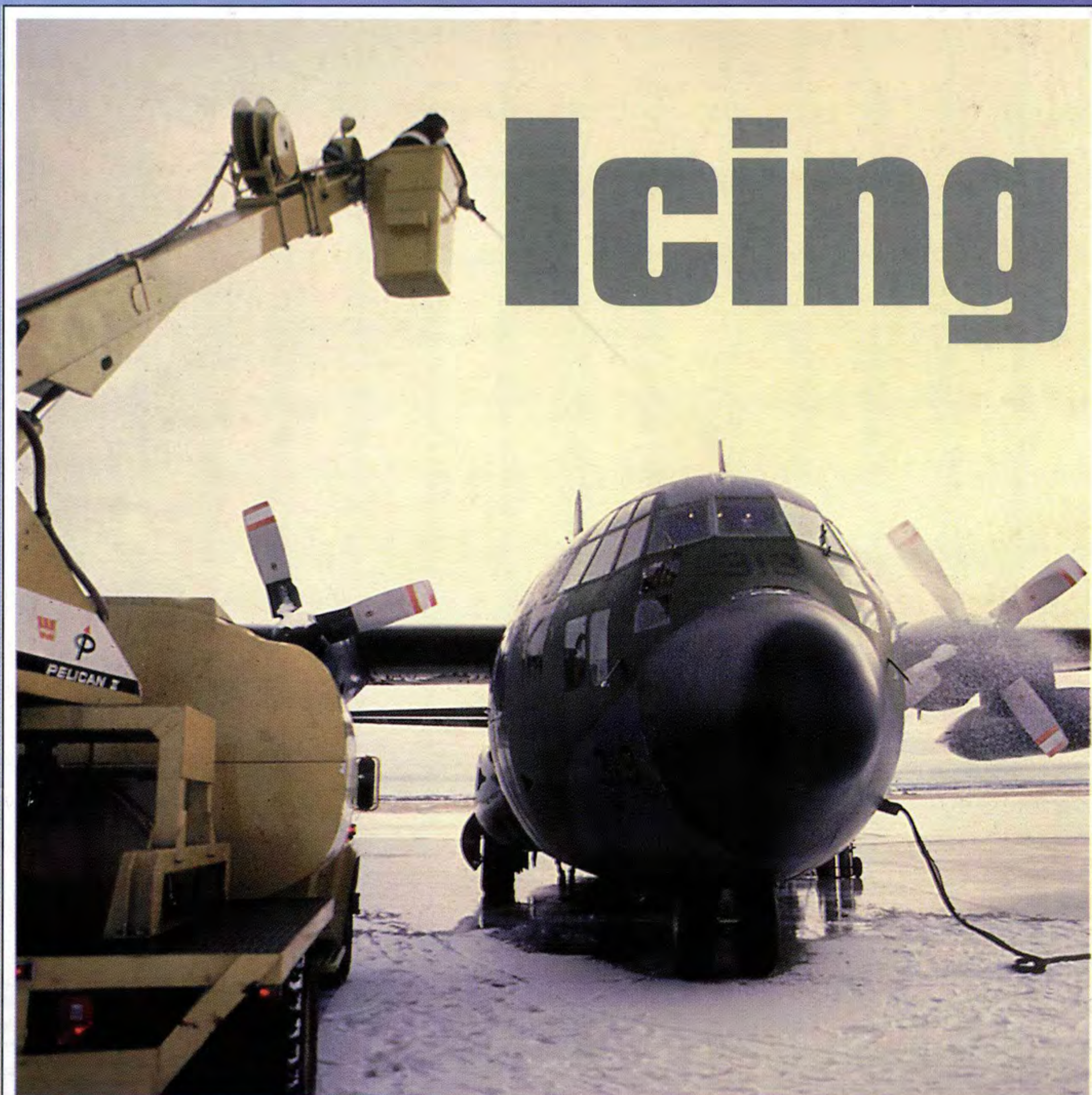
Flying Safety

OCTOBER 1997

The Issue:



Unbalanced Bays

Official USAF Photo by SSgt Greg Sukay

MAJ JEFF THOMAS
HQ AFSC/SEF

Over the years, KC-135s have experienced numerous instances of uncommanded rotation on initial takeoff during winter months. The common thread in these incidents was found to be the balance bays forward of the elevators were contaminated with ice and/or snow. In all instances, aircrews were fortunate enough to safely recover the aircraft.

In one incident, at approximately 110 knots (30 knots below rotate speed), the aircraft nose began to rise. Despite the pilot's full nose-down inputs on the yoke and full nose-down trim, at approximately 115 to 120 knots, the aircraft became airborne. The aircraft continued to accelerate, and the nose continued to track upward to 30 degrees nose high. At approximately 180 to 190 knots and 2,000 feet AGL, the pilot reduced power and successfully recovered to level flight. A controllability check with flaps 50, gear down, revealed limited nose-down pitch authority. Using flaps 50 and 2.5 nosedown stab trim, the crew landed the aircraft safely. Bet that was an exciting debriefing!

This event, in concert with other uncommanded rotations during KC-135 winter operations, highlights the need for aircrews to better understand the function of the elevator balance bays and be able to answer the question, "What can I do to keep this from happening to me?"

In a nutshell, the balance bays at the leading edge of the elevators contain balance panels which are attached to the elevator's leading edge. In high-speed subsonic flight, airloads are too great for the pilot to move the elevator solely by control tabs. The boost required is created by the balance panels.

The KC-135 has five balance panels per elevator. These panels are hinged to the elevator and operate inside the structure of the horizontal stabilizer. Without being overly technical, deflection of the control surface (elevator) creates a pressure differential that increases pressure on the side of the control surface getting deflected into the airstream while the opposite side has a decrease in pressure. Increased pressure on the elevator is transmitted through cavity vents at the leading edge of the elevator into the balance bays which "pushes" the balance panel into the low-pressure portion of the bay and reduces the force required to deflect the control surface. Simple enough, right? See figure 1.

Problems occur when ice or snow is introduced into the balance bays. The Dash 1, Chapter 7, states "Any ice or slush in the balance bay could possibly limit control surface movement and reduce aircraft control." This situation would be noticeable during the flight control check ***IF*** restricted movement was encountered. This fact

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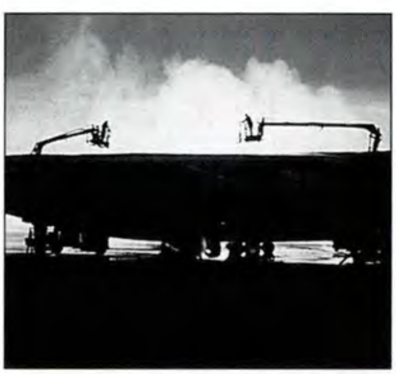

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SPECIAL FEATURES

Front cover: official USAF photo

CONTRIBUTIONS

Contributions are welcome as are comments and criticism. No payments can be made for manuscripts submitted for publication. Call the Editor at DSN 246-0936 or send correspondence to Editor, *Flying Safety* Magazine, HQ AFSC/PA, 9700 G Ave., S.E., Ste 282, Kirtland Air Force Base, New Mexico 87117-5670. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning.

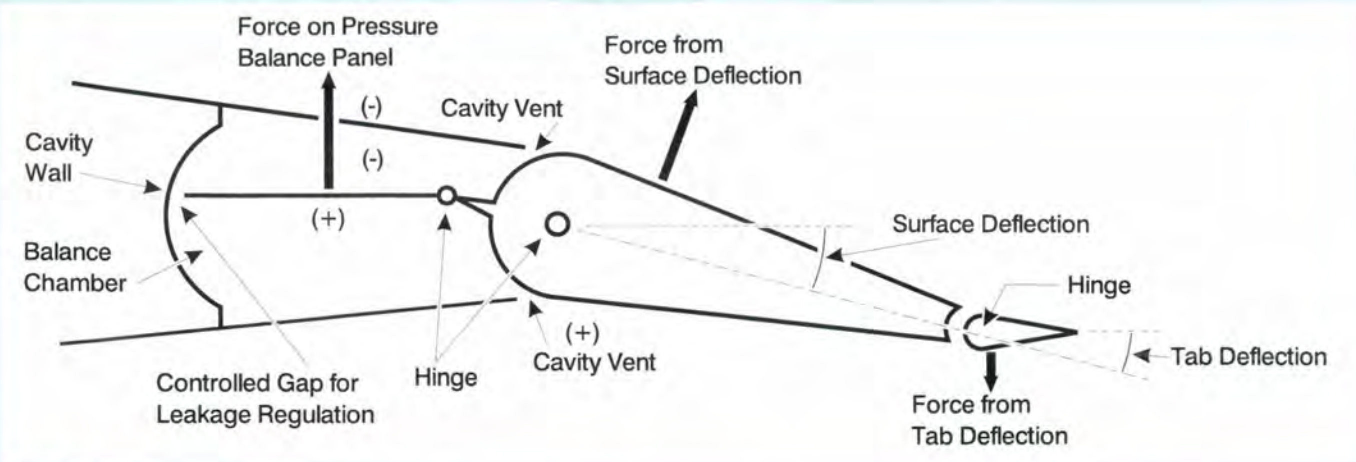

Figure 1

was verified in another KC-135 uncommanded winter rotation incident where the crew noticed during taxi-out the elevator response was different from normal as full forward elevator was more difficult to obtain. The aircraft commander and instructor pilot discussed the abnormal elevator feel and agreed the aircraft was acceptable. The result—an uncommanded rotation approximately 40 knots below rotation speed!

Not only are the balance bays themselves susceptible to contamination, but the venting gaps between the interior of the horizontal stabilizer and the balance panels could be blocked by ice and snow accumulations. On the ground, it would be possible to have a satisfactory flight control check despite the presence of snow or ice blocking the vent. The insidious nature of this discrepancy would ***NOT*** become evident until well into the takeoff roll.

Normally, setting the stabilizer trim for takeoff places the stabilizer leading edge slightly down (i.e., nose-up trim). As the aircraft accelerates, airflow over the bottom of the horizontal stabilizer will be faster than across the top. This causes the elevator to move up and the yoke to move aft (countered by holding the yoke forward during the takeoff roll).

When undetected ice or snow is present, the gap between the elevator and the balance bay could be blocked, increasing the downward force on the balance panel as the elevator deflects upward, forcing the elevator to the full up (yoke aft) position. Simple enough, right? The result is an inadvertent, uncommanded early rotation and the possibility of an excessively high climbout or even a stall. From this discussion, it's easy to see that contamination in the balance bays may go unrecognized during flight control checks depending on the location of the contamination. Bottom line: Don't rely on limited flight control movement to tell you your balance bays are contaminated.

If you find yourself in the situation of being prematurely airborne, you can retrim electrically with the stab trim thumb switches against any amount of stick forces up to a speed of approximately 200 knots (according to the October-December 1983 Boeing Service News). However, even with the ability to trim full nose down, the aircraft will still require an excessive amount of forward yoke due to the new "neutral" trim position of the elevator with the displaced balance panel. Large elevator deflection (stick forces) at speeds above 200 knots will likely "stall" the trim motor, rendering it useless to help control a pitchup. Use of split spoilers may be helpful in this situation.

Place yourself in the situation of the aircraft inadvertently pitching up and becoming airborne…you've reached the end of the nose-down trim limit capabilities and yoke travel…you want to lower the nose using split spoilers…which spoiler switch do you cut out? Time's up!

Cutting out the outboard spoiler switch (right-hand switch) and using the speed brake lever to raise the inboard spoilers will help control an excessive, on-the-verge-of-stalling climbout attitude. However, the mechanics of cutting out the outboard spoilers and raising the speed brakes may be difficult with both the pilot and copilot holding the yokes full forward with elbows most likely locked.

How can we prevent becoming the next KC-135 inadvertent winter rotation incident? The Dash 1 states, "Under conditions of blowing snow or where the airplane has been exposed to unusual freezing conditions that require the use of deicing fluid…or heat on the exposed surfaces, the control surface balance bays shall be visually inspected for evidence of snow or ice accumulations."

If the weather has been such that ice/snow contamination of the balance bays is possible, ask the crew chief if the balance bays have been inspected. If not, request it be accomplished. Better yet, if you are so inclined, climb up on the stand with the crew chief and inspect the drain holes on the bottom of the horizontal stabilizer in the areas of the balance bays. Any ice or blockage of the drain holes should be further investigated. While on the stand, grasp the trailing edge of each elevator and move the control surface through full travel to ensure freedom of movement.

If contamination is found, it can be removed one of

Figure 2

two ways. Undiluted hot glycol (glycol diluted with water is deicing fluid and could refreeze in the balance bays if used) can be sprayed in the balance bay area to remove snow and ice.

The second option (the one most likely to be used by maintenance) is to use a ground heater. This should be accomplished with care because the temperature is often difficult to control, and the aluminum structure and honeycomb can be damaged or weakened by excessive heat. In addition, if heat is not applied long enough, the obstruction can be aggravated by turning powdery snow into ice or wet snow—a Catch-22 if improperly performed. Additionally, failure to properly set the stab trim (full up) and elevator (full down) prior to deicing can introduce contamination into the balance bays as illustrated above. See figure 2.

Proper positioning of control surfaces will prevent the runoff from deicing operations from seeping into balance bay areas and refreezing. Also, ensure deicing is accomplished from the leading edge of control surfaces to the trailing edge. This will prevent fluid runback into the balance bays.

Think you've covered all the bases? Place yourself in a scenario where the weather's clear and it hasn't snowed in several days. Ask the crew chief when the aircraft last flew and if the balance bays have been inspected recently. In several of the recent incidents, the aircraft had been exposed to a snowstorm several days prior and had not flown since. The temperature had not climbed above freezing, and snow was still packed in the balance bays. If in doubt, ask the crew chief to inspect the balance bays. Remember, the best surprise when it comes to gambling with your life is no surprise! ✈

Flying Safety

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Does "Bold" N

LT COL GREG ROGGE
301 FW/AFA

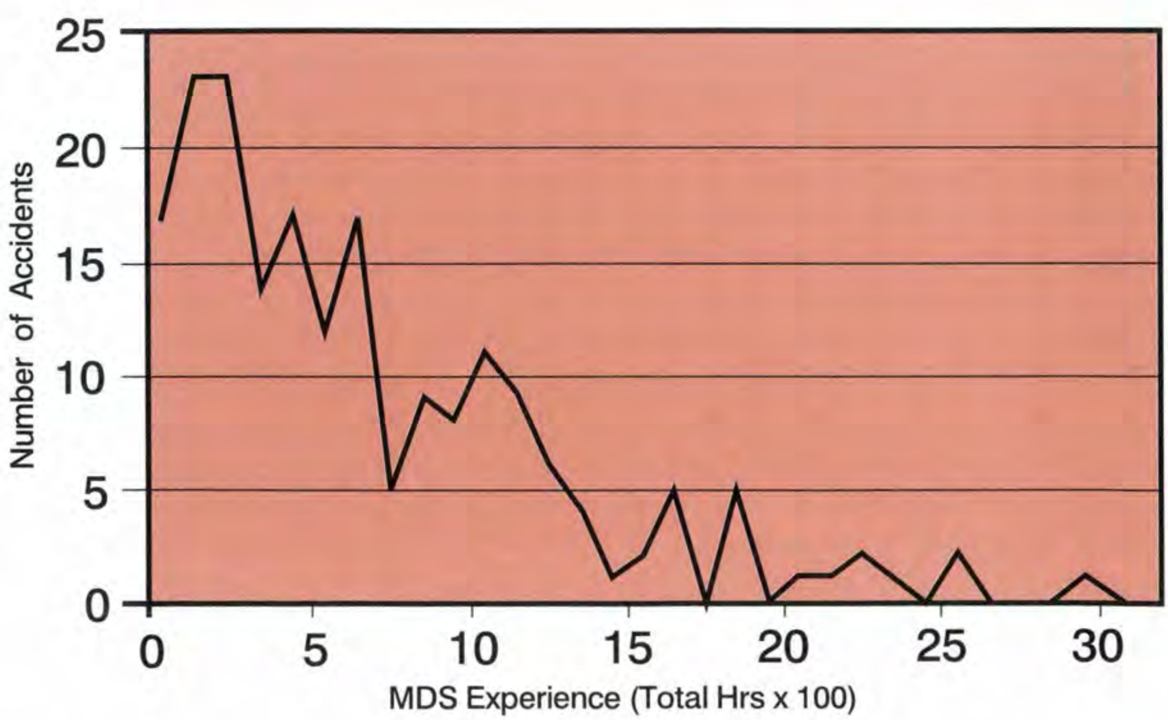
At the bar, one evening long ago, where the war stories were about South*east* Asia and the songs were X-rated, a proverbial crusty old safety officer was waxing philosophical. It was his opinion that one of the most dangerous pilots around was an experienced fighter jock who had just transitioned to a new aircraft. He based this on friends lost flying Rhinos and SLUFs after years in Huns and Thuds. I heard the same thing on other occasions, but I was too busy building the experience to be a "bold" pilot to worry about that day in the hazy future when I might be an "old" pilot.

Well, the young guys now tell me about South*west* Asia, and we don't sing much, so I guess the hazy future is here. A recent TDY to the Safety Center at Kirtland AFB got me thinking again about what I was told long ago—that total fighter experience was less important than time in a particular aircraft when it came to being a safer pilot. I asked if any studies had ever been done on this and was told, yes, they had, but none of the studies could immediately be found. So at the risk of rehashing what's probably been done before (and probably done better), here is my cut on the subject.

From a database provided by HQ AFSC/SEC, I created two charts. The first chart plots the number of fighter/attack/reconnaissance (FAR) ops mishaps for FY87 to FY95 versus pilot experience in hundred-hour increments. I cut off the data at the 3,500-hour mark for three reasons. One, to make the graph fit on the page; two, the mishap rate levels out (but doesn't disappear) past this point; and third, with current budgets, not many of today's jocks are going to exceed this experience level.

As you can see, the graph shows a lot of spikes. The first big one is in the 300- to 500-hour range. No surprises there—these are the young, inexperienced guys (and now gals) you'd expect to be at higher risk. The mishap rate then goes down as you pass the 500-hour "experienced" definition—no surprise either. What is surprising is the data starting at the 1,200-hour mark. There are lots of peaks and valleys, but the overall trend is upward to the next highest peak around the 2,000-hour mark. The trend more or less starts back down at this point, although whether due to more savvy pilots or less pilots around with 2,000+ hours is hard to say.

So how do we explain these "trends"? As a non-statistician, I'll make an intuitive leap and say confidence—or,



...ot Equal "Old"?

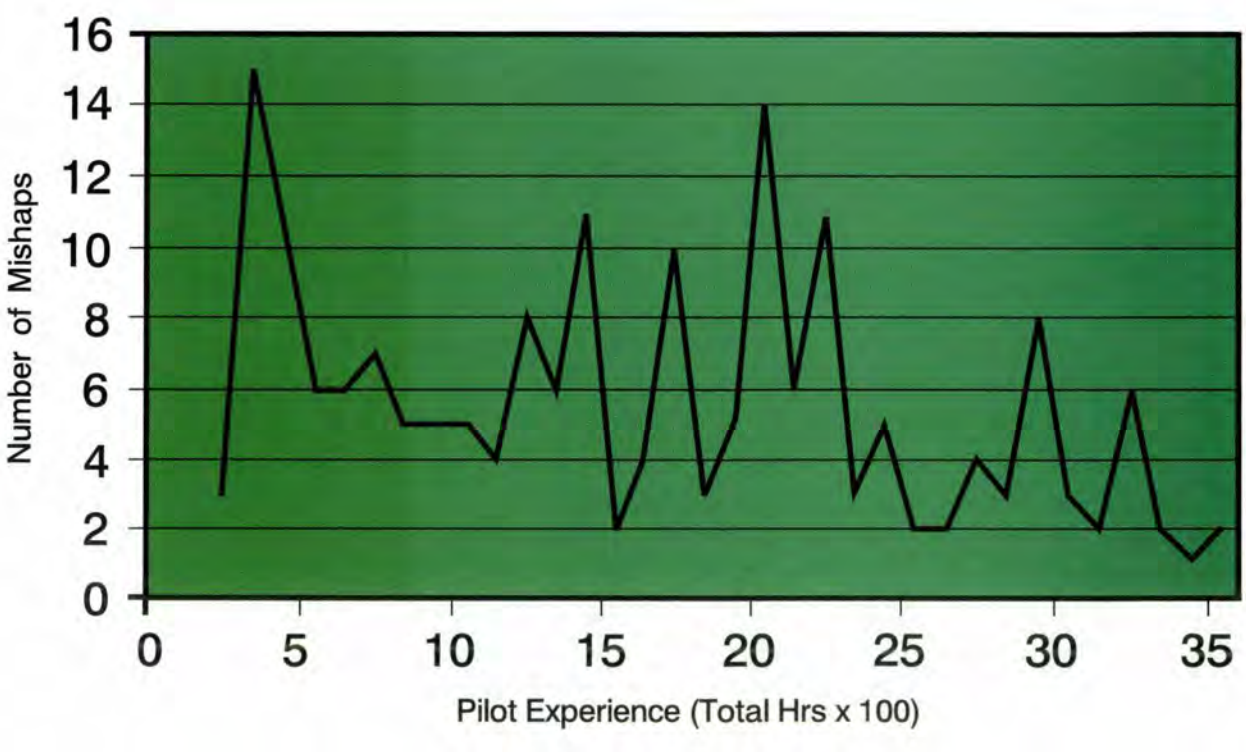
rather, overconfidence—is one reason. My first operational tour was in USAFE. While keeping the Godless commie hordes at bay, it was the IPs and supervisors that were putting smoking holes in the European countryside and not the first lieutenants like myself. A common thread among these and other mishaps seemed to be a "seen this before, hacked this before" mentality. One would expect this mentality to be more prevalent in the elder craniums than in the young troops.

One area where the skill and cunning of experience does seem to translate into safer flying is in total time by type. The next chart shows the number of mishaps versus flying time in that particular aircraft. As you get to the 300-hour point, the mishap rate starts down. Except for a small hump around the 1,000-hour mark (I wonder if getting that 1,000-hour patch causes a temporary return of the specter of overconfidence), the rate approaches zero around the 2,000-hour mark.

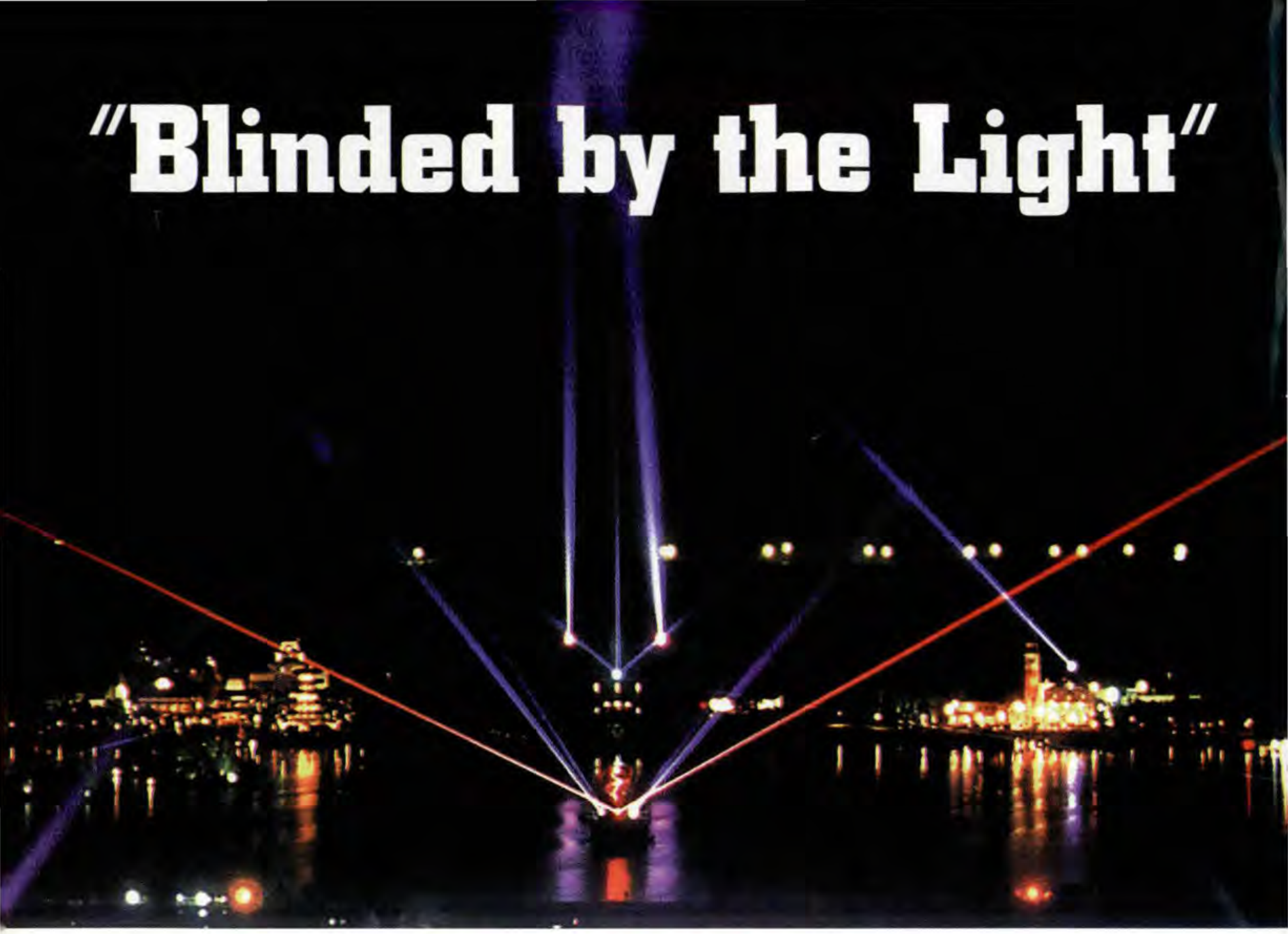
Okay, fellow prognosticators, why do you think this is? Yeah, I know, by the time you do an Alpha, staff, and other "career broadening" tours, it's tough for active-duty folks to get much over 1,000 hours in one aircraft type, so there aren't as many guys at this level to bust their posteriors. But another reason might seem to be that experience in a specific aircraft's systems and missions truly does make one a safer pilot. (Note I said "safer" and not "perfectly safe." One "data point" off the scale I used was a fatality with 2,069 hours in type and 8,100 hours total.) On the other hand, feel free to use this article to explain to your new wing king (with a bunch of fighter hours but few in your unit equipment) that he needs extra supervision.

So what's the bottom line for the elder craniums out there? The old saying about there being "no old, bold pilots" has some—but not total—validity. One of the things that keeps flying fighters interesting is that every mission is different. Each flight has a unique mix of weather, configuration, aircraft weight, wingman experience, target sets, and so on. To help us assess the risks of each sortie, we access those brain cells labeled "experience."

However, experience must be compared to the situation facing you today. If you assume the eye-watering maneuver you're about to do will work today because it worked in a previous aircraft in another theater, you may end up as a data point in these graphs. Apply your experience conservatively, set a good example for the young guys, and you will end up as an old, bold pilot. ✈



"Blinded by the Light"



An Old Song With New Consequences

DOUGLAS J. FREY, SETA TEAM
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The experienced commercial pilot scanned the sky ahead as he reached 5,000 feet during takeoff from McCarran International Airport near Las Vegas. Without warning, he was startled and distracted by a bright green light. Momentarily blinded, he realized he could no longer safely control the airliner. Instantly, he called on his copilot. "Take the controls—I can't see!" Fortunately, the copilot had been looking away when the light passed through the plane's cockpit. While the passengers were unaware an in-flight emergency had just occurred, if the copilot had been glancing in the same direction as the pilot, the result could have been disastrous.

From 1993 to 1995, there were more than 50 laser incidents reported by military and civilian pilots flying near Las Vegas. Similar incidents have occurred at other facilities that are close to outdoor laser light shows or near major tourist sites using lasers to attract attention. In December of last year, for example, the pilot of a Delta flight inbound for a Florida airport was temporarily blinded by a beam from a spectacular outdoor laser light show that was entertaining thousands.

Powerful lasers can cause irreparable eye damage. Scientists have developed procedures that establish minimum safe distances to prevent injuries, and the Federal Aviation Administration has established eye damage hazard zones for outdoor laser shows. Unfortunately, staying beyond this Nominal Ocular Hazard Distance (NOHD) does not solve all the safety problems for pilots. The glare and flash-blindness danger presented by entertainment (laser light shows) and commercial promotion lasers extends far beyond the established NOHD. If a pilot cannot safely control an aircraft because of momentary blindness caused by glare and flash-blindness, there may be much more than damage to one set of eyes involved—lives could be in jeopardy.

The Air Force predicted these problems years ago and began to explore laser exposure hazards and establish laser safety standards. The Optical Radiation Division of Armstrong Laboratory at Brooks AFB, Texas, is the leading Department of Defense element in this area, providing laser safety information to government and civilian agencies for years. In late 1994, the Air Force formed a Tiger Team under the direction of the Flight Standards Agency to address the flight hazards posed by commercial laser light shows. The Tiger Team faced two key challenges: Quantify the flight hazard distances upon which the controlling agencies could base regulatory controls, and develop methods to educate military and other aircrews to the growing flight hazards associated with lasers. As an immediate result of the team's efforts, laser hazard information is being developed for pilot refresher courses, and outdoor commercial laser show information was included in the military NOTAM system.

Because of their laser expertise and experience, Air Force scientists and engineers from the Optical Radiation Division were asked to join the Society of Automotive Engineers (Aerospace Council) G-10 Committee, the Washington DC-based group that has been charged with resolving laser dangers to flight safety. As an interim measure, the committee has prepared a safety video script and coordinated with Walt Disney Studios for production assistance.

Meanwhile, the Federal Aviation Administration has been working with the airline industry and with laser light show presenters to come up with a solution that will be satisfactory for all interests.

"If some of the previous illumination incidents had happened to pilots of single-seat aircraft, the results could have been disastrous," said Lt Col Leon McLin, cochair of the G-10 Committee and a researcher at the Brooks AFB laser lab. "What we want to do is take steps to minimize the risks to flight operations while still making the use of laser technology available to promoters and entrepreneurs."

McLin added that the people who put on laser light shows for a living have been generally cooperative and helpful in the efforts to protect safe flight operations. He warns, however, that serious laser flight hazards still exist. "The FAA considered restricting the output power of the lasers used by promoters, but instead established areas around active runways where promoters must adjust the laser output intensity of any beams that might enter those areas and present a flight safety hazard. These laser protection zones reduce the dangers presented by unintentional exposures that could result in glare and flash-blindness."

As the various agencies work to decrease laser flight hazards, it is imperative that all cockpit exposures get reported. Although there is little chance of permanent eye damage beyond NOHD warning distances, notify your local flight surgeon of any laser incidents. The flight surgeon can coordinate with bioenvironmental engineers and with the laser lab at Brooks AFB to report safety issues and verify exposure limits. Report any incidents of possible laser exposure to your flight safety office.

Laser light shows are proliferating at an astounding rate. Technology has given us a new way to entertain and attract attention. Unfortunately, these "happy" beams could prove deadly for air traffic. Especially in single-seat cockpits, these beams could put lives in jeopardy!

The possibility of laser exposure during flights is real. "The idea of flying blind during high-risk activities such as takeoff and landing is frightening. To lose a pilot or commercial air carrier because of exposure to a spectacular beam of light that was intended to entertain thousands would be a tragedy," said McLin. "We've been lucky, so far." ✈

Editor's Note: There is also a Laser Safety Consultation Team at Brooks that can respond to most questions about the safe use of lasers in the Air Force. They can be reached at 1-800-473-3549.

Am I Ready to Fly?

Here are some thoughts from an attached F-16 pilot on mentally preparing ourselves every time we fly.

USAF Photo by SSgt Steve Thurow

MAJ RICK "MOSES" BURGESS
31 FW Chief of Safety
Aviano, Italy

For months the 31 FW at Aviano had a special interest item on "personal readiness to fly." We recently received an interesting briefing from Maj (sel) Tracy "Lilith" Dillinger, the 31 FW Flight Psychologist. She talked about our Personal "ACES" Preflight, or how we get ourselves ready to fly.

It hit home with me, especially now that I'm a member of the leper colony as an attached weenie. Specifically, it made me realize how differently I have to prepare myself to fly now that I spend more time pushing papers from one side of my desk to the other than I do reading 3-1 or talking about Viper vs. Fulcrum visual merges. My thoughts here may apply to you if you're a fat-bellied attached field grader like myself or a hair-on-fire lieutenant whose only additional duty is not letting the refrigerator go empty. We all have to get ourselves pumped and focused to fly fast, break, and kill things.

Capt Dillinger used the acronym "ACES" to highlight four areas which affect our readiness to fly. ACES stands for *affect, cognition, environment*, and *somatic*. Of course, if you can't remember acronyms any longer, you're really headed downhill.

The one thing I most remember her talking about was compartmentalization. We've all heard for years that pilots have a great ability to put pieces of our lives in small containers and reach into them and grab the applicable portions as we need them. Once we hit life support, zip up our G-suits, and step to the jet, our son's expulsion from school or the car's "strange grinding noise" doesn't seem to matter anymore (at least until we return to life support in a few hours). World War III could be happening around us and we wouldn't care (except that we want to be right in the thick of it with live GBUs, Mavericks, Slammers, and a hot gun). But I've found that I compartmentalize differently now that my "real job" requires me to spend a lot of time and brain cells thinking about things that have nothing to do with flying or employing the jet.

Before I moved from being a squadron Assistant Operations Officer (ADO) to my present job as Chief of Safety, I knew everything that was going on in the squadron—who was on what upgrade rides, who was flying with the two-star, who was at the sim in Ramstein. Just by being in the scheduling shop or sitting around the weapons shop, I was constantly surrounded by discussions on when to do a vis bracket on an aware bandit or the advantages of a level versus a diving CCRP self-lase delivery.

But now I spend most of my time worrying about terms I couldn't even spell 3 months ago, like NSI, EPR, EMR, NEW, QD, etc. When I moved into this position, my predecessor called it right (almost). He said about 80 percent of my time would be taken up dealing with ground and explosive safety issues. Well, try about 95 percent. As I'm writing this, we're in the midst of our INSI (Initial Nuclear Surety Inspection). The last 2 months have been nonstop dealing with explosive site plans, electromagnetic radiation hazards, net explosive weights, and the famous 101 Critical Days of Summer campaign.


USAF Photo by MSgt Perry J. Heimer

What's my point? I could spend 7 days a week, 12 hours a day, trying to be the best Chief of Safety in the Air Force, do trend analyses and risk assessments on everything from the BX to the flightline, and never get near a cockpit. But fortunately for me, I still get to fly. I want to fly. I must fly!

However, I'm finding my ability to auto-switch my brain from queep to a 2 v 2 ACT mission is not what it used to be. I cannot work for hours or days on some critical weapons safety issue and then expect to be full-up ready to give a 9-G BFM brief in 30 minutes. I now need more time to get ready to fly. My "ACES" personal preflight now takes me longer to accomplish. Here are some things I now do when I'm fortunate enough to fly my one sortie of the week whether I need it or not.

◆I go into the squadron much earlier to get the "admin" stuff signed off. I used to sign off the FCIF or Read File about once every four or five sorties. Now every time I walk into the squadron to fly, I have a list of about six letters (S, SE, F, C, L, P) next to my name on the board of things I need to do before they'll trust me with a jet. It's amazing! The ratio of sorties I fly to the CAPs (critical action procedures) I fill out is now about 1:1. That's pretty bad.

◆I force myself to go into the squadron just to read the 3-1 or some new *Weapons Review* article or the ALR-56 manual. "Was it skate or banzai?" "Do I load the DTC first and then turn on the ALE-47, or the other way around?" "Does MAR mean I can still pitch back in after a merge abort, or was that MOR?" I used to know these things. Now the checklist I carry to the jet (where I write things down I used to know by heart, like how to start the engine) is the size of a Webster's dictionary.

◆I force myself to focus only on flying when I'm in the squadron. I used to have a "bubble" of about 30 minutes, which means I wouldn't talk to anyone about nonflying stuff inside of 30 minutes to brief time. Now my bubble starts when I walk in the door of the squadron. I've told my safety staff that if they ever call me in the squadron, there had better be a mushroom cloud nearby.

◆And finally, I try my best to be at as many squadron pilot meetings, academic sessions, social get-togethers, and pick-up basketball games as I can. This is for my own sanity and gives me a good excuse to get out of the office. It helps me stay focused on the flying mission and the squadron so I can stay in touch with what's going on.

No matter what our "real job" is, or what additional duties we have, we all have figured out ways to compartmentalize our lives so we can fly with our minds on the mission. But as we get bigger around the mid-section and pick up more nonflying-related daily responsibilities, we need to concentrate harder on getting ourselves ready to fly and staying focused on the mission. Our ACES personal preflight may need some adjustments and may take a little longer than we'd like. That's okay. When we're strapped into the jet, rolling down the runway in full AB, no one will hear us screaming with laughter or realize our hair (slightly gray) is on fire again. ✈

Mr. FREEZE versus t

or The Icing Con

MAJ TIMOTHY H. MINER
HQ AWS
Directorate of Plans and Operations
Scott AFB, Illinois

From the dark corner of the cell in Gotham City's asylum, a large, silver-suited figure with blue florescence emerges with anger in his heart. His deep voice fills the movie theater. "I'm here to make your life hell. It's wintertime again." Fade to black. Roll the credits. And so ends another action-filled adventure movie in the summer of 1997. What fantasy!

Now for the reality of mid-90-degree temperatures in July outside the building. But before I get up out of the seat and free my feet from the stickiness of the theater's floor, I can't help but wonder how Mr. Freeze would have done against a couple of real heroes—a pair of Air Force pilots.

I wonder…

The Adventure Begins

…It was another dark night in Got-'em-seedy Air Base. Two green-suited warriors emerged from the shadows of the hangar and moved towards the newest piece of technology in the Air Force inventory. The air was cool and damp from the recent fall rains. Puddles of water dotted the tarmac.

"Ready to take it up again?" asked the older man. He was Maj Bruce Bashman, flight lead, and a super pilot.

"You bet," snapped back his pimple-faced sidekick and WSO, Lt Robin Wonder. Lt Wonder was a recent graduate of WSO school. He preferred the name Robin, but ever since he met his squadron commander, who hailed from the South, he was known around the flightline as "The boy, Wonder!"

"Check out the environment on the monitor," Bashman advised.

Robin came back from the remote-briefing weather monitor in the far corner of the mission planning room. "Looks good to me, Bashman!"

Twenty-five minutes later, at FL200, our helmeted heroes noticed a white substance on the outside of their winged machine. It seemed to grow rapidly with every passing moment, especially on the leading edge of the wings.

"Holey white coat, Bashman!" exclaimed the wide-eyed WSO. "What is it?"

"Looks like the work of our old archenemy, Mr. Freeze," Maj Bashman snapped back. "With winter just around the corner, he's up to his old tricks again. The craft needs more power to hold speed and altitude. We'd better head back now."

Icing Is No Piece of Cake

Back in the hangar, Maj Bashman led Robin to the monitor and pressed a button on the keyboard. "Robin, you missed Mr. Freeze's signs before the flight. I think you need 10 more hours of Annual Instrument Refresher Course training and a simulator. Watch this for now."

The face of the wise and faithful weather-flight commander, Capt Alfred, appeared on the screen. The wrinkled lines and the gentle, accepting eyes spoke of the years of experience and life-long dedication.

"He's the oldest captain I've ever seen," said Robin.

"Lots of prior enlisted time," was all Bashman said. Robin could see the admiration in Bashman's eyes.

Alfred began to speak.

"Mr. Freeze is one of the oldest archvillains of all super aviators. He has two weapons that must be carefully watched and planned for in order to neutralize his evil power. The first of these deadly devices is aircraft icing.

"Aircraft icing is what you encountered with Mr. Freeze tonight. Icing occurs when the surface of the aircraft has a temperature below zero degrees Celsius and there are liquid water droplets in the air at below-freezing temperatures—supercooled water droplets.

"Based on the temperature of the air you were flying through and the size of the moisture droplets Freeze was able to throw at you, I'd say he hit you with rime icing. Rime icing occurs usually in stratus clouds between the temperatures of minus 8 degrees Celsius and minus 10 degrees Celsius. But these temperatures are only a guide since it has been known to hit aircraft flying in outside temperatures between minus 2 degrees Celsius and minus 30 degrees Celsius. This icing is relatively easy to spot since it is rough in texture and milky opaque in color from air being trapped in rapidly freezing small water droplets."

Maj Bashman was over at the squadron refrigerator and opened up the top section. "This is a good example of the rime ice we encountered tonight," he said. The never-cleaned freezer was nearly choked with the white granular coating, permanently entombing a half-dozen Mexican TV dinners.

"Wholly enchilada!" exclaimed the boy, Wonder. "This Mr. Freeze is starting to leave me cold."

"Exactly the point," Bashman chimed.

Capt Alfred continued, "There are two other types of icing that Freeze could also throw at you. The most deadly is clear icing. You are most susceptible to this form of icing in cumulus clouds with their larger drops of water. Temperatures between zero degrees Celsius and minus 16 degrees Celsius are a good clue you are vulnerable. Since the larger droplets spread over the aircraft before freezing, this icing looks clear and glossy—a sheet of ice."

he U.S. AIR FORCE,
ieth Again, Man

Maj Bashman piped up, "Robin, I can see you understand clear icing. Your eyes are glazing over." The WSO blinked and sat up straight.

Alfred continued, "The final type of icing is mixed and consists of both rime and clear icing forming on the aircraft due to changing conditions in the flightpath.

"Icing is deadly for several reasons. It can change the shape of the airfoil of the aircraft. This increases drag and weight which raises the stall speed of the aircraft and decreases lift. In 1994, Freeze brought down a commuter aircraft that was holding in stratus clouds over Indiana in November. When the aircraft changed configuration, the aircraft stalled, killing all 68 people on board. But stalling isn't the only hazard. An aircraft's moving surfaces may also be affected by the icing. Fuel consumption increases in the icing environment. Helicopters are even more susceptible to icing's deadly impact because it can cause rotor assemblies to dangerously vibrate.

"The latest research from NASA and the National Center for Atmospheric Research (NCAR) shows Freeze's most deadly weapon to date—the Supercooled Large Water Droplet, or SLD. These very large water droplets, which can reach eight time the normal diameter, occur in temperatures from freezing to minus 8 degrees Celsius at altitudes with large amounts of liquid water content and some vertical motion to keep it aloft. Icing forms very rapidly under these conditions and will overwhelm any anti-icing capability, especially in lighter aircraft."

Robin was fully alert. "Wow, Bashman! If we make one slip on this icing, we could be in for a real fall."

"Exactly," was all his flight lead could say.

Alfred went right on with the presentation. "It's also important, young master Robin, that you also have information on frost crystal clear in your mind. This is the thin deposit of ice crystals from water vapor directly forming from contact with a cold surface. Although thin, this is one of Mr. Freeze's most sinister tricks since it impacts the wing's performance with as little as one-eighth of an inch of thickness."

Freezing Precipitation Isn't Very Sleet

"I mentioned there were two different weapons your enemy could rain at you. Besides in-flight icing, the second threat is freezing precipitation. This lethal winter weapon can create icing conditions in flight as well as endanger ground operations. It is important that you review the different types of freezing precipitation and know the conditions that create each type, be it freezing drizzle, freezing rain, snow, or sleet. Over a dozen airliners each winter run off of runways at major airports."

"That's a chilling thought!" exclaimed the young WSO.

"Exactly!" said Bashman.

Alfred added, "This then, gentlemen, is Mr. Freeze's potent arsenal of white winter worrisome weapons of wanton willful warfare."

The WSO sat speechless for a second, his thoughts frozen on all he had just heard and on all those W's in a sentence. "So how do we make things hot for Mr. Freeze, Bashman?"

"The best way to beat winter is to look for the forecasted hazards, watch for the signs in flight, and be prepared with options," Bashman said.

"So where do we begin to look for Mr. Freeze?" asked the young sidekick.

Capt Alfred took another deep breath and began, "Over eighty percent of icing encounters take place near frontal boundaries. This occurs because fronts tend to lift moisture aloft into colder temperatures where the air becomes saturated. This motion produces areas of supercooled water at altitude. Since fronts move and it's not always obvious where fronts are located, more aircraft have problems here than anywhere else. I want you to study diagrams one and two in the monitor so you will know where icing exists in warm and cold fronts."(See following page.)

"Holy angel food cake! These winter fronts are covered with icing," said Robin as he watched the monitors.

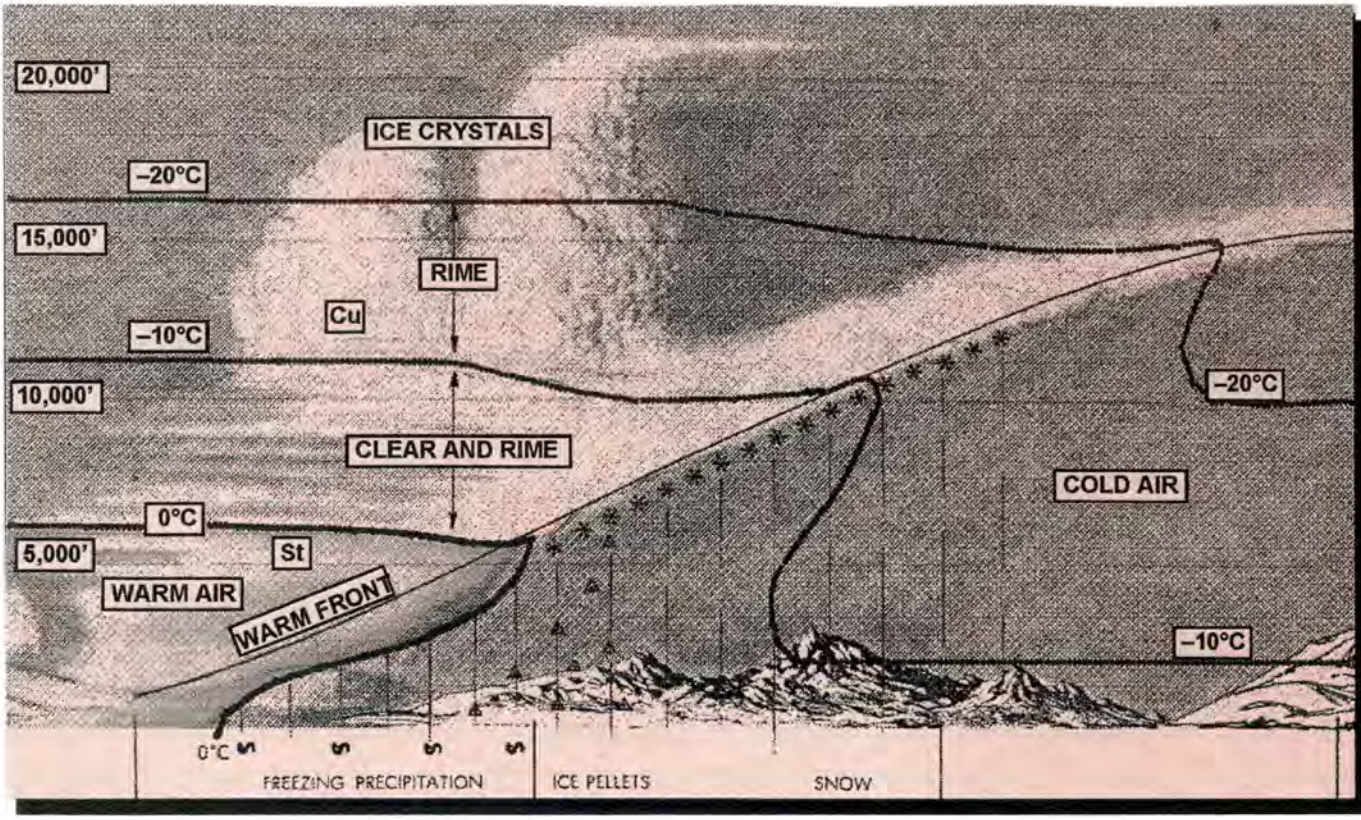
"Exactly!" said Bashman.

"Remember, young master," Alfred cautioned, "warm fronts with stable air will have large areas of icing while cold fronts will have a narrower band of the hazard. But fronts aren't the only places to look for icing. Look for icing anywhere moisture is lifted to colder temperatures at altitude. This will

continued on next page

Icing Type Forecasting

Temperature	At or In	Icing Type Forecast
Below-15°C	Flight Level	Rime
0°C to-8°C	Stable Strataform Clouds	Rime
0°C to-8°C	Cumuliform Clouds and in Freezing Precipitation	Clear
-9°C to 15°C	Cumuliform Clouds	Mixed (Rime & Clear)



include terrain-induced lifting or in cumuliform clouds.

"Mountain ranges tend to create upward motions sending lots of moisture to cooler levels of the atmosphere where it becomes supersaturated. Winter upslope fog and frontal passage over mountains can create really severe icing conditions.

"Icing is a hazard in every season within large towering cumulus and in cumulonimbus clouds. The greatest intensities are associated with updraft areas. Towering cumulus, just before changing to cumulonimbus, has most of its energy devoted to upward growth and provides the greatest likelihood of encountering Freeze's worst. In mature thunderstorms, the greatest area for icing is on the windward side in the updraft regions from the freezing level up. Dissipating cumulonimbus usually produce icing only in a narrow level near the freezing point."

"Hmm, icing is a hazard in column-shaped clouds. That's ionic (sic)," added Lt Wonder. "So what's in the arsenal to keep Freeze from serving us on ice again?"

"If you won't be needing me anymore, I will be off now, sir," Capt Alfred stated.

"Very well, Alfred, we'll see you next time," Bashman replied.

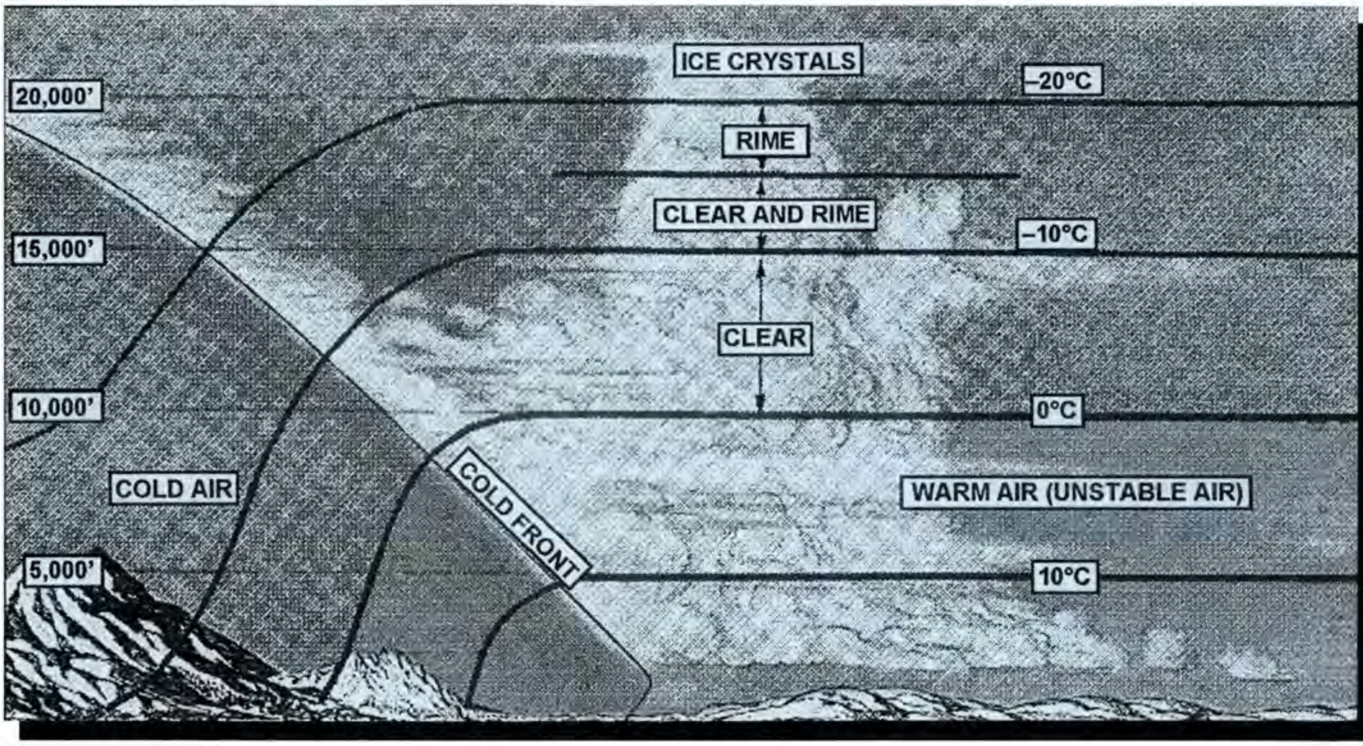
Happy Winter Wonder Landings

"Preparation is our key against Mr. Freeze, Robin. We need to get a thorough briefing on all potential hazardous winter weather along our route of flight. Air Force forecasters put out icing forecasts as part of their TAFs, and Air Force Global Weather Center identifies potential icing areas along our route of flight. The Aviation Weather Center in Kansas City puts out civilian forecasts for icing conditions."

Robin looked at the charts and said, "But Bashman, those warning areas are really large, that's not cool."

"You're right again, Robin. As late as this year, the civilian aviation industry identified the need to more precisely identify areas for icing as the greatest unmet challenge in aviation weather today. Researchers at NOAA and the National Center for Atmospheric Research are working to do just that. The key is getting data on the conditions that lead to icing formation. Researchers are putting humidity sensors onboard civilian aircraft hoping to gather data that will narrow the meteorological parameters we use to forecast icing conditions. Meteorologists are also using the weather radars to identify the freezing levels of the atmosphere and the areas of potential icing.

"However, PIREPs are still the primary source of icing verification, and all aviators need to report the hazard whenever they encounter it so that meteorologists can refine their forecasting techniques. It's important that we use the right terminology in our PIREP, too. Remember, 'light' is used to describe icing conditions where there will be a problem after about an hour of flight, but only occasional use of deicing and anti-icing equipment is necessary to remove any accumulation. 'Moderate' describes conditions where sustained flight would cause unsafe flight conditions and anti-icing and deicing equipment is necessary. Finally, 'severe' describes conditions where safe flight is not possible even



with the use of anti-icing and deicing equipment. Until researchers come up with a new objective index for icing using the sensor technology on the drawing board, this is the only measurement we have.

"Besides the temperature and humidity rules of thumb we talked about earlier, there may be other clues to icing hazards. Recently meteorologists verified a strong correlation between freezing precipitation on the ground and icing conditions at altitude, so we will need to watch for that also. But there is more we will need to do.

"Robin, prior to every flight, we will need to do a good check of our anti-icing and deicing equipment. Good checklist discipline, knowing our craft's limits, and following operating procedures will keep us prepared once we are airborne.

"And once we are airborne, Robin, we'll need to watch for icing's signs while flying in visible moisture. The FAA is studying new technology that will sense ice forming on critical parts of an aircraft, but until that type of sensor is available, the key will be the aviator. We need to do our part and report all icing encounters and have options to get away by changing our altitude or our route if we suspect the aircraft will be impacted by the winter weather.

"Finally, we will need to listen to reports from other aviators on runway conditions and braking action while we are in the terminal area. If the forecast calls for winter weather, we should have an alternate landing location in mind in case the conditions warrant."

Robin, in awe of the weather savvy of Maj Bashman, spoke up. "Gee, Bashman, you've got this down cold."

A Cold Comm Presses In

Suddenly the televideo monitor came on.

"Who's that?" asked the boy, Wonder.

"Robin, from the snow on the screen I'd say we're getting a call from Mr. Freeze."

Just then the chilled mug of Mr. Freeze appeared. "Right again, Bashman," came the voice from the monitor. "Just thought I'd give you a call from my ice cubicle and let you know I'd be in town making life miserable for aviators again."

Robin jumped up. "Go flake off, you dirty snow slush! We know how to scrape you out of the way. All we have to do is know our weather lessons about the types of weather hazards and the conditions that lead to them. Then we'll get a thorough weather briefing before every flight, paying close attention to icing and freezing precipitation forecasts. Finally, we'll follow our operations procedures and always have an escape route planned. If we do that every flight, you'll be in the cooler all season long."

A smile appeared on Mr. Freeze's face. "Very good, boy, but remember—one slip up and you're mine! Mark my words, Bashman, I'll be here all winter long just waiting for you and every other aviator." And with a non-heat wave, he stopped transmitting...

...I wonder.

Now, if I could only get my shoes unstuck from the floor of this theater... ✈

Melatonin a

Recently touted as a cure for jet lag, there is insuffi

SUSAN E. NORTHRUP, M.D.
Courtesy UAL *Safetyliner '96* Vol VII Issue 2

Editor's Note: The following article is good general information about melatonin. However, it is not approved for use by Air Force aircrews. Air Force researchers at Brooks are researching its properties, but there is still insufficient evidence that it is safe for Air Force aircrews.

Recently, melatonin has been touted in popular literature as a cure for everything from jet lag to cancer to aging. While there is little scientific research to support most of the claims, there is a growing body of research supporting melatonin's ability to lessen the effects of circadian rhythm desynchronization. Desynchronization, or jet lag, occurs when our body clock disagrees with the local time. Jet lag can lead to fatigue, headache, sleep disturbances, irritability, and gastrointestinal disturbances—all with a potentially negative impact on flight safety. But is melatonin safe? Should aircrew use it to reduce symptoms of jet lag? This article will briefly discuss what melatonin is, how it works, the pros and cons of its use, side effects, quality control concerns, and recommendations for airline policy.

What Is Melatonin?

Melatonin is a hormone produced in the pineal gland, a pea-sized structure located roughly in the center of the brain. Scientists believe melatonin is crucial to the functioning of our body clock. Bright light suppresses melatonin secretion, while darkness causes the pineal gland to release melatonin, causing drowsiness. Unfortunately, when more than three time zones are crossed, the cycle continues with the body clock which is the primary regulator of melatonin, not the local time zone. The cycle will slowly adjust with external cues (day/night/meals) at about one time zone per day. Until it does, individuals will be out of sync with their environment, awake when they wish to sleep and vice versa.

Treating Jet Lag With Melatonin

Proponents of treating jet lag with melatonin report "it cannot only resolve sleeping problems (sedative effects) after a long flight but can also actually speed up the re-synchronization of the body clock to a new time zone (Dawood, 1994). Ingesting synthetic melatonin provides an artificial peak, "entraining" the body's clock more rapidly. Researchers claim using melatonin will increase adaptation from 1 hour per day to 2 to 3 hours per day.

The medical community is, however, sounding a note of caution. Melatonin is not a panacea for everyone who must travel over many time zones. In fact, Dr. Jon French, of the USAF Fatigue Countermeasures Group, recommends not attempting to modify circadian rhythms unless one wishes to stay in the new time zone at least 3 days. For individuals staying less than 3 days, he advises maintaining

Official USAF Photo

the home time zone and applying the fatigue countermeasures developed by NASA Ames and others (i.e., sleep hygiene, "NASA naps," exercise, and diet).

International aircrews fall in the latter group. Typically, they fly overnight west to east, spend 24 hours on the ground, then return during the day (east to west). The

and Aircrew

cient evidence that the drug is safe for use by pilots.

cycle may repeat several times prior to an extended rest period. Using melatonin to adjust the body clock is inappropriate in this group.

The dose timing of melatonin is very important. Resynchronization only occurred if the subjects were permitted to sleep after taking the medication, if it was carefully scheduled to approach the local time. In those subjects unable to sleep after taking melatonin, the circadian rhythm was actually prolonged, usually into the next operationally required period of wakefulness. Worse, melatonin's effect on fine motor and cognitive tasks is unknown. The nature of melatonin's sedative effects are uncertain.

Unfortunately, there are no published clinical studies evaluating performance in the aviation environment while on melatonin. The Armed Forces are actively evaluating melatonin's aeromedical usefulness at the USN's Naval Aerospace and Operational Medical Institute (NAMI). Despite ongoing research, no service (USAF, USN, and USA) permit routine use of melatonin by aviators. Aircrew participating in study groups are not allowed to perform flying duties within 36 hours of using melatonin. Military aeromedical policy makers have adopted a "wait and see" attitude regarding melatonin's operational future.

What About Side Effects?

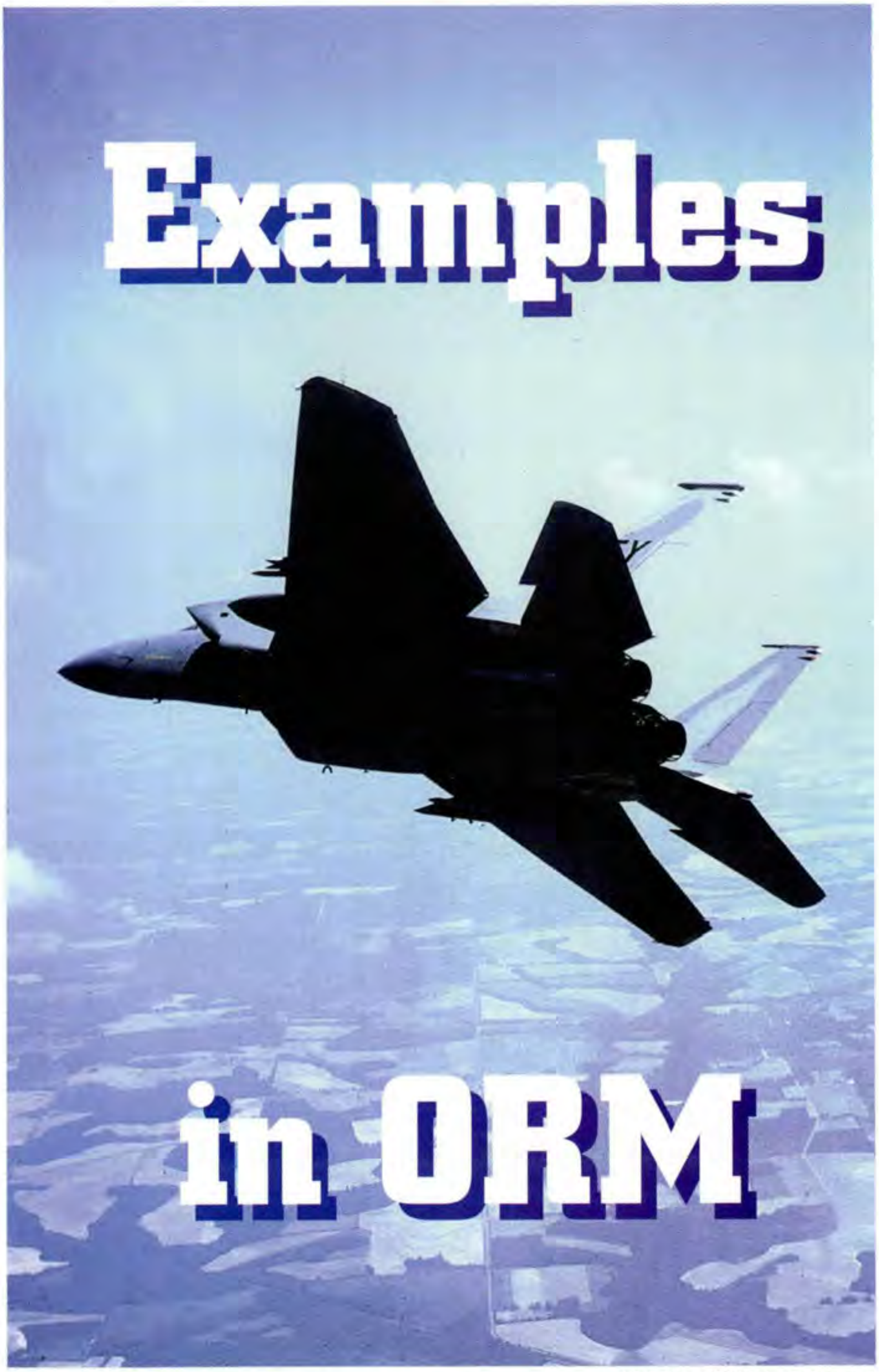
Like all hormones and medications, melatonin is not without side effects. The reported side effects include rapid heartbeat, headache, drowsiness, insomnia, depression, impaired mental performance, impaired sleep, agitation, gastrointestinal disturbance, difficulty conceiving, and low sex drive. While some researchers claim melatonin is among the safest substances known, no large clinical evaluations of physiologic doses have been performed to evaluate the long-term effects in the normal body.

Since melatonin is sold only as a dietary supplement, the Food and Drug Administration (FDA) does not control, or monitor, the substance. There is no guarantee the pills sold as melatonin are safe or pure. The FDA simply warns users that they take it "without any assurance that it is safe or that it will have any beneficial effect." Similar concerns recently prompted Britain's Medicine Control Agency to halt the sale of melatonin until clinical tests demonstrate its safety (Hearn 1995).

In conclusion, should aircrew use melatonin to counteract jet lag? While melatonin may be able to adjust circadian rhythms, there is insufficient evidence that it is safe for use in aviators. Large scale clinical trials need to be performed to document that it poses an acceptable risk in the aviation environment and to elucidate other interactions within the body. ✈

Excerpts from a paper titled "Melatonin and Aircrew" by Susan E. Northrup, M.D.—ATA Safety Council Memorandum 11 April 1996, No. 96-SC-08.

Examples in ORM



USAF Photo by SSgt Andrew N. Dunaway, II

LT COL BOB OTTO
33d Fighter Wing Chief of Safety

Most of us have learned what ORM stands for, but we have many questions about **HOW** to do Operational Risk Management. So far the ORM training courses have been heavy on philosophy, but light on application. The most frequent question I hear is "How are we going to implement ORM?"

My hope is that we don't implement a program per se. Rather, ORM should be a philosophy that becomes a part of our culture. I'd like to share a few ways that the 33 FW Nomads have incorporated ORM philosophy into the business of providing on-demand air superiority—the basic mission of the 33d.

Everyone who has attended an ORM course or viewed the ACC computer training module has been told, "We've been doing ORM for many years." That's true. Therefore, my belief is that if we do nothing different, our core processes will remain what they are today—safe and efficient. However, "safe and efficient" is relative.

While 1.5 mishaps per 100,000 flying hours may define a safe operation, we cannot afford that rate any longer. That's because declining defense procurement requires us to fly our aircraft much longer than expected. Figure 1 from the Quadrennial Defense Review graphically shows declining procurement.

Likewise, we may **THINK** we're efficient, but in reality there's a lot of room for improvement. The 33 FW Nomads proved that by reassessing how we generate F-15s for deployment and found a way to accomplish the same task one-third quicker than ACC's "Outstanding" criteria.

My belief is that we must critically analyze **all** our core processes and find ways to do them better and safer. The "safer" part is where ORM fits in. Since we know our baseline operation is relatively safe and efficient, the ideal time to use ORM is when we do something different—whether it's deploying, flying a training mission we don't do very often, or changing the way we currently do business.

Example 1. In the F-15 community, we do a lot of engine changes. Since 1993, the number of engine changes in the 33 FW has increased by 220 percent. Recognizing this as a core process for our flightline folks, the 33 FW recently assembled a team to look at that process (the quality term is "power team"). We augmented this team with some folks schooled in ORM. In other words, we merged ORM with the power team since we would be doing something different and needed to analyze the risks. The operational results were notable, as Figure 2 shows.

The results from an ORM standpoint were just as notable. The wing uncovered and addressed 16 haz-

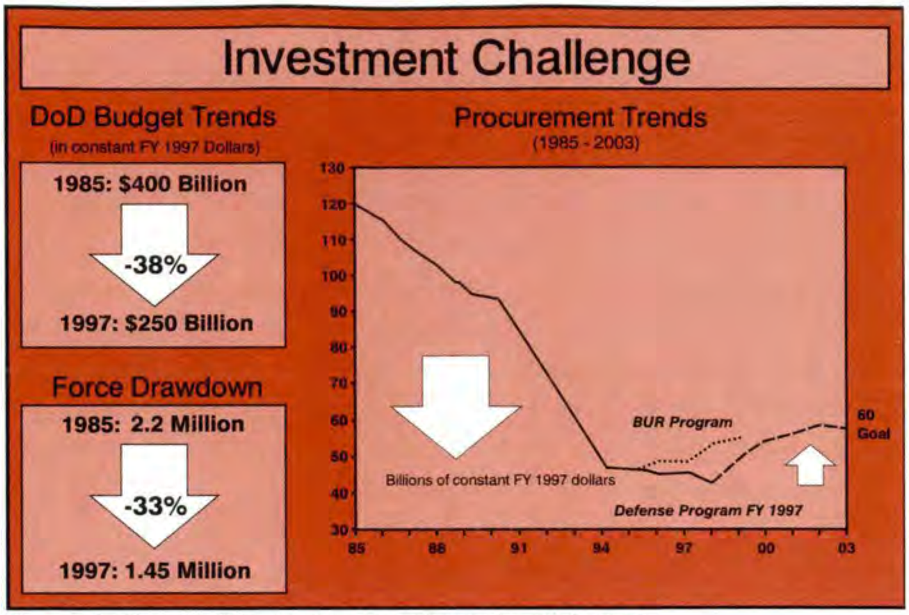


Figure 1. There's little money to replace aircraft losses

ards to the engine change process. All of these hazards could be addressed at the wing level—it came down to how we wanted to do business. One relatively minor hazard had a fix, but the appropriate commander was willing to assume the risk—the benefits of the fix did not outweigh the cost.

The team submitted several AFTO Forms 22 recommending changes in how the engine change process is done. In two cases, the AFTO 22s removed existing technical order requirements because the risk analysis showed that the benefits of accomplishing those steps (and risk of eliminating those steps) were very minor—but eliminating the steps reduced the time required to accomplish the task. Additionally, the team submitted an AFTO 22 to add a step that increased the safety margin of using the engine trailers.

Using simple ORM techniques, the team looked at eliminating the requirement to have quality assurance (QA) inspect every engine bay; the crew chiefs felt that was a good way to save a half hour with little added risk since the **perception** was that QA findings were relatively minor. Rather than just accept this at face value, the team dug out recent QA bay inspection findings and had the crew chiefs grade them according to severity and probability. The findings were surprising!

Considering all 277 QA bay inspections from January to September 1996, the wing had an 85 percent pass rate. Most of the failures were due to minor foreign objects and damaged mounts—no show-stoppers here. However, an analysis of the remaining writeups (figure 3, page 20) reveals that if QA had not inspected all the bays, there is a real chance that nine F-15s would have had IFEs due to something being missed. Additionally, there's a chance (unlikely) that an aircraft would have been lost. As a result of this ORM analysis, we decided that waiving the bay inspection was too risky for the potential gain.

Example 2. The electronic air inlet controller (EAIC) in the F-15 is the "brain" that regulates the intake of airflow to the engines. It is a fly-to-fail item, and the first indication of failure is often a ground abort or in-flight emergency. The safety office got a call from the avionics branch wondering if "fly-to-fail" was too risky, because they thought they were seeing a lot more failures than they had in the past. Since EAICs were "zero balance" (no spares are kept in supply), the avionics shop was also concerned that further discoveries of bad EAICs would ground airplanes due to lack of replacement parts.

Our flight safety officer performed a risk analysis on this question and proposed options for the commander. What he found was this:

1. ID the hazard. The biggest hazard is improper flight control input

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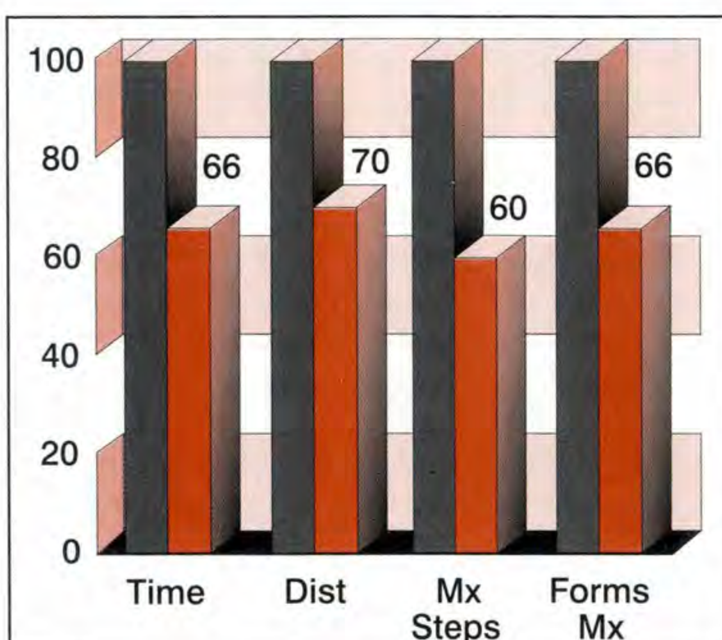


Figure 2. Time required to change an engine was cut 34%, distance traveled was cut 30%, and time spent on forms was cut 26%.

	Likely	Maybe	Unlikely	Never
A/C Loss			1	
IFE	4	5	12	
Code 3	2		14	
Code 2			14	6

Figure 3. QA Bay Inspection Findings, Probability Vs Severity

to the rudders.

2. Risk assessment. There is a low probability of departure from controlled flight. More likely would be a ground or air abort with no associated control problems. Based on this, we concluded that fly-to-fail on this component was an acceptable risk.

3. Risk control measures. Control measures to counter the assessed risks needed attention. Investigation revealed that several methods exist to reduce the number of EAIC incidents. Specifically:

a. "Wet weather starts" can reduce EAIC failures. However, the "procedure" was really a WOM (Word of Mouth), and procedures varied by squadron.

b. The use of certain aircraft covers can greatly affect how long an EAIC will remain corrosion-free. However, this fact needed to be better communicated to the crew chiefs that provide this first line of defense for F-15 EAICs. We discovered several F-15 units are trying to design better covers to reduce EAIC failures.

c. One of the best ways to prevent corrosion of the EAICs is to treat them with a corrosion-preventative spray. A couple of years ago, a message was sent out from depot that basically said "Spray EAICs whenever you get them in for maintenance." However, they did not specify an inspection or maintenance interval. This turns out to be a "Catch-22" because they only come into the shop when they fail, and when they fail, the EAICs are shipped off to depot with no maintenance performed.

4. Make control decisions. We recommended the following:

a. Publish a written notice to all pilots on the correct wet weather start procedure, pending incorporation in an upcoming Dash-1 change.

b. Maximize use of the various aircraft covers that help prevent water entrapment in the EAIC. Educate crew chiefs on the importance of this to "change the culture."

c. Adopt a wing EAIC inspection interval for applying corrosion-prevention coatings.

5. Implementation. The first two recommendations have been implemented; the specific EAIC inspection to be used is under review as of this writing. Now we just have to keep after it with the **"supervise and review"** portion of ORM.

I always preach substance over form—in other words, results count, style is secondary. Both of these examples focused on results rather than some fancy study. But it is important to internalize the philosophy: Critically analyze your key processes and find ways to reduce risk while excelling in mission accomplishment. Alternatively, reduce the cost of ownership without increasing the risk. This is the only way we can remain the world's most respected air and space force in an atmosphere of reduced funding.

Official USAF Photo

"Go for the Road"

Official USAF Photo

CW2 Mike "Lucky" LaMee
Courtesy ***Flightfax***, Mar 97

On 23 October 1995, I was pilot in command of a UH-60A on a medical evacuation mission to transport a patient from the Air Force Academy to a hospital in Denver, Colorado. It was a cold, clear night, and, due to the many ground lights in the area, we were unaided. The mission was uneventful, as far as medevac missions go, until we were almost to our destination.

We were in straight and level flight at approximately 90 KIAS when the low rotor audio sounded. The copilot was on the controls at the time, and he immediately reduced the collective. The rotor RPM increased to the normal operating range, and I directed my attention to the engine TGTs. They were equal and in the normal operating range, so I told the pilot on the controls, "The engines are fine." There were no other abnormal indications.

The copilot then increased the collective to arrest our descent rate, and the rotor rpm immediately started to bleed down again. Our original altitude at the onset of this emergency was 900 to 1,000 feet AGL, so time was now extremely critical. I saw no other option than to execute a forced landing and selected the only unlit and uninhabited area I could see, which was to our front left.

The copilot turned the aircraft toward this area and turned on the landing light which, fortunately, was already extended. The area I had selected, once illuminated, was not a survivable forced-landing site. At that point, I yelled over ICS, "Go for the road," and came on the controls. We managed—how, I have no idea—to clear oncoming traffic and merge with northbound traffic on an overpass, get over a concrete median and under power lines, and come to rest in the breakdown lane (how appropriate) without injury to anyone and with minimal damage to the aircraft.

What Happened?

Our aircraft had experienced a rather rare malfunction known as a "dual engine rollback." Both engines had failed to the low side. This has happened 13 times, with our accident being No. 12. This is not a problem unique to the UH-60A, though. It has also happened in the UH-60L and the AH-64. Not all of these failed as low as ours did that night, and they have happened on the ground, at a hover, and during flight. What causes this malfunction is still being investigated. My intent in writing this article is to share my experience so that if this malfunction presents itself to you, you won't be asking "What's this?" and spend the rest of your life (in my case, it would have been 28 seconds) trying to figure out what's happening.

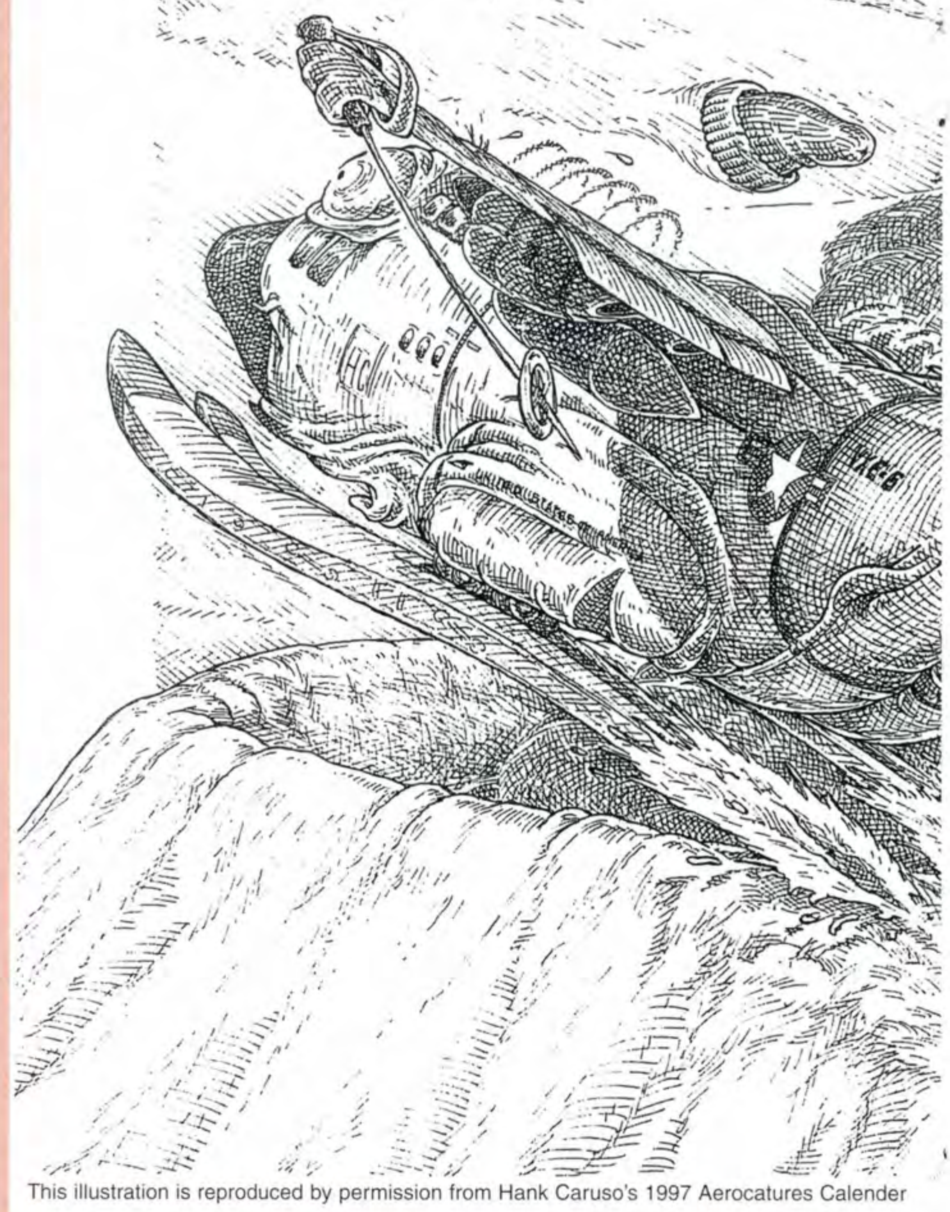
One good thing I have taken away from this accident is that I have learned an invaluable lesson. I once heard an Air Force general speak on crash survival. He said, "If you knew that on your next flight you were going to have an emergency or crash, would you do anything different in preparation for that mission?" Now getting grounded or canceling the mission weren't options! He then said, "If you can think of one thing, you're not ready to fly."

I didn't appreciate his words as much before as I do now. Every situation we might encounter isn't necessarily going to be fixed by an answer memorized from a book. Crew coordination and situational awareness are absolutely key. The most important single consideration will always be aircraft control. And the primary consideration will always be survival of the occupants. Had I not been fortunate enough to be flying with the greatest pilot, crew chief, and medic in the world that night, it all could have turned out differently. ✈

Herk vs. the Vo

I honestly thought I was going to hit the volcano.

LT AL MacGREGOR
Courtesy *Approach*, May-Jun 97


This illustration is reproduced by permission from Hank Caruso's 1997 Aerocatures Calender

Three-and-a-half months into my third deployment to Antarctica with VXE-6, I had gotten used to many of the unique and challenging aspects of flying in the polar environment. One day our mission was easy: Fly 27 passengers to Christchurch, New Zealand.

Soon after the brief, we were at the skiway, finished with loading and preflighting our ski-equipped LC-130, and ready to launch. After another check with our weather gurus, who told us we had a 300-foot ceiling with the nearest VMC above 12,000 feet, we loaded the passengers and got underway. The mood in the cockpit was great; everyone was excited about the prospect of a couple of days in Christchurch.

We taxied for takeoff at 148,000 pounds, our max-gross weight on skis. After calling for release, we were cleared to depart up to an initial altitude of 3,000 feet. McMurdo Station lies on an island, and our departure would take us away from it, clear of any en route obstacles. Our major concern was Mount Erebus, the active volcano on the island whose cone reaches 12,800 feet.

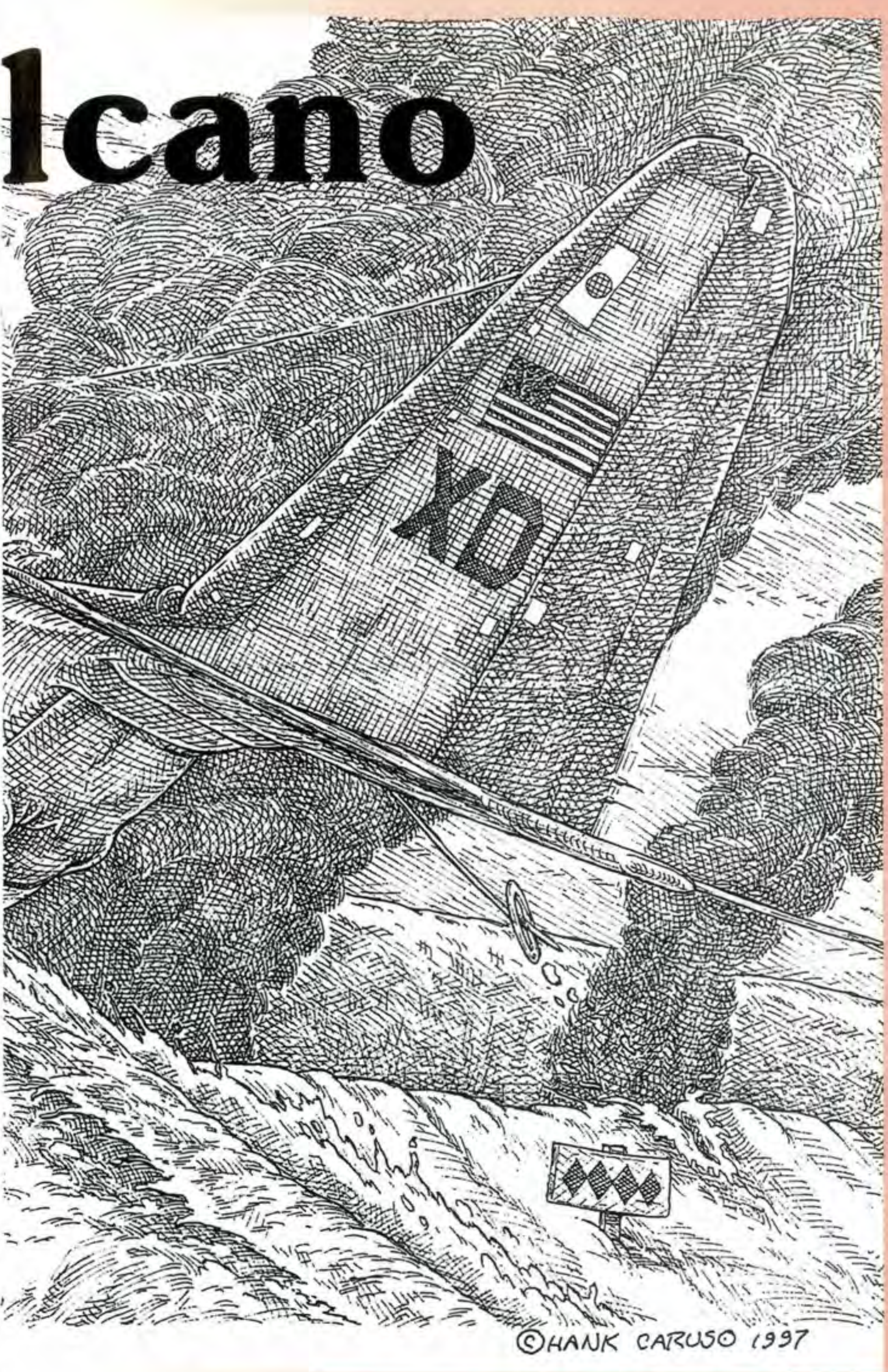
After we took the skiway, I advanced the throttles to 15,000 in/lbs, and my copilot then set 18,000 across the board as we began to accelerate. At 60 knots, I yanked the nose ski off the deck, allowing the aircraft to continue to accelerate on the snow as the main skis planed out, much as a boat planes out on the water. As we passed 90 knots, the heavy aircraft hobbled into the air—well below Vmca speed, but a routine takeoff for an LC-130 on skis. Passing 300 feet, we were in the goo, and I transitioned to instruments as the nav called out an initial heading to Byrd intersection.

Soon after we completed our takeoff checks, we switched up McMurdo Center to pick up the rest of our climb to altitude and out of the cloud deck. As I began the climb, the nav got on the radar.

After a brief check of our position, he cleared us direct to our first point north, cutting the corner on Byrd and taking us over Ross Island and toward the volcano.

At the time, I didn't think twice about this call, since it was a routine time-saver on a long flight north. On top of that, the nav had checked the radar, so I had no reason to assume we were anything other than clear of any obstacles.

lcano



As we passed 9,000 feet on our climbout, I settled into my seat and began thinking about Christchurch and where to eat when we arrived. What occurred next was my worst Antarctic nightmare. I had read about the disaster that had befallen an Air New Zealand DC-10 that had run into Mount Erebus several years earlier. My heart about leapt out of my chest when, out of the corner of my eye, I watched the radar altimeter jump off the peg of 5,000 feet to 4,000 feet, then continue to head toward 3,000 feet.

I yelled at the navigators, "Where in the hell is Erebus?" This reaction, on reflection, was highly inappropriate, because the volcano was obviously directly in my flightpath. My dumbfounded nav looked up from teaching his student, completely unaware of why I was yelling.

I got back on the instruments as the radar altimeter dropped below 3,000 feet. At this point, all my instincts told me to climb, climb, climb! I slammed the throttles forward and yanked back on the yoke.

Even as the climb rate increased toward 4,000 fpm, the radalt continued its descent. We stared as it plunged below 1,000 feet.

When my airspeed dropped below 120 knots, I knew I had to shallow the climb to avoid stalling. Reluctantly, I let out some back-pressure on the yoke. As I lowered the nose, not knowing what to expect next, I cross-checked the altimeters. The barometric gauge was reading over 13,000 feet. The radalt was falling below 400 feet.

I honestly thought I was going to hit the volcano. Suddenly, the plane lurched, and it felt like the bottom had dropped out. At first, I thought we had stalled, but a quick airspeed check confirmed we were at 125 knots, increasing to 130. The radalt was steady at 200 feet, then began rising as quickly as it had fallen.

At that point, I realized that we had just passed over the crater, and the thermal from the volcano's molten core had caused the violent drop.

The LC-130 began to accelerate normally as we broke out of the clouds that had surrounded us during the climb. I could not believe what had just happened. The aircraft was my responsibility, as was the safety of all the people on board, and we had almost crashed into a volcano. I felt sick to my stomach.

"How did this happen?" I kept asking myself. What chain of events had led us almost to the point of a catastrophe? I wanted so badly to blame the navigators for not paying attention and giving me a heading into impending disaster, but part of me knew that it wasn't altogether their fault. The remainder of the flight north to New Zealand was silent, mainly because no one really knew what to say to each other. I wondered if any of the 27 passengers had any idea just how close they had come to becoming a permanent fixture on Mount Erebus.

I believe that we were overconfident. We had been tasked on so many occasions to take our aircraft into places that were hazardous; when we were tasked with a simple routine flight, we got cocky. ✈

MAJ JEFF THOMAS
HQ AFSC/SEF

It's almost that time of year again. In fact, in some places, it's already that time of year—time when the iceman cometh.

Some Background

Recently, the Air Force reviewed its approach to the problem of keeping aircraft clear of ice and snow contamination when the iceman is in town. As a result, T.O. 42C-1-2, *Anti-icing, De-icing and Defrosting of Parked Aircraft*, the Air Force "bible" on winter de/anti-icing procedures was revised, adopting much of the FAA ground deicing program guidance as standard Air Force practice. Current deicing/anti-icing materials and procedures are reviewed and approved by three professional societies: Society of Automotive Engineers (SAE), International Standards Organization (ISO), and Association of European Airlines (AEA). SAE Committee G-12 (Aircraft Ground Deicing) coordinates and approves the two Aerospace Material Specifications (AMS) fluid types used in the industry; AMS Type I (deicing fluid) and AMS Type II/III/IV (anti-icing fluid).

Among the revisions was approval for Air Force use of Type II/IV *anti-icing* fluid as opposed to the past practice of utilizing only MIL-A-8243 Type I/II *deicing* fluid. However, before getting ahead of ourselves, some definitions are in order.

❄ ***Deicing*** is the process of *removing* accumulations of snow, frost, slush, and/or ice from aircraft critical surfaces. This is accomplished by brushing, blowing, wiping, and by spraying heated deicing fluid.

❄ ***Deicing fluid*** (typically called AMS Type I) is used to remove accumulations of frozen precipitation from aircraft surfaces. The AMS Type I fluid has limited anti-ice protection (holdover time) after application and is primarily used as a deicer (holdover time is defined as the estimated time fluid will prevent ice, snow, and/or frost from forming on the treated surfaces of aircraft). However, and this fact will likely come as a surprise to most, MIL-A-8243 Type I fluid offers **zero** holdover time.

❄ ***Anti-icing*** is the process of *preventing* further accu-

Official USAF Photo

mulations of snow, frost, slush, and/or ice by the application of fluids.

❄ ***Anti-icing fluids*** (typically AMS Types II, III, IV) are a thickened material formulated to coat clean aircraft surfaces (after AMS Type I fluid removes ice). Application results in a thick liquid film (gel-like consistency) on the wing and other critical surfaces. Airflow over the wing during takeoff roll causes the fluid to progressively flow off the wing (shear). Provides anti-icing protection (i.e., holdover time) the length of which is dependent on several factors. The AMS Type IV fluid has just recently been approved by the SAE G-12 committee and has improved holdover times compared to the AMS Type II.

If AMS Type II/IV fluids offer anti-icing protection (and a holdover time) that the Military Specification fluids don't, why hasn't the Air Force adopted their use sooner? In a nutshell, the AMS fluids with holdover times have been in widespread use in the United States only since about 1992, and until recently, many personnel were unaware that MIL-A-8243 Type I/II fluids had zero holdover time. (See the table on page 28.)

Of late, the Air Force has begun procurement of propylene glycol-based AMS Type II/IV fluids. (Note: Type III fluids are designed for commuter-type aircraft and are still in development.) This procurement presents new and unique problems as Air Force deicing trucks equipped to dispense the Military Specification fluids cannot properly apply the AMS Type II/IV fluids due to mechanical shearing of the fluid during application. This can result in a 40 to 60 percent loss of the fluid's anti-icing performance. But fear not, the Air Force has begun the acquisition of deicing trucks capable of dispensing the AMS Type II/IV fluids, with the first deliveries taking place at McGuire AFB.

But enough historical stuff. Let's look at what information you, as an aircrew member, can take to the aircraft to safely accomplish your mission when the iceman is in town.

What You Can Do

Several studies have shown attempting takeoff in an aircraft that has ice or snow adhering to the wings, stabilizer, and/or control surfaces can be hazardous to your health. The detrimental effects of wing contamination (i.e., ice and snow) vary with location, roughness, and

continued on next page

shape of the contamination. Mishap reports reveal instances of aircraft rolling inverted due to frost buildup on one wing, pitching up due to small ice patches near the wingtips, rolling to 45° of bank after liftoff due to ice on one flap, etc.

Wind tunnel and flight tests have revealed ice, snow, and frost formations on the leading edge of the wing and upper wing surfaces, with a thickness and surface roughness similar to medium or coarse sandpaper can reduce lift available by up to 30 percent and increase drag by as much as 40 percent. In addition, stall speed is increased and climb capability is decreased. To further complicate an already hazardous situation, as noted above, unsymmetrical wing roughness can cause a wing to drop off at stall speed where there is little margin for maneuvering or gust tolerance. Couple all these effects with an engine loss at or shortly after takeoff, and the wisdom of ensuring the aircraft is "clean" becomes readily apparent. (For some help in making your deice/anti-ice decision, please see the sidebar, "Making the Deice Decision.")

One of the least understood, and most important concepts when dealing with deicing/anti-icing is that of holdover times. (See the table.) As previously noted, holdover time is an estimate of how long fluids will prevent ice, snow, and/or frost accumulations on treated aircraft surfaces. Holdover time begins when the application of deicing/anti-icing fluid commences and expires when the fluid applied to the aircraft loses its effectiveness. Holdover times are highly variable, depending on more than 30 factors to determine the elapsed times between fluid application and loss of fluid effectiveness and cannot be precisely predetermined for each application. Factors include the type and amount of precipitation, wind, application techniques, and fluid concentration, etc.

As noted, AMS Type I fluids offer no significant holdover time. For example, under conditions of freezing rain with the temperature below 32°F, holdover time could be as short as 1 to 3 minutes. Under conditions conducive to frost formation with the temperature hovering around 32°F, holdover time could be extended to as long as 45 minutes. Because taxi times and ground delays are often longer than the holdover provided by AMS Type I fluids, aircrews should be aware that additional deicing may be required before takeoff. Of note, several aircraft Dash-1s include verbiage or a warning stating "Takeoff must be made within 20 minutes after application of deicing fluid." From this discussion, you can see "it depends."

On the other hand, AMS Type II/IV fluids being adopted offer significantly longer holdover times under the same conditions due to the thicker fluid adhering to the treated surface longer. However, like the above discussion on AMS type I fluids, the time is highly dependent on environmental factors.

Ground Deicing Problems

NASA conducted an in-depth review of reports filed with the Aviation Safety Reporting System (ASRS) between January 1986 and January 1993 with regards to air carrier deicing incidents. Although the reports reviewed were limited to air carrier operations, the findings are equally applicable to military pilots. The study revealed the majority of ground deicing problems/incidents could be classified into three major categories:

1. Problems with detecting/inspecting for ice during preflight inspections.

2. Problems with ice removal, or initially verifying successful ice removal after deicing.

3. Difficulties assuring that aircraft critical surfaces were free of frozen contamination before takeoff.

Let's dissect these topics and look at ways to overcome these problems to help you beat the iceman.

1. Problems with detecting/inspecting for ice during preflight inspections:

- When you do a walk-around inspection, dress for the occasion. Adequate clothing for the conditions is important to keep you warm and to help you resist the temptation to do a cursory walk-around, possibly missing contamination. Be deliberate; don't allow yourself to be rushed. Ensure all control surfaces (wing and horizontal stabilizer leading edges, upper and lower surfaces, flaps, etc.) are clean and that static ports, pitot heads, engine inlets, landing gear doors, etc., are clear of snow, ice, and slush. Remember, your life might depend on it.

- Several of the NASA reports cited the elevated height of wing and tail surfaces as a major factor in ice inspection/detection difficulties. If you can't see the upper control surfaces on the wing or horizontal stabilizers, get a ladder or "cherry picker" to assist with the inspection. (Note: This may not be effective on C-5/17/141 horizontal stabilizers. One technique offered by T.O.

42C-1-2 states "...the horizontal stabilizer shall be the last surface to be anti-iced. These areas are not visible...and by applying the anti-icing fluid last, aircrews have some level of confidence the conditions on the horizontal stabilizer are no worse than being experienced on surfaces having been anti-iced first.)

- If rainy or high humidity conditions exist, ice can form on cold-soaked wings even though the outside air temperature may be well above 32°F. This phenomena is known as "cold soaking." An aircraft coming down from a prolonged flight at higher altitudes will have cold-soaked fuel which cools the wing skin to temperatures below freezing. Moisture in the outside air can condense and freeze on the top and/or bottom surfaces of the wings over and under the fuel tanks. Clear ice formed in this manner can cause surface roughness and disrupt airflow in much the same fashion as ice/snow contamination. Be aware that even though freezing precipitation may not be present, deicing may still be required under certain conditions.

2. Problems with ice removal, or initially verifying successful ice removal after deicing:

- Deicing fluids will not remove heavy accumulations of snow. Snow absorbs the fluid and forms a slush that will refreeze and is very difficult to remove. After snow is removed (by some method other than deicing), a layer of rough ice remains which can be quickly dispatched with deicing fluid.

- Remove snow from the fuselage area before heating the aircraft interior. Water from melting snow might refreeze in unheated, perhaps critical portions of the fuselage, such as over static ports, around pitot tubes, etc.

- Be sure to position the aircraft control surfaces as directed by aircraft tech orders. This helps prevent melting snow and ice from running into areas such as flight control balance bays where subsequent refreezing could affect control effectiveness.

- After deicing, ensure both left and right sides of the wing and horizontal stabilizer received the same and complete deicing treatment. This is best accomplished by a followup visual inspection of all treated surfaces by either aircrew or qualified ground personnel. It may be hard to believe, but hurried deice crews have been known to deice only one portion of an aircraft before departing for the next deice job.

3. Difficulties assuring that aircraft critical surfaces were free of frozen contamination before takeoff:

- Critical surfaces can be difficult to see from inside the cockpit on certain aircraft and may require the wing surfaces again be inspected by a qualified aircrew member prior to takeoff. Keep in mind, it is impossible to detect minute but potentially fatal contamination from inside the cockpit. A thin layer of clear ice can be extremely difficult to see unless you get right up to it and perform a tactile inspection. A good time for the final check is just prior to taking the active runway. A good rule of thumb is to scan the aircraft surfaces both from the cockpit and from the best vantage point within the cargo compartment. If possible, ask for qualified ground personnel to help you complete your final visual inspections. If in doubt, deice again. And don't rely exclusively on times published in holdover charts; circumstances may have changed (i.e., precipitation may be heavier, temperature may have dropped, etc.).

- Several NASA reports indicated problems with pilots trying to gauge the amount of snow/ice accumulation on their wings simply by observing the wings of other aircraft. The fallacy is that you don't have perfect knowledge of other aircrafts' deice time, type fluid, concentration used, application technique, holdover time, etc. And if you think you have all that information covered, consider the possibility the aircraft in front of yours has blown taxiway snow up onto your wings. Bottom line—each crew should check their own situation before attempting takeoff!

- During ground operations, allow greater than normal taxi distances between aircraft. This will help reduce the possibility of snow/slush being blown back onto your aircraft and refreezing. The hot exhaust gas from the aircraft in front of you could melt snow on your aircraft, which may cause it to refreeze in vital areas. Additionally, AMS Type II/IV fluids have the potential to be sheared off the wing (thus reducing effectiveness and holdover time) by jet blast from preceding aircraft if the taxi distances between aircraft are not sufficient.

- Never assume that "light layer" of snow on your wings is "inconsequential" and that it will blow off during taxi or takeoff. The safest policy is to have all contamination removed before takeoff. Often loose, dry snow will not blow off during takeoff roll but may instead freeze solidly onto the wings. Due to the venturi effect, airflow accelerating over the wings' upper surface will

continued on next page

sustain a rapid temperature drop. Thus, loose snow may quickly be transformed into frozen wing contamination. Additionally, the possible breaking loose of contamination during takeoff roll/rotation poses a significant hazard to aircraft with centerline fuselage-mounted engines (KC-10) or aft fuselage-mounted engines (C-21, C-9) with the potential for FOD-induced engine failure.

More Concerns

After taking all the proper precautions and accomplishing a successful deicing/anti-icing, how can you tell if the anti-icing fluid is losing or has lost its effectiveness (i.e., holdover time has expired)? Obviously, the fluid has lost its ability to provide anti-icing capabilities when no longer able to absorb and melt precipitation. Some visual clues include the loss of gloss. Look for a change from a smooth, gel-like appearance to a slushy, milky appearance and finally to a snow or crusted surface. Ice or snow accumulation, buildup of ice crystals in or on the fluid, or the presence of slush can also be gauges of lost anti-icing capabilities.

Keep in mind one of the keys throughout the entire deice/anti-icing process is communications between the deicing ground crew and flightcrew. Be sure ground crews advise the type of fluid being used (deice or anti-ice), the exact mixture being used, and the time application began. These are important variables when determining holdover times. And, as stated earlier, maintain situational awareness during de/anti-icing. Know which portions of the aircraft the ground crew had de/anti-iced, what they are currently doing, and which portion of the aircraft they plan on doing next. Make sure they plan on covering all applicable areas!

Finally, avoid rapid rotation rates on takeoff. When combined with possible undetected wing contamination, an excessive rotation rate could result in an over-rotation and approach-to-stall, an unexpected aircraft roll, and a definite reduced stall margin.

The Bottom Line

The performance values in the flight manuals are valid only for aircraft with smooth, clean surfaces. It is impossible to determine the exact effects of frost, snow, or ice on aircraft performance. Wing contamination always results in some adverse aerodynamic effect. The question is whether the effect is severe enough to ruin your day. The problem has only one solution: **KEEP THE SURFACES CLEAN** to keep the iceman at bay. ✈

CAUTION! THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY.
IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKE-OFF CHECK PROCEDURES.

Freezing Point of Type I fluid mixture used must be at least 10°C (18°F) below OAT.

EXAMPLE

Outside Air Temperature		Approximate Holdover Times Anticipated Under Various Weather Conditions (Hours: Minutes)				
°C	°F	FROST	FREEZING FOG	SNOW	FREEZING RAIN	RAIN ON COLD SOAKED WING
0 & above	32 & above	[illegible]	[illegible]	0:06 - 0:15	0:02 - 0:05	0:06 - 0:15
below 0 to -7	below 32 to 19	0:18 - 0:45	0:06 - 0:15	[illegible]	[illegible]	CAUTION! Clear ice may require touch for confirmation
below -7	below 19	0:12 - 0:30	0:06 - 0:15	0:06 - 0:15		

This Table Does Not Apply To Other Than SAE or ISO Type I FPD Fluids.

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

<u>CAUTION</u>: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HIGH WIND VELOCITY AND JET BLAST MAY CAUSE A DEGRADATION OF THE PROTECTIVE FILM. IF THESE CONDITIONS OCCUR, THE TIME OF PROTECTION MAY BE SHORTENED CONSIDERABLY. THIS IS ALSO THE CASE WHEN THE FUEL TEMPERATURE IS SIGNIFICANTLY LOWER THAN OAT.

"Making the Deice Decision"

There are some things to keep in mind when faced with a deicing situation. The following generalized suggestions are based on experience and recommendations by NASA, Boeing McDonnell Douglas, and others, and can be used by aircrews to help make informed deice/anti-ice decisions. The following are applicable to most deice/anti-ice situations:

- Spray fluids from front to back on all wing/tail surfaces.
- Inspect control surfaces following deicing for complete removal of ice, snow, and slush. Hands-on is the only known positive method developed to date.
- The presence of either deicing or anti-icing fluids around LOX servicing/overflow areas can potentially result in a fire.
- Although the fluids' flashpoints are above 200°F, the fluids should be used with care when sprayed around heater and engine exhausts.
- Do not apply fluid by spray method unless all personnel are clear of spray areas. Be sure to stand upwind as de/anti-icing fluids are mildly toxic.
- Deicing/anti-icing with or without engines/APUs running is an aircraft-specific limitation. If approved for your specific aircraft, keep in mind fumes can be drawn into the cabin if air-conditioning pack and APU air switches are not properly positioned or closed. Additionally, on some aircraft, it may be necessary to position the deice truck directly behind the engine exhaust area in order to get deicing/anti-icing fluid on the horizontal stabilizer. Use caution and maintain good situational awareness during deice/anti-icing procedures!

What Is Your IIQ?*

*Icing Intelligence Quotient

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

Knowledge is the key to avoiding winter weather traps. Here's a quiz to test your understanding of aircraft icing and its effect upon aircraft performance and flight characteristics. ✈

- T ☐ F ☐ Slight surface roughness can have significant effects on stall speed and power required to achieve or sustain flight.
- T ☐ F ☐ Surface roughness on the afterbody of a wing can have the same effect on aircraft performance as roughness on the leading edge.
- T ☐ F ☐ Increasing surface roughness due to ice formation on the leading edges and afterbodies will produce additional drag and further reduce lift.
- T ☐ F ☐ Aircraft certified for flight in icing conditions cannot take off with ice formed as a result of ground storage or operations.
- T ☐ F ☐ Ice formation on the wing surfaces decreases stall angle of attack and, in some aircraft, the stall will occur prior to activation of the stall warning devices.
- T ☐ F ☐ Icing changes the aircraft's stall characteristics and, depending on aircraft design and the nature of the ice formation, can either cause violent stall or a slower progression of stall.
- T ☐ F ☐ Ice on aircraft wing leading edges may increase pitchup and rolloff tendencies.
- T ☐ F ☐ Icing may reduce controllability and require greater stick deflection for maneuvers or stall recovery.
- T ☐ F ☐ Thrust available may be reduced due to ice formation on jet engine inlets.
- T ☐ F ☐ Ice has been known to cause control surface flutter.
- T ☐ F ☐ Trim effectiveness can deteriorate with the accumulation of ice.
- T ☐ F ☐ Aircraft ice protection systems are designed basically to cope with the super-cooled cloud environment, not for ice formation while the aircraft is on the ground.
- T ☐ F ☐ Avoid positioning your aircraft in the exhaust of aircraft ahead of you when precipitation is present.
- T ☐ F ☐ Deice areas in view of the pilot first so he or she may have assurance other areas of the aircraft are clean. (The pilot can monitor the area deiced first.)
- T ☐ F ☐ Engine failures may occur due to ice ingestion.
- T ☐ F ☐ Ice formation can reduce the efficiency of communication and navigation equipment.
- T ☐ F ☐ Ice formations, under certain conditions, may not have noticeable effects on aircraft performance and flight characteristics; however, the effects may become quite apparent in the event of an engine failure or other emergency.
- T ☐ F ☐ Ice formation may result in airspeed, altitude, and IFR instrument errors.
- T ☐ F ☐ The use of reverse thrust can result in blowing snow adhering to the aircraft.
- T ☐ F ☐ Close inspection for ice formation just prior to takeoff remains the most important factor for assuring a safe takeoff when conditions conducive to icing are present.

ANSWERS

Hopefully, you answered all questions as *"True."* If not, the quiz may have sparked further study. A little knowledge now can make a big difference later for successful winter decision making.

Official USAF Photo

De-Deicing

CAPT JOHN T. PARK
C-130 Pilot
Yokota AB, Japan

This story took place in November 1994. It represents the challenges and inherent risks that military and civilian aviation must face when dealing with deicing aircraft. In recent years, aircraft mishaps, both minor and major, have made the aviation community hopefully more vigilant about deicing procedures and operations in winter precipitation. As parts of the United States achieve record snowfalls this year, a story about my own first winter weather operation comes to mind.

I was a copilot stationed at Yokota AB, Japan, and this particular mission was flown into Misawa AB about 13 hours into our crew duty day. Unlike Yokota, Misawa is blessed with snow and ice much earlier in the year. On this particular day, our first two stops were in fair weather, but Misawa reported low visibility due to blowing snow and snow showers. This was its first major snowfall of the season.

Our crew rechecked the weather immediately before taking off and once again en route. The snow was still coming down, but the visibility had improved to about 1.5 nm.

The landing was like something out of a simulator mission. We broke out of the weather on the ILS about 1,500 AGL and had clear visibility below the clouds, but everything was white. I had to cross-check that I was on the localizer course...the runway should be straight ahead. About 2 miles out, we picked up the "rabbit" and the outline of the runway lights. We had apparently made our approach between snow showers. The next one was at the west end of the field and headed our way. This was my first landing on about 4 inches of new-fallen snow. As advertised, the snow was blowing around quite a bit as the C-130 slowed below 50 knots in full reverse power. An uneventful, yet memorable landing!

Upon engine shutdown, the snow started a heavy fall again. After unloading and loading cargo for 2 hours, the snow had accumulated quite a bit on the top of the Herc. The engineer called for a deice truck. And this is where it gets real interesting. He did an excellent job of directing the transient alert (TA) personnel on thoroughly de-

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icing the aircraft. The problem was not where they were spraying the plane, but with what.

As mentioned earlier, this was the first major snowfall for Misawa that year. One of TA's truck was full of deice fluid, and the other had been used for washing an aircraft several days earlier. Well, this wash truck was still half full of soapy water. Mistakenly, this washing solution was thought to be deice fluid. TA filled it up the rest of the way with real deicer. Well, you guessed it. We got the truck with the 50/50 soapy water and deicing fluid!

After deicing the tail section, the engineer came into the aircraft and closed the crew entrance door to prevent deicer from getting in the aircraft. As bulldozers continued to remove snow from the runway, he monitored the last of the deicing from the center escape hatch. It was now dark. The snow was still falling heavily as we prepared for engine start. We had a full cargo load and a snow-covered runway. With the RCR, the engineer figured critical field length at 7,700 feet, over 1,000 feet to spare beyond the actual runway length. No problem. As we continued with the before-starting-engines checklist, the loadmaster (outside the airplane) reported that the airman out there with him refused to pull chocks.

We all got out and started looking at the aircraft we had just thoroughly deiced. It looked like a big bundt cake with whitish icing poured all over it, streaks running down the sides. Icicles hung off props and wingtips. Wow!

The pilot asked, "What's the problem?"

"He says he won't pull the chocks because there is ice on the plane."

"What ice is he talking about?" inquired the pilot.

"The ice on the side of the airplane," said the loadmaster.

As they carried on this conversation, I looked back at the No. 4 prop and could see icicles hanging off the blades against the backlighting of the ramp lights.

"Pilot, there are icicles on the props! Something ain't right!" I said with a slight wavering in my voice.

We all got out and started looking at the aircraft we had just thoroughly deiced. It looked like a big bundt cake with whitish icing poured all over it, streaks running down the sides. Icicles hung off props and wingtips. Wow! Something was really messed up! The engineer, pilot, and I got real quiet for a minute as we looked at each other with wide eyes. We all suddenly realized that the young airman who refused to pull chocks had probably just saved our lives.

I could picture us starting engines and taxiing out into the darkness. The sheet of ice on the flight controls would give way to 3,000 psi of hydraulic pressure, and we would never suspect a thing. As we rolled down the runway, acceleration would be normal. But when I said "Go" and the pilot pulled back on the yoke, nothing from that point on would be as predicted. With all our lifting surfaces covered with an uneven layer of ice, plus the extra weight, I started to wonder how many knots above our charted takeoff speed we would need to limp into the air. Would we be able to clear the hills at the end of the runway or make the minimum climb gradients? What if we lost an engine after takeoff? I had to stop. It was freezing out there on the ramp, and thinking about what might have occurred made me shiver even more.

After 40 minutes, our crew and TA figured out what was going on. They called for the other deice truck, but it was too late. We were initially pushing a 16-hour crew day, and now with another deicing, we were staring at almost 18 hours. The aircraft commander decided we had had too much excitement for one night, and we called it quits.

As the aircraft commander canceled our flight plan, I started filling out the safety report. I stated that the airman launching us out had broken the "chain of events" that leads to every aircraft accident. I hope he realized the momentous decision he had made by refusing to pull our chocks. We thanked him as a crew and told him he had done a great thing.

In retrospect, my only regret is that I cannot remember the name of the young airman who most likely saved my life. If he is reading this story, I want him to know I will never forget the actions he took that night on his tour in Japan. ✈

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Often loose, dry snow will not blow off during takeoff roll but may instead freeze solidly onto the wings.

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