://rmis.kirtland.af.mil. The author flew KC-135As and Rs for the Strategic Air Command before getting into contractor aircraft operations. He retired in 2001 after 21 ½ years on active duty.

IAF to FAF

And Beginning Descent On The ILS – A Good Place To...Have A Near Mid-Air Collision (NMAC)!



LT COL BOB MORSE
190 ARW/SE
Forbes Field, KS

After flying for almost 20 years as a pilot and about three years before that as a nav, my eyes got opened big-time to the danger zone we fly through every time we take vectors to final at any Class D airport in the U.S. To remain outside this Class D airspace, most VFR pilots are keeping a look out for the airfield, instead of the final approach course to that field. Most aircraft receiving vectors in VMC conditions are also clearing toward the field or the final approach course. What surprises me is how easy it is for the VFR pilot to be right where you want to be immediately following the FAF.

A quick glance revealed a co-altitude Cessna 172 converging with us.

At Forbes Field (ANG), KS, the altitude prior to intercepting the glide slope on the ILS to Rwy 31 is 2700 feet. A VFR aircraft heading generally westbound but trying to skirt the outside of the Class D airspace would naturally be at 2500 feet. This is a perfect set up for the scenario that happened on 31 Jan 03, upon returning from Geilenkerchen AB, Germany.

It was a beautiful day and we were almost done with the long flight home. We received an early handoff from center with no mention of traffic. The co-pilot was flying and I was clearing toward the airfield and backing up the ILS. With the help of a TCAS callout of TRAFFIC, we glanced at the display to see the target was practically on top of us. A quick glance out the co-pilot's window revealed a co-altitude Cessna 172 converging with us. As I directed a steeper descent and the co-pilot was already making inputs for that descent, an RA (Resolution Advisory) directed, DESCEND, DESCEND! As the Cessna passed overhead from right to left, we saw +300 feet on the TCAS display. (HATR # 7424)

Photo Illustration by Dan Harman

How often do we fly these approaches with a bug-smasher just climbing out from a local field with the intentions of bypassing the field to which we are flying our approach without thinking to look away from the field for traffic coming in on an approach? And how often do we get locked in on precision flying, backed up with our clearing being focused mostly in front of the aircraft? Do most of you look seriously for traffic to the far left and right during the phase of flight between the handoff from center and the FAF with the radio call to tower, and the final configuration and checklist items prior to commencing the final descent? I have to say I didn't, and I didn't even realize how dangerous that omission was. Or how about that first couple hundred feet on the final approach, surely you're protected by that time? The fact is, tower is only responsible out to five NM at most fields, and if the VFR traffic isn't talking to him he most probably won't have a chance to call out traffic. In this case, due to the recent departure of the civilian traffic from a nearby field, Center evidently assumed that there would not be a conflict, since the tanker was almost to the final approach course when he handed him off. Unfortunately, that was the only chance we had for any outside help. As it was, our tanker and the Cessna were on a collision course.

With a new found respect for the dangers of that segment of our day-to-day flying, I decided to do a little research to see if this was just an isolated case, or if this kind of near miss happened fairly often. MSgt Elliot at the HQ AF Safety Center was kind enough to provide me with a printout of all the HATRs that were traffic pattern-related in the last five years. After eliminating all those that involved strictly military aircraft and those that took place out of the U.S., I still found a list of over 60 similar NMACs during that time period (an average of at least one per month).

Most of these NMACs took place in or just outside of Class D airspace with Class C being the next most frequent place. As we would expect, many of these also took place near large metropolitan cities with multiple airports in close proximity. Some of the most frequent reports came from San Antonio, Los Angeles and the Salt Lake areas.

Regardless of where in the U.S. you are flying, approaching final approach in VMC conditions is extremely hazardous. Some localities seem to have a significantly higher incidence of these types of NMACs, such as Hill AFB, UT, but every airport we fly into has the potential for just such an incident. TCAS is reported to have alerted many of us to these collision courses in time to avert disaster, but occasionally the civilian VFR traffic has not had the transponder on, and good old-fashioned clearing saved the day.

We've all been told of the importance of clearing and most of us take pride in our clearing techniques. The point here is that perhaps we need to think about the aircraft on a similar course or converging from an extreme angle. Clearing to the far right and far left of your aircraft is absolutely critical just prior to and just after intercepting final approach to any airport on any approach…not just visual approaches. ■

Clearing to the far right and far left of your aircraft is absolutely critical

The OODA Loop

Inflight Mission Risk Assessment

Illustration by Dan Harman

MAJ BERNIE "JEEP" WILLI
H-60 CTF/FD
Nellis AFB NV

You may be familiar with the proverb of the frog in a boiling pot of water. Place the frog in the boiling pot and it will jump out immediately. But, if you place the frog into the pot while the water is cool and heat the water up slowly enough until it boils, the frog will remain in the pot and suffer the consequences. This is a good parallel of what can happen if you don't identify how changes to your planned and briefed mission affect the overall risk level.

Assessing the risks associated with a planned mission by using an ORM checklist is a great way to ensure you're aware of the risks you expect to encounter, but risk mitigation doesn't stop there. You need to stay ahead of the aircraft and not let yourself or members of the formation get into a situation that you can't recover from. One of the methods of doing this is by using an OODA loop (observe-orient-decide-act). Usually, the OODA loop technique is used when assessing the threat when operating in combat, but you can use an OODA loop to help assess and mitigate risks as your mission tasks change.

There are many scenarios which aircrew encounter, both operationally and in training, where changing mission tasks can negatively influence the overall risk level. You need to be situationally aware of how these risk level changes impact your ability to successfully accomplish the mission.

For test sorties, the mission is highly scripted and thoroughly briefed. Deviations from the briefed mission are rarely tolerated. This is necessary to keep crews out of flight regimes that their prior planning has not prepared them for. That rigidity works well in the test environment, but it is not always appropriate in an operational or training environment. During operational missions, you have to remain flexible to get the bombs on target, engage the stray leaker, recover the survivor or drop the needed supplies. You have all heard that flexibility is the key to airpower. Using the OODA loop to assess mission risk is an example of flexibility in action.

The obvious operational example where quick mission response can result in increased risk is time-critical targeting missions. Accomplishing a solid inflight mission risk assessment relies on your experience and flexibility in the mission area to keep your OODA loop dynamic regarding the changes involved in these types of missions. In English, that means asking yourself, your crew, your wingman or available C2 assets whether this is the best orbit point, the best avenue of approach, or the best plan to accomplish the mission. For a mission that isn't as time-critical, slip the time-on-target if you need more time to assess the changing risk level.

An example of this for us helo bubbas would be to *observe* a change to the planned Air Refueling Control Point (ARCP) and consider one that takes us into a different area. You *orient* yourself to how this will impact the risk level of the mission. What effect does this new ARCP have on our risk level? What is the weather like at this new ARCP? Is it at a higher density altitude or in more rugged terrain than the one you had planned to use? If so, you determine *(decide)* that your power margin may be less than you planned, and/or the new terrain is tighter than your ability to turn the formation, or rises faster than the climb capability of the formation. Once you determine the change is going to negatively impact mission risk, you move the formation to remain in an area that affords the same or better conditions that you planned on *(act)*. You can either establish an orbit until the tanker can rendezvous at the original ARCP or select a new ARCP that affords similar conditions to the original.

Inflight mission changes are not only found in the operational environment. Conducting RTU training can also involve changes in the mission that can have an impact on overall risk. Having two students on one sortie in multi-place aircraft or flying multiple training sorties in a day can get the student numbers up, but it can also paint you into a corner.

For example, say you are planning on going out to train an RTU student on how to do tactical approaches, then move to threat maneuvering, finally finishing the flight with AR training. (This would be a typical flow for a helo RTU sortie. You can think of a scenario applicable to your airframe.) You perform a good pre-mission risk assessment using the ORM checklist, but find that during the flight you observe your student is having problems with tactical approaches that require extra time to fix. You then orient yourself to the impact this change will have on the overall risk. It will push back the threat reaction training and make it tougher to meet your planned ARCT. But more importantly, it will affect the student's fatigue level. You may decide the student has enough to work on by focusing on the tactical approaches and adjust your original plan.

The next action is to eliminate the threat reaction training or call the tanker and cancel the AR. If it gets to the point that the student sounds fatigued during the sortie, take it home. Don't wear the student out. The learning stopped about 50 miles back anyway. The point is to assess the changes to your mission and remain flexible to keep your risk level manageable.

In operational units, trying to knock out a year's worth of CT training in the six months between deployments can make aircrew press on with a flight without properly assessing mission risks as they change in-flight. Meeting all the RAP (Rated Aircrew Program) requirements can be a challenge but you may still need to call knock-it-off if the situation calls for it. You don't need to get the last bomb run, coordinate one more engagement or fly one more pattern if the weather is collapsing around you or the moon has just set and the ambient illumination went from 60% to 5%.

Whether it is deteriorating weather, weak student performance, changing timelines, changing threat levels, or fatigue levels, etc., make sure you have the best and most current information to improve your OODA loop performance. Don't just press on with the mission. Use your brain and the brains of those there to support you to make the best decisions.

Taking your time to assess the risk involved with what you are doing can actually speed things up. We've all heard that no one has time to do it right, but they always make time to do it again. Unfortunately in our business, sometimes you don't get another chance to do it again.

Safety principles still apply in combat. Get your mission done, but do your best to evaluate whether it is the best and safest way of doing it as your mission risks change with the task. Using an OODA loop to assess changing mission risk is the ultimate in remaining flexible. Assessing the risk can keep you from missing the target, committing a friendly fire incident, becoming an evader or worse. Make sure you do your best to consider how mission changes affect your overall risk level and how they affect your ability to safely accomplish the mission.

Timeless Topics

10 Rules

For Safe, Low-Level Flight

CAPT THOMAS E. BOYLE
25 TRWg
USAFE AIRSCOOP, Nov/Dec 1965

(Editor's Note: The USAFE regulations cited in this article have been superseded by the AFCENT Low Flying Handbook—and the bases no longer exist—but the advice here is still pertinent a generation later to all types of flying. As they say, "Plus ça change, plus c'est la même chose.")

Have you ever noticed the alarming number of major accidents that have occurred to USAFE tactical aircraft on low-level missions? One of our tactical aircrews has, and he decided to jot down his ideas on the problem and share them with the rest of us. He is Captain Thomas E. Boyle of the 25th Tactical Reconnaissance Wing at Chambley AB, France. His ideas are sound ones designed to meet the threats of low-level flying.

A look at the records shows that the threat is a real one. Since January 1963, we have had nine accidents that might have been prevented by adherence to this checklist. And in those nine accidents we have killed eight aircrew members. Their mistakes—pressing on in marginal weather, low-altitude trail aerobatics, non-use of navigational aids, IMC climbs in unknown terrain…and the list goes on. In addition to the accidents there have been numerous incidents with the same overtones. Reading the accounts of some of these near-misses is a frightening experience.

These "ten rules" should assist USAFE outfits in performing low-level missions. Used together with applicable regulations, good maps, informative briefings and mixed with good common sense, they will go a long way in lessening the low-level threat. A well-prepared aircrew flying a reliable aircraft should always be able to accomplish that mission "on the deck."

1. PLAN EVERY LOW-LEVEL FLIGHT METICULOUSLY

Use current charts. Fly the routes in the direction prescribed. Flying them backwards ups the mid-air rate. Do not fly against a target of opportunity at low-level. Memorize the target run. Plan the flight; fly the plan.

2. DO NOT CONTINUE A LOW-LEVEL FLIGHT IN MARGINAL WEATHER

The greatest danger occurs in marginal weather over rolling, hilly terrain. (Everyone is careful when hills become mountains.) If it were solid soup, you would have already gone home. When it's marginal, there is a tendency to press on with the hope that the weather will improve. Flying low-level around hills in marginal weather is like Russian roulette; most of the time you win. But losing is a disaster.

3. FLY LOW OR SLOW, NEVER LOW AND SLOW

There is safety in speed as well as altitude. Higher speeds will give you the option to zoom in an emergency. Don't box yourself into a tense situation with neither speed nor altitude.

4. BE ALERT FOR THE UNEXPECTED

Have your maps ready before descent. Keep folding to a minimum. It's better to have a few maps and number them. Be alert for runaway trim. Watch out for uncharted towers and their guy wires. River valleys are often crossed by invisible cables. There are many glider fields in Europe; even a near-miss can be dangerous to a glider, or to a light Army aircraft. Fly with your helmet visor down whenever conditions permit. Impact with a bird shattered the windshield of an F-4C. The visor saved the pilot's eyesight. The gold-plated visor is also excellent for reducing haze.

5. PLAN ESCAPE ROUTES

Check the terrain on both sides of each leg and decide ahead of time which way to turn if the horizon disappears.

6. DO NOT TURN ON TIME ALONE IN THE HILLS OR MOUNTAINS

Normally, if you fail to identify a turning point, you would turn on ETA. Not in the hills or mountains. This faux pas could lead you up a box canyon if you were deceived by a similar checkpoint. This possibility was a suspected cause of an accident in USAFE last year. You must be positive of the turning point when flying around mountains or hills.

7. MONITOR THE ALTIMETER

Altimeters have been noted by USAFE aircrews to be wrong by as much as 2000 feet. Always get a target area altimeter setting from the forecaster. If you get another one in the target area, ask him if it's a QNH or a QFE. If you have a radar altimeter, crosscheck it.

8. CLIMB, IF YOU BECOME DISORIENTED

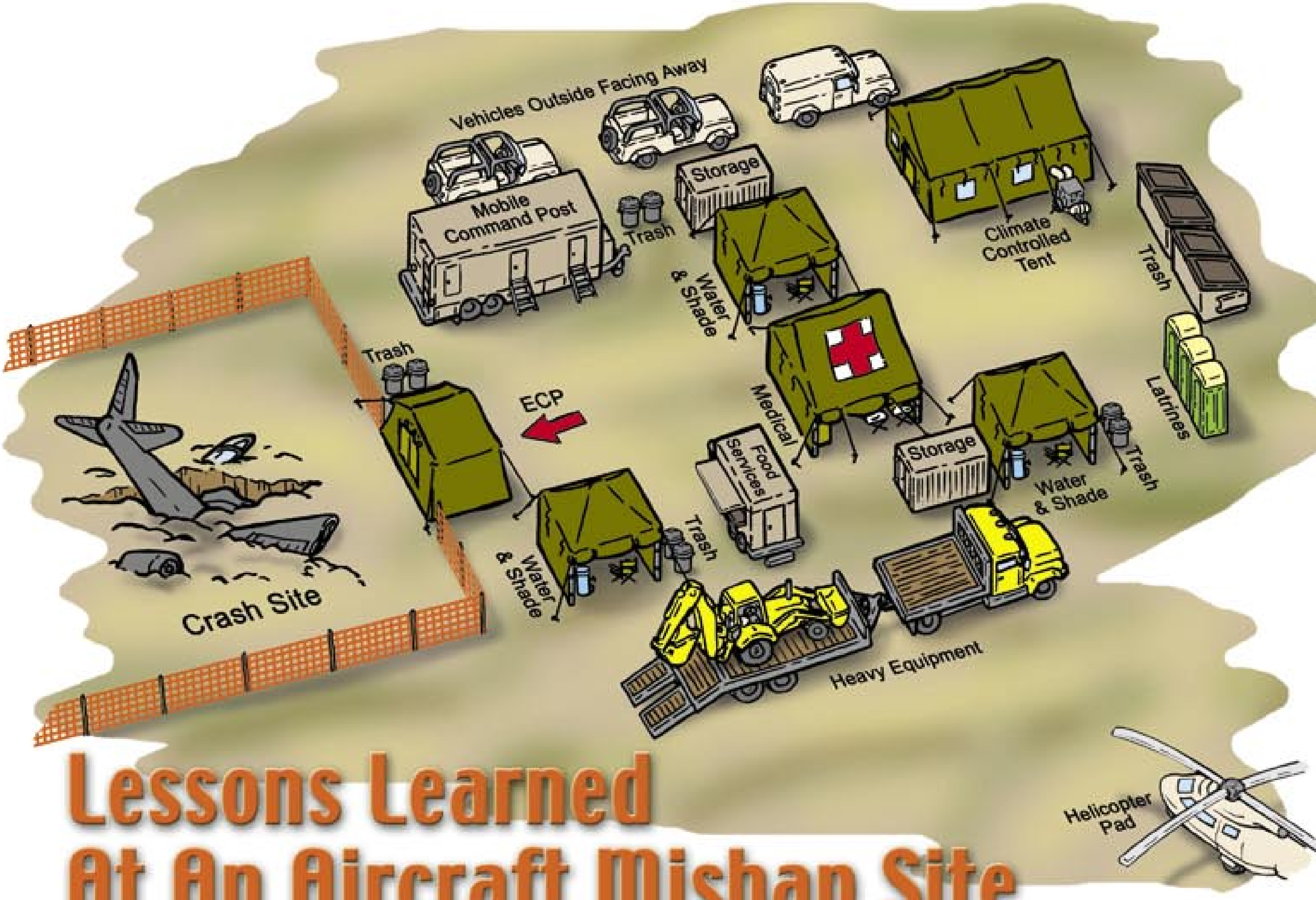
Plot a nav aid near each leg in case you have to climb for orientation. USAFE Reg. 50-7A requires you to plot nav aids for your entire low-level route and then use them to assure accurate navigation. If you cannot climb to 1500 feet above the ground in VMC conditions, then start your 180 immediately.

9. CHECK THE NOTAMS

Some parachuting areas are reserved for continuous use, some by Notam only. Hundreds of Frenchmen skydive at their local airports on weekends and holidays from early spring to the late fall. This is one reason why low-level flights are prohibited over France on Saturday afternoons, Sundays and holidays. French holidays are listed in the FLIP planning, Section II, German holidays are listed in USAFE Regulation 50-7. (Seems like the holidays of all countries in the USAFE area should be in one publication.) Know the drop zones in your local area. Avoid gunnery and artillery ranges unless you are doing the shooting.

10. LEAVE LOW-LEVEL ACROBATICS TO THE THUNDERBIRDS

Even they practice for weeks at altitude before they slowly lower their routine. Low-level flight requires more attention to details than the high-level version. Be professional.



Lessons Learned At An Aircraft Mishap Site

Illustration by Dan Harman

TSGT TODD PARISH
56 FW/SEG
Luke AFB AZ

Many ground safety professionals think they have little need to respond to an aircraft mishap site. Chances are, they believe this only because they never got involved in the tedious tasks associated with aircraft mishap investigations and recovery. From the start, ground safety should be involved helping plan, lay out and develop this new industrial working environment. After the environment is planned, safety should remain to observe operations and oversee workers' activities to help prevent another mishap from occurring.

Since arriving at Luke AFB, I have responded to multiple aircraft mishaps. No two are alike, but I have discovered several common themes and can share a few lessons learned.

(1) Operation Orders: Well before any mishap occurs, review lessons learned, Operation Orders and Situation Reports from previous crashes. Quite often, Crash Recovery Teams (CRT) are able to save hours of planning by going over these records. Old Ops Orders are God's gift to a CRT. Use them, and ensure you pass on this gift to other teams by listing key facts of the current recovery effort like conditions, procedures and equipment used, time expended and other key lessons learned.

(2) Take Your Time: There is no reason to rush to a crash site unless vital evidence is being lost due to environmental factors. A good crash recovery team needs time to assemble and devise an effective strategy for the response. Do not overlook this important step. Talk over the operation before heading out the door. The initial instinct is to run to the site, but if you can suppress this, you will be rewarded later.

(3) Control the Flow To and From the Mishap Site: When a major mishap occurs, it seems every office on base tries to send a representative to the crash site, mainly to satisfy a curiosity factor. Too many people can interfere with the tasks at hand. Ensure only personnel with duty requirements go to the crash site.

(4) Mishap Kit: Most SEG offices already have a mishap response kit. Do not forget to include your government credit card, a cell phone, a change of clothes, headgear, a Camelbak® or other hydration system, a fold-up chair, a camera, and hygiene items, to include sun block and baby powder. (Yes, baby powder! It has a million-and-one uses, all of which make being in the heat, dust and sticks a bit more bearable.)

(5) Convoy Procedures: All personnel should travel in a convoy to the site following a predetermined route. Each driver should have a map to the scene and a method for contacting other drivers. Each team member should be listed by name and unit, and should check on and off base through *one* established office. Do not make the mistake of having multiple check-in and send-out points or the on-scene commander will quickly lose control of the site.

As a safety advisor, you should be as near to the front of the convoy as possible and have mobile maintenance in the rear. This allows you to lead the convoy keeping speeds in check and allows for mobile maintenance to assist those with mechanical problems.

(6) En Route: Travel at speeds agreeable to the slowest response vehicle. Bear in mind, many of the response vehicles have not been off base at highway speeds in a long while. Bringing a convoy onto freeways and highways is tricky at best. All vehicles should merge onto the freeway and pull to the far right *after a mile or so* of travel to allow others to catch up. DO NOT try reassembling the convoy immediately after entering the freeway. This causes a huge bottleneck and could cause a serious mishap.

Make frequent and *planned* stops. At each stop, check the gear stowed on large trucks and flatbeds to ensure everything stays snug. Why so many stops? If your crash site is at a remote location, services provided by gas stations and rest stops will be invaluable.

(7) Arrival: Once you arrive at a crash site, the natural tendency is to take a look and immediately focus on the smoking hole. Don't. You'll have enough time later on to take pictures and such. Spend your first few hours setting up a proper base camp. Face all vehicles away from the crash site; that way if there is a need to get up and go you can do so quickly. Also, place hydration stations in several locations in the camp (see sample camp layout).

(8) Be the Commander's Eyes and Ears: Get with the on-scene commander and let him/her know your roles and responsibilities. Be that little voice in the back of his/her head safely focusing the investigation and recovery efforts. However, do not overdo your welcome. There are a million considerations at a mishap site, and immediately pestering the commander about a minor interim board requirement, or some other trite matter, might not be the wisest thing to do.

(9) Keep the Mishap Prevention Hat On: Don't solely focus on the investigation at hand. Watch the people, trucks and forklifts, and stay focused on mishap prevention. I have seen people wearing full respirators and body suits to protect against chemicals and composite fibers working right next to an unsuspecting fellow with only a tank top and BDU to protect him. And they were literally two feet apart. Someone needs to think safety, because most folks there are just thinking about recovery.

(10) Control the Crash Site: Work with the commander to keep the crash site as little disturbed as possible. Many teams of people will go out to the site before the interim board even assembles. There will be crews doing hydrazine, composite fibers, EOD, and so on. Know each of their roles, instruct them to all approach the aircraft from the same path, and attempt to preserve as much of the original mishap site as possible.

(11) Lastly… Be Flexible: There are so many variables at aircraft mishap sites. Your job is to ensure the mission gets accomplished as safely as possible. There are going to be many hazardous operations and tasks, and not all will go as planned. Your job is to stay on scene and do risk analysis *throughout* the operation. Your efforts will help ensure one mishap site doesn't become two.

Water and Shade: You can never have too much of either. Encourage your people to drink before they are thirsty and to have a sports beverage every fourth drink.
Medical: Should be near the center and easily accessible with a clear route to exit, if needed.
Heavy Equipment: Your camp will be less hazardous if the heavy equipment stays on the outer edges. This allows it to be operating without exposing many personnel.
Latrines: They rarely come out the first day but are so nice to have during the recovery. Keep outside of camp and put a water station nearby and waterless hand cleaner.
Food Services: If you are lucky enough to have a camp food service, it is good to have it away from your mobile command post. That way, folks can eat away from the working environment and have a place to relax.
Entry Control Point: Maintain control of the crash site at the ECP. Have all personnel sign in and out with name and time. This helps monitor things like heat stress and work/rest cycles.
Helicopter Pad: Ensure you have thought out where you would land a helicopter in case of emergency. Also, the board president will likely tour the mishap scene by helicopter and on occasion will land.
Mobile Command Post: The MCP is the heart of the camp. Here is where most of the meetings and planning take place. Safety should be on-hand to advise the commander and monitor the industrial activities associated with cleanup. Keep extra PPE and safety gear in the MCP, and share it with the workers on-hand. All personnel should check in and out of the MCP each day. □

Photo Illustration
by Dan Harman

Class Act

MAJ CHUCK SHUMAKER
479th Flying Training Group
Moody AFB, GA

Our heroic, on-call Flight Safety Officer (FSO) was ahead of schedule for once! He had finished his morning airfield inspection and was just sitting down to spend some quality time with his favorite publication, to be followed by the requisite paperwork, when the Crash Net call echoed off the linoleum, abruptly shattering his quiet solitude…

The mishap aircraft (MA) had been departing on a surface attack training mission. The mishap pilot (MP) selected max AB for the takeoff and all engine indications were normal. During the takeoff roll, the number one engine fire warning light illuminated. The MP didn't see any engine instruments indicating a fire, but since his airspeed was below refusal speed he aborted the takeoff. After pulling the throttles out of AB to idle the pilot noted that the fire light went out. Coming to a stop, he shut down both engines and completed an uneventful emergency ground egress.

Our speedy FSO was on-scene by the time Crash Recovery hooked the aircraft to the tug. Since it was just a Class E event with no apparent damage or injuries, he didn't have the aircraft impounded. That way maintenance could begin repairs while he responded to yet another IFE (a solo student pilot with unsafe gear indications). When the FSO got back to the engine shop (the solo student landed uneventfully), maintainers told him that pressurized fuel leaking at a connection in the line to the afterburner fuel manifold had ignited, activating the fire warning circuit. After initiating the abort, the fuel must have stopped leaking, and the temperature in the number one engine bay decreased as the fire went out. These were motivated maintainers, and they had already begun removing and replacing the manifold. With any luck, they would probably have the engine ready for the second go the following day.

The ever-curious FSO was not satisfied, though. “But why did fuel leak out of that connection? That connection is held by a safety-wired nut, right?”

“Yeah, that’s right,” replied the shop foreman. “Couldn’t tell ya’ why this one leaked. Guess it happens sometimes. The connection looked pretty good to me before we removed the manifold.”

The FSO surmised that the nut was most likely not safety-wired quite right, but he couldn’t confirm that, since the assembly had already been removed. The engine was last overhauled and that part inspected 69 flight hours earlier in the Engine Regional Repair Center (ERRC) almost a thousand miles away. The FSO phoned the ERRC supervisor and they discussed this theory about the fuel leak. Neither of them knew of any other such failures, and with the lack of further information they concluded this was probably an isolated incident. There were no recommendations listed in the safety report.

If this were a Class A mishap, would that be a complete and thorough investigation? Or would you expect that some Sherlock Holmes with unlimited time and resources would leave no stone unturned until he cracked the case of the mysterious fuel leak? If a nut failed to hold a fuel line connection tightly enough, why did it get loose? If the nut was installed and safety-wired wrong, why was it installed wrong? Was the mechanic properly trained? Was he referencing the current and correct tech order when performing the work? Were there any outstanding Deficiency Reports on this type of part? Did the HQ USAF Safety Center or MAJCOM Safety office have any reports of previous similar mishaps? Did maintenance databases have a record of past failure modes matching this one? Was this really just an isolated incident? Is a one-time inspection of all similar engines a feasible recommendation?

As an FSO and pilot, how many times have you heard (or maybe even rationalized to yourself), “This investigation is sufficiently thorough. After all, it was just a Class E, and probably is just an isolated incident.” Is this the mantra of a slacker-investigator, or does it reflect a mindset prompted by regulatory guidance on “minor” mishaps? I submit it’s the latter, and it’s a mindset we need to avoid because today’s Class E could be tomorrow’s Class A.

AFI 91-204, *Safety Investigations and Reports*, can leave you with the distinct impression that Class E investigations aren’t as important as Class As. From the basic definitions, to the convening authority, to Safety Investigation Board (SIB) composition, to toxicology testing, to reporting schedules, to briefing requirements, Class A mishaps are clearly given more emphasis. Is this bad? Not necessarily. With limited resources, we have to prioritize our time and efforts. It’s bad only if it leads an FSO to undervalue the importance of those pesky Class Es. Safety officers should avoid letting the regulatory differences between the two types of mishaps cause complacency when reporting seemingly minor events. Think of it this way: A Class E investigation is a way of attacking an issue that might result in a Class A catastrophe.

For example, investigating a HATR on conflicting VFR pattern and departure procedures might seem mundane on the surface. But you could be preventing a Class A mishap that otherwise would have happened next month. All safety investigations are done to *prevent* future mishaps. So, isn’t it better to prevent a Class A by investigating a Class E, rather than by first having the Class A and investigating that? Thought of in this manner, investigating minor mishaps, while by nature a reactive process, is actually a proactive means of preventing serious problems.

This is not a revolutionary concept. It’s nothing you and I didn’t already learn at the HQ USAF Safety Center. It’s just easy to forget it when you’re digging into your eighth Class E investigation this year, especially if someone in another shop, with competing priorities, is saying, “Aw, I wouldn’t worry too much about this one. Probably just an isolated incident. Stuff happens, y’know?” You, the investigating officer (and the convening authority, of course), decide when you’ve dug deep enough based on the resources available, regulatory guidance, and limitations involved. Just remember that sometimes the only thing keeping a Class E from being a Class A is luck or timing.

For example, with a little more fuel leaking out, the above engine fire (based on an actual incident) could easily have happened as follows: The mishap pilot (MP) selected Max AB for the takeoff and all engine indications were normal. Just after retracting the gear and flaps the number 1 engine fire warning light illuminated. The MP noted that the number one engine instruments confirmed the existence of an engine fire, so he shut that engine down IAW the boldface emergency procedure. The fire light remained illuminated and as the MP turned crosswind to enter the VFR pattern the tower controller notified him that his aircraft was trailing smoke. The aircraft then began an uncontrollable descending left roll…

…Well, at least this time you’re not investigating one of those “routine” Class Es!

Real Time Risk Assessment: It Could Save Your Life

USAF Photo by SSgt Aaron D. Allmon II

LT COL JAMES PETERSON
HQ AF/SEI

How many clichés should a pilot have to endure? Stick around long enough and you'll hear them all—from "Safety is paramount" and "Slow down to speed up" to "Don't do anything dumb, dangerous, or different." Although they are sometimes flawed (after all, the *mission* is really paramount), there's a good reason we still hear them year after year. Grudgingly, we must accept the fact that these advisory clichés can prevent mishaps—no matter how trite they may sound. Also, they eventually point toward a key ally in mishap prevention—risk reduction.

Of course, this risk management business can be carried too far. Imagine my surprise during the opening brief of a NATO exercise when the commanding two-star general declared, "Most importantly, we will take no risks." I whispered, "Are we going to fly?"

The Air Force has spent a great deal of time and money over the past several years promoting risk management as a means to preventing mishaps. Since we cannot keep statistics on accidents that were avoided, it is impossible to quantify the impact of such a campaign. My pitch in this article is to convince pilots and aircrew that one key component, Real Time Risk Assessment (RTRA), must be a *conscious* part of every mission they fly.

"Conscious?" you ask. Well, it is a certainty we all subconsciously do things to avoid risk during missions—for example, glancing at engine instruments, clearing for traffic, listening to radio chatter, and monitoring our wingmen—all of which lead to risk reduction. By seeing potential dangers or oddities early, we can easily adapt and make changes to eliminate serious consequences.

The conscious things we do to reduce risks (performing checklists, making radio calls, requesting flight following, etc.) go mostly unnoticed as risk reducing agents because they are so common—and sometimes required. However, there is another side to that conscious risk reduction that we must incorporate. This is where RTRA enters the picture.

What is RTRA? Simply put, it is a constant evaluation of the changing risks being encountered as a mission proceeds. Of course, risk is dynamic. It changes as conditions change. We've all seen the preflight risk evaluations with point values assigned to various categories. These evaluations only provide a snapshot view, but they can be used to help aircrew and supervisors evaluate *expected* risks. Once those expected risks change, that evaluation is no longer valid. This is an extremely important point.

RTRA takes risk assessment beyond the snapshot view, making it more useful during a mission. This is because you're experiencing real things—deteriorating weather, poor communications, unresponsive wingmen, poor ATC control, AAA or SAM fire—and you must make immediate risk management decisions based on these factors. Remember the cliché… "Flexibility is the key to airpower." RTRA is that flexibility.

Does RTRA matter? Consider this: From 1993 to 2003 roughly half of 393 Class A mishaps were directly caused by human factors (these are mishaps attributed to operations—I did not look into logistical human factors causes). Even more startling, midair collision and controlled flight into terrain (CFIT) mishaps accounted for 69% (231 of 336) of the Class A fatalities over the same period. You may want to read that sentence again—and let it sink in.

So, yes, RTRA matters. Human factors mishaps are easily the most preventable mishaps. Why? If you look at enough of these, it becomes clear that a different course of action, or a single verbal input by *someone* along the chain of events leading to the mishap could have easily prevented it. In most human factors mishaps, it boils down to a failure to recognize and avoid (or lessen) a situation of increased risk.

So, how about all these mishaps we may have prevented? Here are some personal examples. On my recent fini-flight in Germany, I received a call from squadron operations as I was taxiing out. They told me my scheduled range had just closed due to a fire hazard. On my fini-flight?! Are you kidding me? They offered me the alternative of using a range I had not briefed, had not been to in over a year (the one time I'd ever been there), where the weather was good enough for low altitude bombing only, and with a slot time I should've already been airborne to meet.

Tempting? C'mon…who wouldn't want to drop bombs on perhaps their final flight in the A-10? My RTRA debate, however, was quick—nope, sounds kind of dumb to me. Despite the "encouragement" of my wingmen, it was my job as the flight lead to think for all of us.

On the other side of who thinks for whom, there was a readiness exercise sortie where I was number three in a four-ship. The newly certified four-ship flight lead was desperately fighting bad weather trying to get an effective mission for the exercise tally. Unfortunately, the cloud heights were clearly not acceptable. Does a training exercise change our weather minimums? After my first not-so-subtle prompt went unheeded, I was forced to play my instructor pilot/squadron supervisor card and simply make him abort the mission.

Did I prevent mishaps in either of these cases? Maybe. Have any of the thousands of RTRA decisions and actions I've made prevented mishaps? I believe so.

Why? I have about 1900 hours in the A/OA-10 and 550 hours in the AT-38B. I've never had a Class A or Class B mishap (in itself not terribly unusual), nor have I ever had a serious emergency. Is that just good luck, or are some people just better at RTRA? Hard to say, but should I bring up that "old, bold pilot" cliché now?

The facts show there continue to be pilots who just make incredibly dumb decisions. Some of these decisions just cost money, and, unfortunately, some of these turn out to be fatal. We can all recite some of the stupid, senseless things we've seen. Here are a few things on my list.

On one occasion, there was a T-37 IP returning from a cross-country. The weather was marginal, which forced him to recover IFR. He started a missed approach, but saw the runway just after executing it. He decided to land instead. During this frenetic decision, he forgot he had already raised his gear. His memory got a jolt when he touched down.

More recently, I read the report on six IPs (including the commander and operations officer) who flew through thunderstorms on a cross-country return. The entire flight had varying amounts of damage including lightning strikes, broken wing-tip lights, and damaged onboard armament. The Class B investigation board added to the mishap costs. Are we to believe there was no way to avoid this?

Twice now in my career, I have had the airborne experience of listening to a wingman make calls on Guard after the flight lead had looked inside the cockpit too long, realized it too late, and fatally hit the ground. Talk about a sick feeling of helplessness.

Are we supposed to shrug our shoulders at these types of mishaps?

These stories are not new. As we often say in the safety business, there are no new ways to crash an aircraft. Fair enough, but are there new ways to prevent the crashes? New technology certainly gives us ways to save ourselves from our human fallibilities, but RTRA offers the oldest, easiest, and cheapest method.

The only cost of RTRA is continuous, conscious thought about the changing risks during a mission, a willingness to change courses of action to eliminate or reduce those risks, and thoughtful discretion in testing your abilities.

After all, "Discretion is the better part of valor." At least, that's a cliché I've heard…

USAF Photo by SSgt. Cherie A. Thurley

USAF Photo by TSgt Burke Baker
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(Editor's Note: The section on deicing fluids has been updated to reflect current technical order guidance.)

Within the Air Force's flight operations community, there exist 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 timeframe), 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 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:

1. Frozen precipitation—snow or sleet.

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

3. 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.

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

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

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

6. 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.

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

8. 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 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.

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 three types of fluid in the USAF inventory according to T.O. 42C-1-2: Mil-A-8243 Type I and Type II (Mil-A-8243 has been discontinued due to environmental concerns and can no longer be ordered, but you can use your existing stock until depleted), AMS 1424 Type I Deicing

Ice, frost, or snow on the wing can reduce lift by as much as 30 percent and increase drag by 40 percent.

Fluid, and AMS 1428 Type II and Type IV Anti-icing fluids.

AMS 1424 Type I deicing fluid is glycol-based, and under current AF policy only propylene glycol-based fluids will be procured due to environmental concerns. If you are at a commercial or international location, other than USAF installations, you can use any qualified AMS fluid.

AMS 1428 Type II and Type IV fluids are basically the same as AMS 1424 with one main difference—the ability for the fluid to stick to your aircraft or, as the engineers put it, ability to withstand applied stress (airflow). Therefore, it's an anti-icing versus deicing fluid.

What is the actual difference between the fluids? We won't talk about Mil-A-8243 as it is discontinued, but will focus on the remaining fluids. Manufacturers aren't required to test each batch, but must have proven the fluids' conformance to specifications. Make sure you don't mix the fluids together as they ARE NOT COMPATIBLE; this includes different manufacturers of AMS 1428 Type II and Type IV. If you do cross-mix the fluids, you must dispose of the fluid IAW local environmental requirements.

AMS 1424 Type I, when applied according to requirements for temperature, will move immediately when stress is applied. This means as soon as your aircraft starts to move, the fluid will be leaving and you lose the deicing capability. A key property of this fluid is that it is similar in color to hydraulic fluid. If you return from flight and find streaks of fluid after a sortie in which you were deiced, make sure the fluid is not residual deicing fluid that was trapped in the aircraft.

AMS 1428 Type II and Type IV, when applied according to requirements, will allow a longer holdover time and provides a longer time from application to departure. This fluid is only to be used on aircraft with rotation speeds generally higher than 100-110 knots and only for fixed-wing aircraft. FAA guidance (AC 120-58) states that some large aircraft may experience performance degradation and may require weight reduction or other takeoff compensation. This degradation may be significant on smaller aircraft. Make sure you consult *your aircraft-specific manuals* to determine your course of action.

In these fluids, there is no difference between the commercial and the military fluids as far as performing the functions.

Some Recommendations

An end-of-runway check (ERC) is critical and should be accomplished by a supervisor of flying (SOP) 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, be sure to 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 USAF 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!

USAF Photo by SSgt John E. Lasky

The Aviation Well Done Award is presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Mishap Prevention Program.

MAJ MICHAEL A. MEANS
1 RS/DO
Beale AFB CA

Approximately four hours into a high-altitude training mission, instructor pilot Maj Mike Means and an upgrade pilot encountered an electrical malfunction of a type that had never occurred in the history of the U-2, and was thought to be impossible. Flying above 60,000 feet in one of only four two-seat U-2s, the crew began to lose electrical components one by one. Digital airspeed and altitude readouts disappeared, followed by the loss of fuel quantity and gear position indicators, radios and navigation equipment. Even emergency backup systems were not immune. Sensing an impending total electrical failure, the crew shut down all electrical equipment, in an attempt to preserve emergency battery power. While the intercom was still functioning, they quickly briefed up the approach, then turned the battery switch to "OFF."

With no speed brakes or lift spoilers to increase drag, the aircraft took nearly 90 minutes to descend, during which time Maj Means had to hand-fly the aircraft without the benefit of trim, a task made more difficult by the cumbersome full-pressure suit he was wearing. Having lost the ability to dump fuel and to lower flaps, he would have to fly a very challenging heavy weight, no-flap approach. The U-2 produces so much lift even at idle power, that to land safely without flaps and speed brakes the approach must be flown at a 1-1/4-degree glideslope, approximately two knots above the onset of stall buffet. The aircarft cannot be allowed to get even a few knots slow, as it could easily stall and crash. Before the engine had time to spool up for a go-around. Nor can the pilot afford to fly even a couple of knots fast, as every additional knot of airspeed when crossing the threshold will cause the aircraft to float an additional 1000 feet down the runway before it lands. Since the calculated landing distance for a perfectly flown no-flap approach at their gross weight actually exceeded Beale's 12,000-foot runway length, there was, on this day, absolutely no room for error. And, with no fuel quantity indication, Maj Means had to calculate this critical approach speed based on his best estimate of the fuel remaining, and the feel of the aircraft as he slowed it down.

Meanwhile, the upgrade pilot ran all normal checklists to prepare for the emergency landing and lowered the landing gear using the emergency manual system, which relies on gravity and air pressure to bring the wheels down. However, they had no cockpit indications to confirm that the gear were locked in position. When the upgrade pilot tried to turn the battery back on, it was dead. Consequently, the aircrew had no intercom for the approach and landing.

Drawing on every ounce of experience gained in over 1000 hours in the U-2, Maj Means flew a flawless no-flap approach. Touching down just past the threshold to ensure he had every inch of runway available, he placed the throttle to cutoff to minimize rollout distance. The braking system worked, and the aircraft came to rest 8000 feet down the runway. The crew egressed uneventfully, and the aircraft suffered no damage.

Well Done!

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

Following the books and knowing what the airplane is saying to you are key to preventing mishaps. Here are a few cases where the book may not have been followed and knowledge of what the airplane is saying to you could have reduced the impact of the mishap.

Overworked Loadmaster

A C-130 crew was performing one of their fun missions, throwing out paratroopers, when the loadmaster overexerted himself. The crew had to declare an emergency and was met by emergency personnel who took the loadmaster to the hospital where he was determined to have suffered a back strain. How do loadmasters get back strain during paratroop drops?

The book states that manual retrieval of static lines may be used to retrieve no more than 10 static lines per door, per pass, with one loadmaster, or 20 static lines per pass with two people. Plus, the aircraft had a working static line retriever. Which method do you think this loadmaster used to retrieve the static lines? What should be the simple task can turn difficult fast. Use the technology and equipment that the Air Force provides to prevent an injury.

A Wayward F-16

The mishap flight was a normal two-ship night surface attack sortie, and the takeoff was briefed as a night single-ship rolling takeoff. The mishap occurred after a scheduled hot-pit and all runway checks were good. As the mishap aircraft took off, and was accelerating through 130 knots, the nose tire suffered a catastrophic failure after striking a foreign object. The pilot aborted at about 142 knots. He was moving! As the nose tire came apart, pieces of the tire severed the nose wheel steering (NWS), NLG downlock actuator and nose weight-on-wheel wire bundle. In other words, the pilot lost all nose wheel steering and resulted in an unstable condition called reverse castering, or the steering goes in the opposite direction of brake and/or rudder inputs. Unable to maintain control, the pilot safely ejected and the aircraft left the runway. Emergency personnel secured the aircraft and recovered the pilot.

The nose tire failure resulted in severe damage to some unprotected aircraft components that rendered the NWS inoperative, and in this failure mode the NWS warning system is also inoperative. So the pilot is not receiving all the clues he needs to make some choices. With the nose wheel steering inoperative, as it was, and no real nose tire, reverse castering comes into play. The F-16 NLG is designed with a forward angle and it provides the appropriate caster angle, with a tire installed. With the nose tire removed, or in this case blown away, the nose strut angle changes relative to the ground and reduces the caster angle to approximately zero. As what is left of the wheel rolls on the runway, it enters the reverse caster mode.

The point here is, if your nose tire leaves you unexpectedly, be aware that the NWS can/will become inoperative and your steering actions using the rudder or brakes may be opposite of what you intend, causing you to lose control of the aircraft. Be aware, and if you need more info, contact your wing safety office for a copy of this Class A mishap.

I'm Talking To You

A KC-10 recently was talking to the aircrew, but someone forgot to listen. During a local air refueling mission a failure was noted in an engine performance monitoring coupon. All readings were recorded manually and discovered to be well off the baseline (at least 25 degrees Celsius). The crew continued the mission and later accomplished a second coupon, which gave them the same results. ("I told you once and then told you twice!") As the crew was completing an auto-go-around for some continuation training, the tower informed the crew that sparks were coming from the tail of the aircraft. Now the aircraft was really talking to everyone. The aircrew safely landed, shut down the suspect motor and returned to parking.

Maintenance took a look at the engine and found substantial damage to the number two engine compressor section. They sent off a FAST kit and the forensic evidence, just like CSI, indicated that a cadmium-plated steel fastener initiated the damage. This material is foreign to the engine but specific to fasteners on the KC-10. The initial impact initiated a fracture on one of the compressor blades, but it did not break up at the time of impact, just caused an upward shift of the EGT. Do you remember the engine monitoring coupon results? Here the aircraft was telling the crew, "I have a problem." Eventually, the damaged blade couldn't take the stress anymore and broke off, and at the high power settings and stress during the auto-go-around it ended in total engine failure. The fastener that started the event is a common KC-10 fastener and the aircraft was missing no fasteners, and neither was the aircraft that refueled the mishap aircraft during the mission. So, where did it come from? We don't know, but they do know that it happened on that sortie.

Bottom line is, when you get an unusual reading from the aircraft, it is usually for a reason. To "what if?" this a little: If the crew had terminated the sortie at the first indication, most likely the Air Force wouldn't have had to rebuild the engine to the tune of $2.7 million. It would have still needed repairs, but it would not have been a total rebuild. When your aircraft talks to you, please listen. It can save you from having to use the emergency procedures, and prevent a catastrophic in-flight failure.

Did I Call For Clearance?

A member of the base aero club flew one of their Cessna 172s to a location for its scheduled 100-hour check. Normally they perform the inspection the same day and the pilot flies the aircraft back that night. The pilot delivered the aircraft and the aero club manager looked at the pilot's credentials and found he was overdue his annual standardization test and flight check. The pilot thought his FAA check for his license five months earlier fulfilled the requirement. It didn't. The manager arranged for the pilot to receive his test and checkout and he passed. Now the aircraft was receiving the checkout, and it was taking longer than planned. That happens with maintenance sometimes. In order for the pilot to get back home before dark he had to leave by 1600, so he needed another aircraft. The aero club manager, being the helpful person he was, arranged for the pilot to fly one of the other aircraft back to home station.

Now, the pilot was in the other aircraft and heading for home, or so he thought. He called ground for clearance to taxi and requested flight following. Once at the runway, he called the tower and stated his readiness for takeoff. He had not yet received his departure clearance, so the tower referred him back to ground. He called ground, got his clearance and was directed to recontact the tower. He must have thought he did, but the tapes show he then called ground for his departure and took off, still on the ground frequency. I don't think this is allowed, do you? After several attempts, they finally contacted the pilot and directed him to return to base and land. He didn't get home by dark. The rules are simple. When you take off you need to be in contact with the tower, and this example of miscommunication is what sets us up for mishaps!

See And Avoid

A KC-135 was heading northeast towards a tactical route at a deployed location, and a BUFF was headed northwest toward a different tactical route in the same area. The normal radar coverage agency (RCA) was not on station at the time. The KC-135 was on the frequency normally used by the RCA, while the BUFF was on the frequency specified in command guidance for self-reporting procedures. Which one do you think is on the correct frequency? The KC-135 observed the BUFF on their TCAS (isn't technology wonderful), and noted they were on a converging heading at the same altitude. They tried to contact the BUFF on their frequency and a common frequency, but were unable to reach them to resolve the conflict. The KC-135 now had a visual on the BUFF and they then received a TCAS resolution advisory, so they followed the advisory and descended. The KC-135 then passed 800 feet below the BUFF.

How did two warfighters almost meet in the middle of nowhere? Both were following established procedures to be at the same altitude, but since the RCA was off-station they both should have been on frequency for self-reporting. Guidance was vague on this and there was confusion among the crews and squadrons as to what frequencies should be used. It also became apparent that the command and control authorities had not advised those responsible for mission execution that the RCA would be unavailable that day. Here we have established procedures that did not ensure two aircraft would be deconflicted once airborne. Vague guidance and commonly accepted practices led to the two aircraft being on different frequencies. Had they both been on the same frequency and their flight paths deconflicted in planning, this incident would have been avoided. We all need to ensure that our command and control procedures are clearly understood, and that we do all we can to avoid those near misses before they become a hit.

Maintenance *Matters*

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

Tech data and training are always a theme in this magazine, and here are some cases where if the T.O. or training had been followed the damage would not have happened. Like we've said before, the books are there for a reason, to keep you alive and the aircraft safe.

F-16 Takes A Drop

An F-16 was washed and seven days later got to take to the air. The flight was a normal flight until the end. The pilot put the gear handle down and the red light came on and went off, but unfortunately, he didn't get the three green he was expecting. The lights checked good, so he did a go-around and contacted the SOF for a chase aircraft. The chase aircraft came around, and the pilot cycled the gear handle with the same results. The gear appeared to be in the down and locked position, and the speed brakes would go to the full open position. If the gear wasn't down all the way the speed brakes should have been limited to less than 43 degrees. The aircraft came around and the pilot set up to catch the barrier. As he landed, he caught the bi-directional hook BAK-12B approximately two to three feet off the ground and at 148 knots, resulting in a hard landing. Luckily, the barrier stopped the aircraft and the landing gear stayed down and locked.

Now, what caused this hard landing, besides the pilot? Let's go back seven days earlier to the aircraft wash. The landing gear downlock switches, are protected with paper during the wash, but during the process the high-pressure hose was directed at the landing gear. Where do you think the water ended up? After the mishap, maintenance checked the downlock switches, and they were somewhat surprised to find moisture in the switches. They also discovered two broken wires on the right main landing gear and the uplock/downlock circuit breakers open. After fixing the wires, drying out the switches and resetting the circuit breakers, the aircraft checked good.

There is a caution in the wash tech data that states, "Do not direct high pressure hose into the main landing gear wheel well area or damage to electrical connectors in the main gear wheel well *will* result." This incident is proof that the caution was put there for a good reason! Once again the book is there to prevent mishaps. All we have to do is follow it.

B-1 Pops the Tops

A B-1 was parked on the ramp minding its own business with some troops working on it, and the next thing people knew, the pilots' and defensive system operator's (DSO) hatches were jettisoned. The pilots' hatch landed 55 feet aft and left of the nose gear, and the DSO's hatch landed aft and left of the tail by 41 feet. Bet that got a lot of people's attention real quick!

Now, how do you pop the tops on a B-1? In this case there were several factors that came into play.

- The crew chief involved had received his initial training almost ten months prior to the incident, and the training was an HTML PowerPoint presentation that covered the hatch jettison system.
- The training course does not have a direct link to a good picture of the system.
- Part of the training consisted of computer aca-

demics and used scanned photos of the system, and this is mandatory training for all personnel.

• There is a cockpit mock-up of the aircraft, but this is usually used for egress technicians, not the crew chiefs.

• The crew chief received his Able Chief course training eight months prior to the incident, and during the training they did not have access to a real aircraft, as none were available. Basically he didn't get a chance for hands-on training on where the pins go and how the handle looks and works.

• The students are taught where and why the handles are where they are, and why they need to be safed.

• The aircraft that popped the top was undergoing some maintenance that included a window change and an engine run for a bleed air problem.

• The T.O. required that the pins be pulled during the engine run. The engine run and a subsequent refueling were accomplished with no problems.

• When the aircraft was safed after the engine run, the hatches decided they needed to go away.

How good is your training program and are the people dealing with the aircraft qualified to perform the task at hand? We have a young workforce, and experience only comes with time. We need to ensure that troops who are unsure or whose training may be a little less than required, are qualified to perform the assigned task without supervision.

How Do You Test The Engine?

An E-8C had a writeup in the forms for "number one and four engines require an EGT check on next engine run." The aircrew that came out to fly the aircraft were asked to do the engine run prior to takeoff. Great ops maintenance interface! During the engine run, the engines produced normal indications, and the crew signed off the writeup in the forms and took off. The FE noticed that the number four engine EGT climbed to 590 degrees, and they performed an emergency shutdown of the affected engine. The crew dumped fuel and returned to where they started.

Here we have an expensive training mission that must be flown again. For what reason? The initial writeup for the engine run came from the previous sortie when the crew wrote up that the number four engine EGT approached the overtemp limit. Maintenance performed a Jet-Cal check of the system and found the gauge to be reading 20 degrees Celsius high. To verify the system, they removed the indicator from the number one engine and checked it on the number four system during an engine run. After verifying that the number four indicator was high, they reinstalled the number one indicator back into the number one position and installed a new indicator in the number four system. A writeup was then entered into the forms that both engines required an engine run before flight. Now, T.O. 1E-8C-2-77JG-00-1 requires that an operational check should be performed using the Jet-Cal analyzer. Due to the time crunch to launch this aircraft, they asked the aircrew to perform the engine run instead of using the Jet-Cal analyzer. The crew ran the engines, and the rest is history.

Another example of where we took the shortcut to meet a deadline and didn't get anywhere. The aircraft didn't meet its mission, and we had a bunch of extra work to do after the mishap. Had the crew taken the time to perform the Jet-Cal test, as the tech data required, the mishap never would have happened. I know the Air Force is busy, but do we have to make more work for ourselves so often?

A Sparky F-15

An F-15 was prepared for a normal 1v1 basic fighter maneuver flight, and all preparations were normal. Once the pilot was onboard, things went great until the right Multi-Function Display (MFD) became unreadable. The pilot informed the ground crew, and a red-ball maintenance team was called to troubleshoot the problem. The team showed up, and after discussion with the pilot, it was determined that the MFD processor (MFDP) had failed and needed to be changed. Following the red-ball checklist, the pilot shut down the left engine and pulled all the applicable circuit breakers for the MFDP. The expeditor brought the replacement part and the ground crew went about changing the part. The next thing that happened was the pilot shutting down the engine and ground-egressed the aircraft. They had to take one of the workers to the emergency room for treatment after he received a shock from the aircraft.

How did a worker receive a shock during normal red-ball maintenance that was following the checklist? In this case, an after-the-fact inspection of the aircraft found no evidence of shorted wires on the MFDP. They did find shorted wires on the radar unit wire bundle that sits behind the MFDP. The wire bundles were chafed due to the frequent removal and installation of the MFDP. Over time, the insulation had broken down and allowed a path for 115 Volt 3 phase stray electrons to reach the MFDP when it was installed. Luckily, the maintainer was only disoriented and had to spend a couple of days on quarters.

We must always be ready for the unexpected. Here was a case where a worker could have received a life-ending shock, but we were lucky. Make sure when you are changing a black box that you take a few seconds to look around for things that aren't right…like chafed wire bundles!

USAF Class A Flight Mishaps

FY03 Flight Mishaps (Oct 02-Sep 03)

27 Class A Mishaps
10 Fatalities
20 Aircraft Destroyed

FY02 Flight Mishaps (Oct 01-Sep 02)

35 Class A Mishaps
22 Fatalities
19 Aircraft Destroyed

18 Oct	✈	A TG-10D glider crashed during a student sortie.
24 Oct		An F-15 experienced an engine failure during takeoff.
25 Oct	✈✶	An RQ-1 Predator crashed during a training mission.
25 Oct	✈✈	Two F-16s collided in midair during a training mission. One pilot did not survive.
13 Nov	✈	An F-16 crashed during a training mission. The pilot did not survive.
04 Dec	✈✈	Two A-10s collided in midair during a training mission. One pilot did not survive.
18 Dec		Two F-16s collided in midair during a training mission.
20 Dec	✈	Two T-37s collided in midair during a training sortie.
02 Jan	✈✶	An RQ-1 Predator crashed during a training mission.
26 Jan	✈	A U-2 crashed during a training mission.
06 Feb		A manned QF-4E departed the runway during takeoff roll.
11 Feb	✈✶	A QF-4 drone crashed during a landing approach.
13 Feb	✈	An MH-53 crashed during a mission.
08 Mar	✈	A T-38A crashed during a training mission.
17 Mar	✈	Two F-15s collided in midair during a training mission.
19 Mar	✈	An MH-53 crashed during a brownout landing.
19 Mar		A T-38 crashed during a runway abort. One pilot did not survive.
23 Mar	✈	An HH-60 crashed during a mission. All crewmembers were killed.
31 Mar		A B-1 received damage during weapons release.
16 Apr		An F-15 experienced a single-engine failure inflight.
21 Apr		A C-17 suffered heavy damage to the MLG during a landing.

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02 May		A KC-135 experienced a birdstrike during landing roll.
22 May		An MH-53 suffered severe damage to the main rotor system.
29 May	✈	An F-16 crashed during takeoff.
04 Jun	✈	An F-15E departed controlled flight and crashed.
10 Jun	✈	An F-16 crashed during a training sortie.
12 Jun	✈	An F-16 crashed during a training sortie.
13 Jun	✈	An F-16 crashed during a training sortie.
16 Aug		A T-1 departed the runway.
09 Sep	✈	An F-16 crashed during a training sortie.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF military fatalities.
- ”✈” Denotes a destroyed aircraft.
- “✶” Denotes a Class A mishap that is of the “non-rate producer” variety. Per AFI 91-204 criteria, only those mishaps categorized as “Flight Mishaps” are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A “Flight-Related,” “Flight-Unmanned Vehicle,” and “Ground” mishaps that are shown here for information purposes.
- Flight and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html.
- **Current as of 12 Sep 03.**

DRESS SMART

THINK SMART

WORK SMART

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. . . . . TO BEAT THE PROBLEMS OF WINTER.

Cold should be respected for the havoc it can wreak, but your learning and experience will overcome any maintenance "curves" that Ol' Man Winter hurls.

The more things change...the more they stay the same.