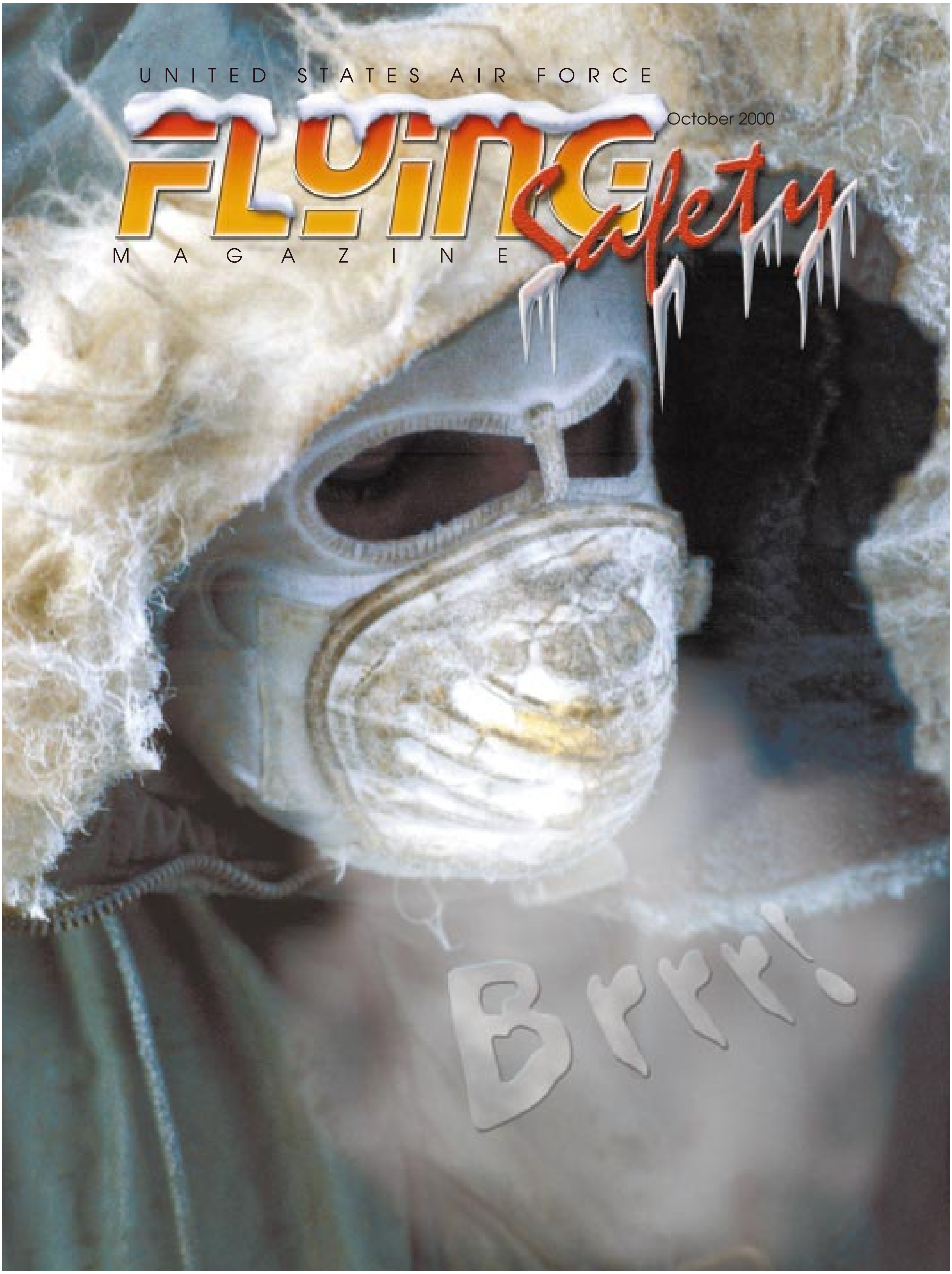
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FLYING Safety
MAGAZINE
October 2000
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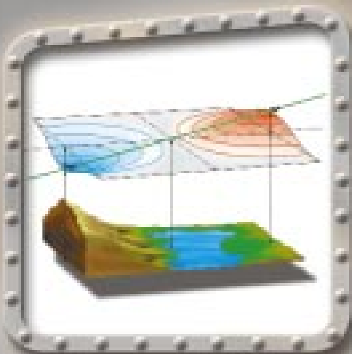

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FSM notams

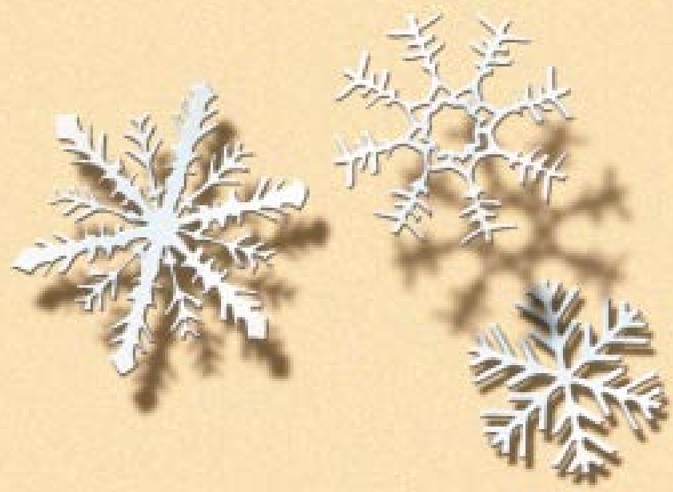
FROZEN SLUSHY

Courtesy ASRS *Callback* #238, Apr 99
NASA's Aviation Safety Reporting System

We landed at [the] airport just after a wet snowstorm had finished dumping approximately 2 inches of wet snow on the runway... That was a termination flight for the evening. On postflight noticed slush had blown up into [the] wheelwell. The next morning on the walkaround, the First Officer reported slush had frozen to the gear doors and general area around the gear. [He] reported it to the mechanic on duty. [The mechanic] said he would deice the area when crew was done [with] the airplane. [The] area was deiced with glycol. Then taxied out and took off. We received 2 main gear in-transit lights after selecting gear up. Tried cycling gear to no avail...We flew the published departure to altitude and held over VOR. [We then] consulted with our Dispatch on plan of action. Since the departure airport [had] marginal weather and...high terrain, we elected to proceed to destination. We climbed to 20,000 feet and flew at 210 knots (aircraft limitation due to in-transit light). En route we consulted with Dispatch and determined that with fuel burn and winds aloft, we would have to divert [for fuel].

I believe CRM was very helpful in that the First Officer flew the airplane while I worked on the problem with Dispatch and Maintenance. Also, next time I land on wet, slushy runways I am going to request that heat be applied to the gear area instead of glycol.

The only method of ice removal approved by many airlines is use of heated de-icing fluid (glycol). Deicing should always be followed by a visual inspection of the surface areas to which the mixture is applied.



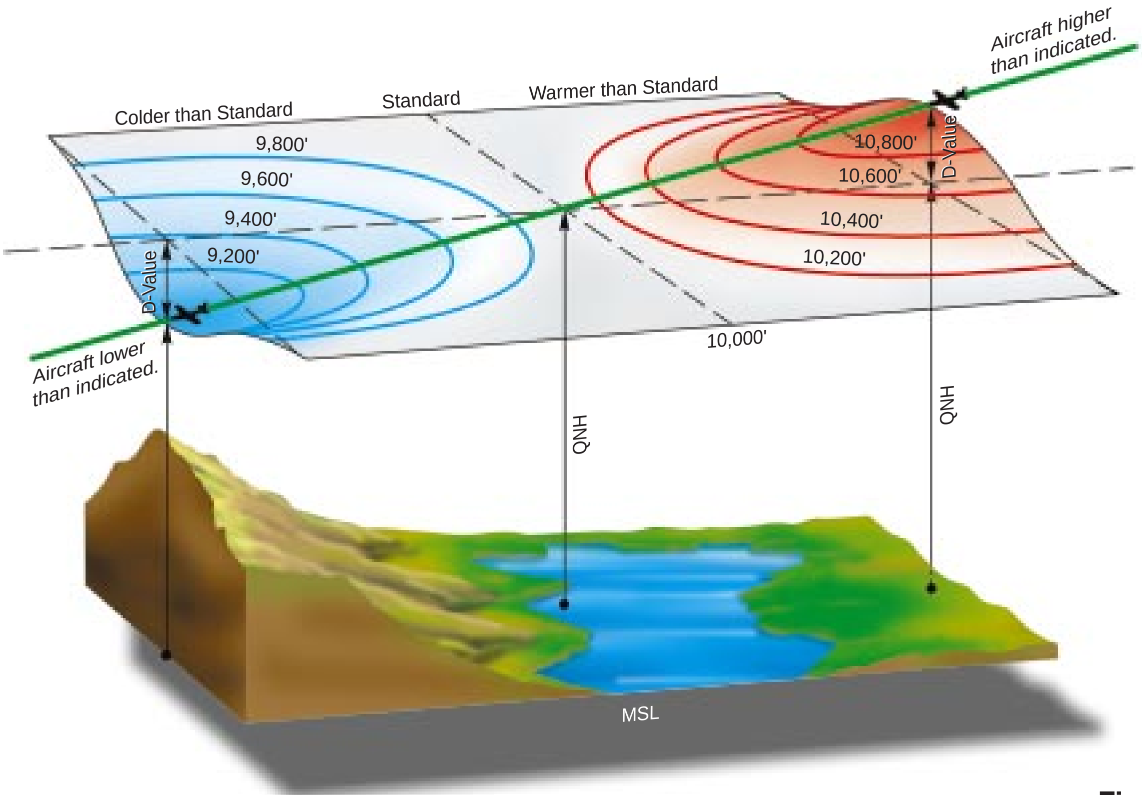


Figure 1

TEMPERATURE ERRORS & ALTIMETERS or D-VALUES: WHO CARES?

MAJ TIM COONS
333 FS
Seymour-Johnson AFB, NC

There are "gotchas" lurking in the cold air.

Cold, dense air is the stuff that jet engines love. More molecules crammed together means more thrust per cubic foot. The colder, the better. And up in Alaska, for instance, there's plenty of that, plus mountainous terrain crying out for high performance. Frozen Arctic air is a tonic for aircraft performance, and the winter mountain snowscape is just the place to use it.

There are, of course, "gotchas" lurking in the cold air. One of the more insidious ones is the effect on the trusty old barometric altimeter. The same cold atmosphere that results in higher engine performance will trick your barometric altimeter in ways that may not be immediately obvious. Cold air can make your barometric altimeter think you're flying higher than you really are.

Staying Above the Rocks

Typically, when eyeballs, radar altimeters and the like won't suffice, we rely on flying at some indicated altitude selected to ensure positive terrain clearance. We pick an MSL altitude based on terrain elevation, which will keep us clear. For this method to work, you've naturally got to get to that actual MSL altitude, or there's no guarantee of having the prescribed terrain clearance.

The problem is, indicated and true are not necessarily the same things. (Think about how true airspeed relates to indicated airspeed.)

When it comes to staying above terra firma, what counts is obviously height AGL. The potential for trouble arises when you're trying to keep a positive height AGL based on indicated altitude, such as during a route abort for loss of VMC and, unlucky for you, indicated altitude is making you think you're higher than you really are.

As mentioned above, barometric altimeters are susceptible to errors due to temperature effects. In general, the colder it gets, the greater the errors can be. D-Values can be used to measure those errors.

So why care? Because you don't want to be in a survival situation when it's butt-cold, that's why.

"Indicated" vs. "True"

Barometric altimeters read "indicated altitude," which only equals true altitude in the "standard atmosphere" on a "standard day." The standard atmosphere makes assumptions about how pressure and temperature drop off at height. When the actual atmosphere strays from the model, things start to give. On any given day, pressure and temperature will not necessarily match the standard atmosphere. This means your indicated altitude is susceptible to both pressure and temperature errors. Setting the correct local altimeter compensates for non-standard pressure, but barometric altimeters do not compensate for non-standard *temperature.*

Temperature effects become important when it's really cold, especially in high terrain. If it's colder than standard day, your true altitude will be lower than what you're showing. This is generally considered bad.

Is this a big deal? Well, it can be. The good news is, even in Alaska, it's not all that common to find temperature effects causing huge inaccuracies in indicated altitude. The bad news is that there are detrimental effects on indicated altitude whenever it's colder than standard day (which is most of the time, in some parts of the world). In fact, when conditions are right, the error can exceed 1000 feet, which could count as a big deal. Now, the combination of atmospheric conditions that cause an error in excess of 1000 feet is not something we're guaranteed to see *every* winter, but I'd hate to be the one flying popeye into a mountain when I thought I was at Min Safe Altitude.

So what's the fix? First, always set the correct altimeter. This compensates for non-standard surface pressure. Then, consider the effects of colder-than-standard temperature. You may need to fly at a higher indicated altitude to achieve any given height AGL.

D-Values

How can you tell how much this "temperature effect" is? One way is to look at something called a "D-Value." D-Values are a Weather Shop measure of the effect on the actual atmosphere due to non-standard temperature at a given altitude, location and time. They can be used to determine how far off your barometric altimeter is.

The D-Value is the difference between indicated altitude and true altitude. A negative D-Value will cause true altitude to be less than indicated altitude (bad).

When terrain clearance is a factor, add the magnitude of a negative D-Value as a safety pad. For instance, if the D-Value on a given day at 5000 feet MSL is -250 feet, this means if you are flying at an indicated altitude of 5000 feet, your true altitude is only 4750 feet MSL, or 250 feet lower than the barometric altimeter shows. Therefore, fly at an indicated altitude that is the sum of the magnitude of the D-Value and the actual true altitude where you want to be. In this example, with a -250-foot D-Value, fly at 5250 feet indicated altitude to achieve 5000 feet true altitude above Mean Sea Level.

By the way, positive D-Values can be applied to correct for non-standard *high* temperatures, too, but that doesn't happen much up North, and in any case the effect is to fly higher than indicated, lessening any terrain clearance concerns.

So what should you ask Weather for?

1. Ask if they're anticipating negative D-Values.

2. Ask them to give you the D-Value for any altitude flown off the barometric altimeter that's critical for maintaining terrain clearance. These might include route abort altitudes, min safe altitudes, recover initiation altitudes, etc. You'll need to tell Weather where you're flying, at what altitude, and when.

Weather will look at what the pressure should be in the standard atmosphere for any altitude you're interested in. Then they'll figure at what altitude that pressure is actually occurring. If the pressure actually occurs lower than where the Standard Atmosphere predicts, you've got a negative D-Value, so watch out. The larger the magnitude, the more of a factor it is.

Negative D-Types

You can expect negative D-Values whenever there is colder-than-standard-day air. This can occur at any altitude. If it's colder than standard at the altitude you're flying, there's a good chance there's some temperature error induced. Weather can help you figure out how much it's likely to be.

The bottom line is you need to consider temperature effects on your barometric altimeter any time it is the primary reference for keeping a positive AGL altitude. Remember, negative D-Values are bad. You should compensate for negative D-Values by adding their magnitude to any altitude critical for maintaining terrain clearance, using the barometric altimeter.

One way to avoid having everybody calling up Weather for D-Values is to have them calculate "worst-case area D-Values." They can assess the largest magnitude negative D-Value for any altitude where terrain clearance might be a factor in given local areas (i.e., the "worst case"). This number could

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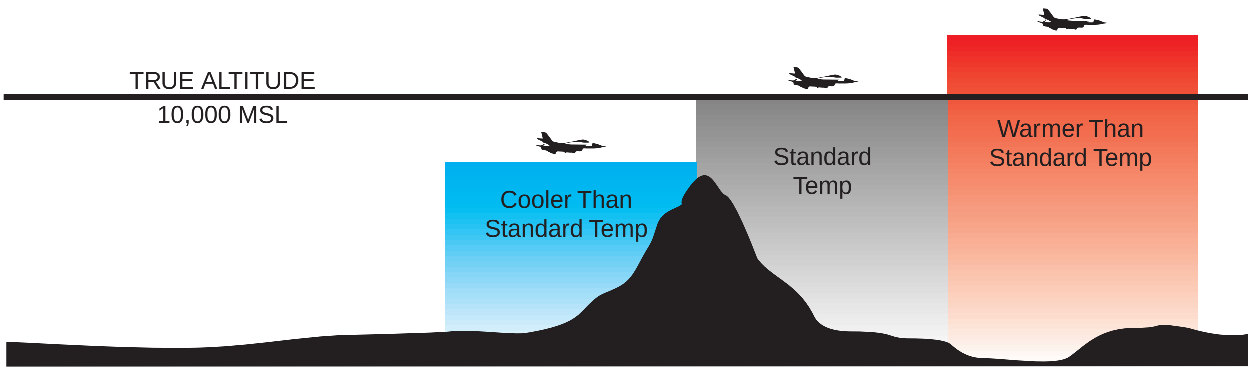
A negative D-Value will cause true altitude to be less than indicated altitude (bad).



10,000 Ft Altitude Indicated in each case. **Figure 2**

Barometric altimeters do a perfectly adequate job of providing vertical traffic separation.

then be briefed as a conservative safety pad, similar to area minimum altimeter.

Application to Air Traffic Control

So far, we've focused on tactical low-level flying, but the principles and effects on barometric altimeters apply universally. However, and this is important, the specific procedures to apply when dealing with ATC are set out in the various applicable directives.

Indicated altitude errors due to non-standard temperatures are not a factor in the vast majority of ATC operations. Barometric altimeters do a perfectly adequate job of providing vertical traffic separation, and rudimentary corrections for use on Instrument Approach Procedures are specified.

If ATC assigns an altitude, they expect you to fly at that indicated altitude. They do not expect you to start arbitrarily adding temperature corrections (ATC requires everyone to be singing off the same sheet of music to provide vertical traffic separation).

Nonetheless, do not figure ATC to have considered the effects of temperature for you. If you consider temperature effects to be a factor, query the controller and request a high enough altitude assignment to overcome any temperature effect. Perhaps the next higher available altitude would suffice? It depends on just how extreme the D-Values are and how close to terra firma you are. Cold days and operations near to MOCAs or MVAs might be occasions to consider temperature effects.

Again, preflight consultation with WX should give you an idea if temperature effects are significant. Discrepancies between measured AGL height, say, from radar altimeters and what was expected off the barometric altimeter, could also be a tipoff that something's not quite right.

Once on an Instrument Approach Procedure, the Flight Information Handbook (FIH) contains specific guidance on correcting for non-standard temperatures inside the Final Approach Fix (FAF). This chart (see Figure 1) gives a correction based on airport temperature and your height above it, for any altitude inside the FAF. These corrections are meant to keep you from flying into the dirt as you get closer and closer to it. They bear careful consideration and review. It's not the sort of thing you want to figure out for the first time on short final. Keeping track of actual AGL height, if available as you approach minimums, is always a good idea, too.

Temperature Extremes

All kinds of sources give dire warnings about the hazards of flying in cold weather, particularly in mountainous areas. They say temperature should be considered, but are frequently vague about just how to do it. The bottom line is that most of the time temperature effects are not all that extreme. Most of the world's flying is not done in high mountains or where it's potentially extremely cold, never mind both.

Also, the potential for trouble should only exist when terrain clearance is being maintained by reference to the barometric altimeter. Most tactical flying close to the ground is done in VMC, but route abort due to loss of VMC is a prime candidate for trouble. Now, even in Alaska, it takes something to get the conditions right for the errors to really mount. But if margins are already relatively small, and the conditions are right, it could be a huge smokin' deal.

Aircraft Separation

If you think about it, temperature effects have nothing to do with aircraft-to-aircraft separation. As long as everybody has the appropriate altimeter set, everyone in a given piece of sky will be off the same amount due to temperature.

cruising levels and applying corrections from the FIH (as discussed above) may be appropriate. Another formula for assessing the temperature effect on altimeters is the following:

Temperature Error (ft) = 4 x height above altimeter reporting station ÷ 1000 x difference from Standard Day Surface Temperature (15° C).

Example: Say surface temperature = -10°C, altimeter reporting station elevation = 1100 ft MSL, and you are cruising at 8000 ft Indicated Altitude.

Make sure you have always considered the effects of lower-than-standard temperatures.

Temperature Corrections and the Flight Information Handbook

The Flight Information Handbook's "Temperature Correction Chart" gives temperature corrections that apply to instrument approaches. These should be adhered to, when applicable, but recognize that the chart only applies under the conditions set out. Simply applying those numbers to any situation is not a "be-all" answer. Among other things, the FIH Temperature Correction Table does not necessarily account for the behavior of the actual atmosphere, as measured by Weather on a given day.

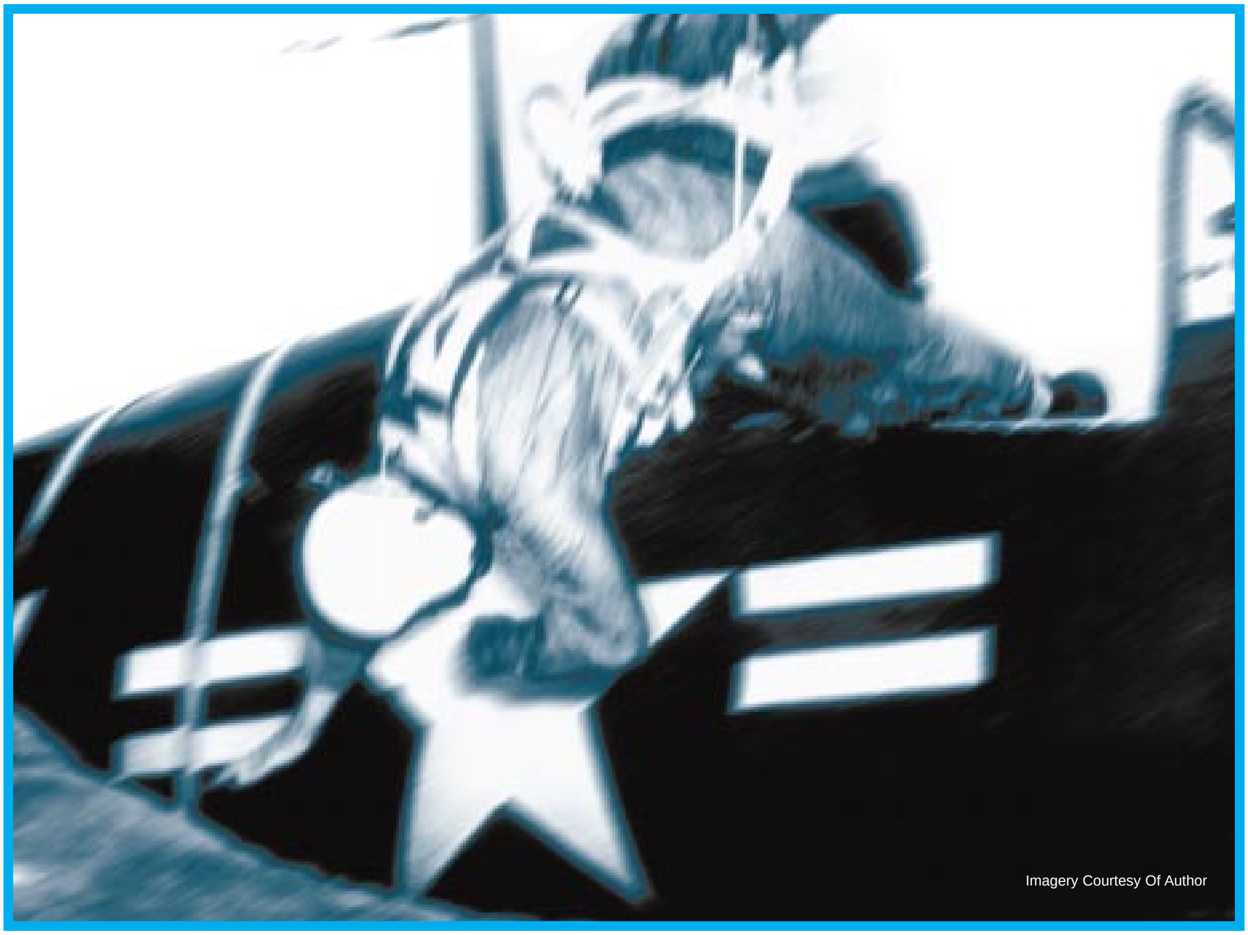
Are there other ways to compensate for temperature errors? Yes, there's more than one way to skin this cat. Selecting higher

Temperature Error = 4 x (8000 - 1100) ÷ 1000 x [15 - (-10)]
= 4 x 6900 ÷ 1000 x 25
= -1625 ft

So, actual altitude is predicted to be 1625 feet lower than indicated.

This formula will yield generally conservative results, but does not take the "actual" atmosphere into account the way D-Values do.

The bottom line is: Make sure you have always considered the effects of lower-than-standard temperatures whenever terrain clearance may be a factor. Setting the correct altimeter is the first step, but that will not in itself compensate for temperature effects. Extreme temperature effects may not be widespread, but don't get yourself caught if they are. If it's butt-cold, look out below.



Imagery Courtesy Of Author

EGRESS SYSTEMS: WHAT'S NEW?

MR. PERRY NELSON
311 HSW/YACSS
Brooks AFB TX

In the Air Force, there is a group of professionals whose job is to ensure aircraft ejection seats will work as designed, regardless of the equipment's age—they are your egress specialists. Every year, US and Allied Nation egress specialists gather to confront and resolve problems that concern those who trust their lives to an ejection seat.

In odd-numbered years the group meets for the Biennial Worldwide Egress Conference, the last one being held 1-4 Nov 99. As you're reading this, the Air National Guard will be hosting another egress conference with attendees from ANG, AFRC, and active duty units.

These conferences provide a medium for egress specialists from USAF and foreign military services that operate USAF and USAF-type aircraft to discuss lots of different issues, including deficiency reports, equipment failures and methods to improve maintenance practices. These conferences also give the egress community an opportunity to discuss ongoing and future performance improvements to ejection seats, as well as brainstorm to help each other resolve problems.

These conferences also present an opportunity for one-on-one dialogue between egress mechanics and the engineers, technicians, program managers and contractors responsible for ejection seats and the aircraft portion of escape systems. In short, all the primary players have a forum like no other to improve aircraft escape systems and the aircrew member's last chance for survival.

The Worldwide Egress Conference is a function of the Life Support Systems Program Office (311 HSW/YA) at Brooks AFB, TX. As OPR for ejection seats, parachutes, survival and personnel equipment used by the USAF, "YA" works with equipment maintainers to ensure the crewmembers flying today's high performance air-


Imagery Courtesy Of Author

311 HSW/YA works to ensure the crewmembers have the best ejection seat, parachute and survival equipment available.

craft have the best ejection seat, parachute and survival equipment—radio, raft, helmet and G-suit—available.

In September 1988, the first Worldwide Egress Conference was held in San Antonio TX. The vision was for a workshop where egress specialists representing units and different weapon systems from around the world could gather with program managers and brainstorm solutions to critical life-sustaining issues. The goals of the initial conference were to: (1) Establish a forum for sharing information between all USAF ejection seat maintainers, designers, and managers; (2) Establish a single voice for the egress community so the group could present a unified approach when issues did arise; (3) Educate the egress community so it would be aware of ejection seat innovations; and (4) Improve maintenance procedures, and resolve maintainability and reliability issues with the seats in operation.

Joint Working Group

The 1999 Conference, hosted by NASA-Houston and executed by YA, took the original concept one step further. Using the Department of Defense's own vision of "joint programs," the US Navy's Life Support team participated to discuss egress

continued on next page

issues in the first-ever joint working group. More joint working groups are planned. The 1999 Conference tackled many serious issues and was a tremendous success. Many thanks to our NASA host, Mr. Jose Rangel, and the conference chairperson and leader, SMSgt Doug Gorniak, for their outstanding efforts.

Some of the significant issues discussed during the November conference were: USAF T-38 seat performance; ejection seat capabilities with "extreme size" crewmembers (especially the dangers for those weighing more than 225 pounds); ongoing seat modifications; disposal of hazardous materials used in egress shops; and mishap statistics. The group divided into weapon system-specific teams to brainstorm issues unique to each platform. Each of these major topics was covered in detail during the conference, and we'll assess progress during the ANG conference in October.

Today, crewmembers may range from 103 pounds to 245 pounds, with those below 145 pounds and above 211 pounds considered "extreme size."

One of the most interesting topics concerned NASA's decision to retrofit their T-38 aircraft with a new ejection seat. NASA shared what it has learned—and continues to learn—about their new seat. NASA's T-38 aircraft are outfitted with seats manufactured by Martin-Baker, one of the pioneers of ejection seat technology. The new seat combines superb performance with high levels of maintainability and provides the aircrew a much greater chance for survival than the original 1950s-era seat.

USAF T-38 ejection seats underwent a major upgrade during the mid-seventies but they're still based on 1950's technology. The time from ejection initiation to a full parachute is from four to five seconds. That's very slow when you consider the Advanced Concept Ejection Seat II (ACES II) provides a full parachute in two seconds under optimal conditions.

Extreme Sizes

The T-38 ejection seat was originally designed for persons in the 145-to-211 pound range and it is sensitive to crewmember size. Today, crewmembers may range from 103 pounds to 245 pounds, with those below 145 pounds and above 211 pounds considered "extreme size," as they're on the extreme limits of allowable size.

HQ AETC/LGM and YA analyzed and discussed results of two years of extensive T-38 seat sled testing with extreme size occupants, and decided during the Nov 99 conference to pursue a new—or vastly improved—ejection seat for all USAF T-38 aircraft. HQ AETC has prepared an Operational Requirements Document (ORD) and is examining costs of a seat retrofit program for their nearly 350 aircraft.

Another critical topic at the workshop was ACES II ejection seat performance testing with extreme size—225 pound and 245 pound—manikins. As a point of reference, the ACES II ejection seat was originally tested and qualified to provide a survivable ejection up to 600 knots equivalent airspeed (KEAS) using a 211-pound manikin.

311 HSW tests in June and July 1999 proved the F-16's ACES II seat could eject a manikin weighing more than 225 pounds at 600 KEAS, but they were good news/bad news events. Generally speaking, any ejection at 600 KEAS or greater is dangerous. The combined effects of wind blast with a large—greater than 211 pounds—crewmember make for a "challenging" escape. Although leg mass is more critical than body weight, the normal-size lower torso of a person who weighs in excess of 211 pounds can create an overload situation on the seat sides when ejecting at 600 KEAS. Bottom Line: Catastrophic structural failure of the seat is possible. The good news was even though the ejection seats used in the June and July 1999 tests were some of the oldest F-16 seats in the inventory, they were, from a metallurgical standpoint, "as good as new" before ejection. The bad news is they broke apart with the 225 and 245 pound manikins. But clearly it's better to experiment with manikins than to wait for a high-speed mishap and wonder after-the-fact how we could have better protected the crewmember.

As a result, an F-16 ejection seat structural upgrade program has been initiated. Once completed, a structural upgrade will be available to modify the seats so they can withstand the forces of a 245-pound crewmember ejecting at 600 KEAS. F-15 ejection seat testing with extreme-size manikins at high speeds is tentatively scheduled for FY01.

Now, one word of reassurance for all you aviators reading this who weigh more than 211 pounds and depend on the ACES II ejection seat for survival: Relax. Load analysis and testing prove ejections at 500 KEAS or less are "no sweat." When airspeed exceeds 500 KEAS, if at all possible, trade airspeed for altitude prior to ejecting. Ejections above 500 KEAS for those weighing more than 211 pounds take the ACES II into the "danger zone."

ACES II CMP

Together, the structural upgrade and the ACES II Cooperative Modification Program (ACES CMP) are two major modification programs that will bring the ejection seat capability in line with current-day aircraft and the wider range of crewmember size. The ACES II CMP is the first-ever international ejection seat development program. It combines the efforts of both the US and Japan and has three major objectives. The first is to increase yaw stability by placing a new drogue system on the seats. This "enhanced drogue" stabilizes the seat in half the time of the current ACES II drogue chute, a tremendous improvement over current seat performance. The second improvement is the addition of leg and arm restraints, which will vastly reduce the number and severity of limb flail injuries. The third and final portion of the CMP modification will be the addition of improved seat cushions and backrest pads for small-statured crewmembers.

ACES II ejection seats are used in our A-10, F-15, F-16, F-117, B-1, B-2 and F-22 aircraft, and their performance has been superb since introduction in 1978. The ACES II success rate is nearly 92 percent, but we're always looking for ways to improve that rate. All the aforementioned modifications and studies are critical to continued ejection success and risk-reduction. As mission requirements and crewmember sizes change, so too must the ejection seat.

Photo by TSgt Michael Featherston

Teamwork!

A survivable ejection requires the teamwork of several groups of people. First, escape systems designers must develop seats, parachutes and survival equipment that are capable and reliable. Second are those experts who maintain the seat and pack the parachutes. Without a doubt, the crewmember's life is in the hands of the parachute rigger and the egress mechanic who last performed maintenance on that seat.

The third group of individuals critical to a successful ejection are the specialists who manage the escape system program. These are the individuals from the respective aircraft system offices, the explosive experts commonly referred to as "CAD-PAD" equipment managers, and last but not least, 311 HSW/YAC personnel. These folks gather data from both crewmembers and maintainers, and it's their job to ensure the accuracy of engineering data—like seat performance criteria—and maintenance procedural tech data, to help mechanics do their job properly and effectively.

The final link for a successful ejection rests with you aircrews. The primary cause for an unsuccessful ejection? Ejecting out of the envelope, too late to allow the seat to provide a safe escape. This is an issue that hasn't changed since ejection seats were first installed in 1949. What was true in 1988, when the first conference was held, remains true today: Out-of-the-envelope ejections account for nearly 50% of the ejection seat fatalities. In fact, statistics indicate of the 46 fatalities in the ACES II seat over its lifetime, 24 were out-of-the-envelope ejections. (The remaining 22 were due to drowning, collision with other objects and other causes.) The most frequent cause of a delayed ejection (or no attempt to eject) is the loss of situational awareness (SA). Maintaining SA, knowing and adhering to ejection seat minimums and understanding when your jet is beyond recovery are what will allow your escape system to save your life and allow you to fly another day. You must "pull the handles" in order for the escape system to work.

When you do eject, you may do so knowing the best equipment is available and it's properly maintained by a group of professionals who always put aircrew safety first. Fly Safe!

About the author: Mr. Nelson is the Egress Integrated Process Team Lead in the Sustainment Branch at Brooks AFB. He has 16 years experience with various ejection systems.

Out-of-the-envelope ejections account for nearly 50% of the ejection seat fatalities.

Seasonal Affective Disorder ?

RELAX, YOU PROBABLY DON'T HAVE IT.

FREDERICK V. MALMSTROM, PhD., CPE
USAF ACADEMY, CO

Oh, it's a long, long time from December to May. The days turn short, the weather turns gloomy, and the world turns against you. For no known reason you feel the weight of the world's problems on your shoulders. You somehow know you've become the man with the unpronounceable name, Joe Btfsplk, the jinxed character creation of Al Capp (left).

Then you read in a supermarket tabloid the breaking claim that as many as 10 million Americans are struck down by Seasonal Affective Disorder, known to the medical community as SAD. This currently fashionable yet seasonal form of mental depression would, by pure body count alone, rank up there with alcoholism and cancer. Should the U.S. Public Health Service be notified about an undocumented epidemic? Are you a victim?

Relax—you probably don't have it. The real facts are that true, diagnosed cases of SAD are rather rare, affecting perhaps not more than one to five percent of clinically depressed patients. I've treated perhaps hundreds of depressed patients in my clinical practice, and I can say that only one has ever fit the classical diagnosis of SAD.

There's Major Confusion Between Major Depression and SAD

Major depression is not to be scoffed at—and it's relatively well-defined. Its effects can only be vaguely compared to a crippling, permanent hangover, the kind where you're afraid you're *not* going to die. When it comes to mental health matters, most of us are ready to expect the worst. However, Seasonal Affective Disorder *isn't* well defined and is *sometimes* called the Winter Blues—I'll discuss them later. All of these may be related, but Major Depression with seasonal pattern is *much* more serious.

To be diagnosed with a major depression, according to the psychiatrist's cookbook, the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV), a patient must have at least five (that's right, 5) of the following abbreviated symptoms listed in Table I.

Table I Symptoms describing Major Depressive Disorder*

1. Depressed mood every day, nearly every day
2. Markedly diminished interest or pleasure in almost all activities
3. Significant weight loss or gain of at least 5%, with decreased or increased appetite
4. Insomnia or hypersomnia nearly every day
5. Psychomotor agitation or retardation nearly every day
6. Fatigue or loss of energy nearly every day
7. Feelings of worthlessness or excessive guilt nearly every day
8. Diminished ability to think or concentrate nearly every day
9. Recurrent thoughts of death or suicide

*If any five of these symptoms appear regularly (as in the fall) and then disappear (as in the spring), then your disorder is called officially "Major Depressive Disorder with seasonal pattern."

I'll bet good money this doesn't describe you. However, if you know of anyone who exhibits this quite serious psychiatric disorder, then this person ought to be referred immediately to the flight surgeon. *A person who flies with this diagnosis is a clear and present danger to both self and others.*

Pinning Down SAD

So, I'll move away from that cheery note and move on to Seasonal Affective Disorder (SAD). What is SAD? Well, it sort of depends upon whose dictionary you buy. The American Psychiatric Association hasn't yet come up with an official definition of SAD, but here is a pretty good one (shown in Table II) constructed by Dr. Michael Terman, a clinical psychologist at New York's Columbia Presbyterian Medical Center.

Table II Symptoms describing Seasonal Affective Disorder ** (after Terman, 1999)

1. Depressed mood every day, nearly every day
2. Intentional social withdrawal
3. Body weight gain of 10% or more
4. Long periods of power sleeping
5. An almost overpowering urge to binge on carbohydrates (or alcohol)
6. An ability to maintain a regular work schedule

**This debilitating mental disorder also takes up residence in the late fall and lifts in the spring.

Like Major Depression, SAD is still serious stuff. Does *this* sound like something you might have? Again, probably not.

Perhaps the ultimate personification of the Seasonal Affective Disorder was Al Capp's infamous cartoon character, Joe Btfsplk, that unfortunate little depressed, jinxed fellow who walked around with a constant raincloud over his head. It seems that Capp had the genius to diagnose SAD 50 years before it had a clinical name.

"Seasonal patterns of depression are common, but SAD seems to be less common."

Almost All Animals and Plants Have Natural Seasonal Responses

Yet most people, including me, would still insist that our moods and behavior fluctuate regularly with the seasons. The British medical journal *Lancet* states, "Seasonal patterns of depression are common, but SAD seems to be less common. It was once believed to be related to abnormal [hormonal] melatonin levels, but these findings are now not supported." In other words, the Winter Blues have been described in the lit-

continued on next page

The 20 Jan 96 Lancet stated the US over-the-counter sales of melatonin had surpassed sales of vitamin C.

erature from the beginning of recorded history, and melatonin may have nothing to do with them. Nothing is ever that simple.

All vertebrates (including humans) are believed to produce in their brain stems a very special, primitive hormone called melatonin. Melatonin wasn't discovered until the 1950s, and it took another decade or so for the realization to sink in that this molecule is largely responsible for coordinating (but not directly causing) the rhythmic variations in behavior, like seasonal hibernation, and, to a lesser extent, in daily sleep cycles. Young animals produce a lot of it, whereas old animals produce very little. Exactly how the hormone melatonin works is still a mystery, but our scientific ignorance hasn't even slowed down our alternative medicine and non-prescription commercial drug community from making claims that melatonin somehow prevents aging, enhances sexual performance, cures cancer and combats insomnia. Melatonin has received so much popular press that the 20 Jan 96 *Lancet* stated the US over-the-counter sales of melatonin had surpassed sales of vitamin C, and there was now a worldwide shortage of the hormone!

Melatonin is Too Simplistic a Cure

But why single out melatonin? It's now quite clear that melatonin isn't the *only* chemical involved in seasonal responses. Our bodies contain cocktails full of them. As is always the case with physiology, nothing is simple. Assigning sole responsibility to melatonin for the actions of daily and seasonal rhythms is far too boneheaded a solution.

Another Wonder Drug Claim?

To confuse matters even further, the tabloid press has confused SAD with jet lag. Some of the scientific literature supports the view that administration of properly timed melatonin therapy does help control SAD, but only about 2/3 of the time. And about 10% of the time melatonin has an unfortunate, opposite effect. Since it takes time to pass the blood-brain barrier, a patient will have to ingest it for at least ten days before it takes effect. Lots of perfectly healthy people pop three-milligram capsules of over-the-counter melatonin in the expectation that it will help reverse aging, extend their lives, aid the immune system, fight cancer, brighten their moods, and rejuvenate their sex lives. Alas, this is probably another case of wishful thinking. The only claim supported in the medical literature is that melatonin administration—if properly timed—is useful in countering jet lag, not SAD.

Fortunately, one of the more effective cures for SAD is simple light therapy. That is, a patient exposes him- or herself to bright light (tending towards the UV side and equivalent to a 250-watt light bulb or more) or sunlight for 30 minutes or longer in the early morning hours. Some upscale hotels now offer pricey "light boxes" which jet-

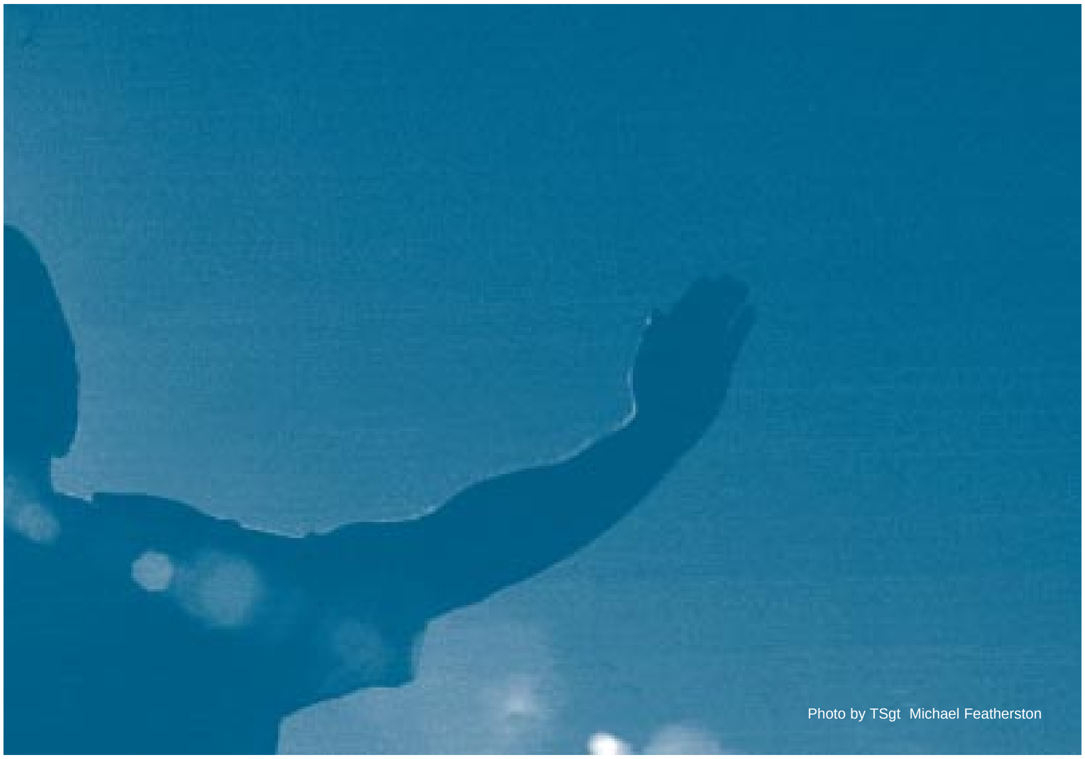


Photo by TSgt Michael Featherston

lagged passengers can climb into. However, the value of this self-therapy has yet to be proven. Even so, light therapy treatment is effective only 60% of the time.

Healthy People Don't Need Supplemental Melatonin

So much for SAD patients. But what about *you*, the average, healthy, young (and probably good-looking) crewmember? If you don't have either Major Depression or SAD, what then do you have? The short answer is Winter Blues, an even less well-defined seasonal mood pattern of crankiness, increased sleep patterns, and lack of motivation—and it's all quite normal. After reviewing the literature, I've pieced together in Table III the most commonly listed complaints and symptoms of the Winter Blues.

Table III Symptoms popularly describing Winter Blues***
1. Occasional depressed moods
2. Increased sleeping
3. Increased irritability
4. Decreased motivation

***This syndrome also normally begins in the late fall and lifts in the spring.

Beware Self-Medicating With Melatonin

Remember, ingesting melatonin doesn't cure SAD, it's what kick-starts the sleep/depression cycle. Bright light suppresses melatonin and is, therefore, believed to chase away the blues. As the comedian Henny Youngman probably said, timing is everything. To be effective as either an anti-depressant or an anti-jet lag cure, the drug must be precisely timed for maximum effectiveness. Therefore, an excess of this drug at the wrong time may necessarily bring on the effects shown in Table IV.

Table IV Possible side effects of increased and wrongly-timed melatonin
1. Decreased balance control
2. Decreased retinal sensitivity to specific colors
3. Increased drowsiness
4. Decreased alertness

Therefore, I'd strongly advise crewmembers against self-medicating with melatonin. It is a hormone, and it does affect human behavior and performance, so by definition it can't be totally benign. It's of unproven value with healthy people. There are more effective ways of combating Winter Blues, such as light therapy and regular exposure to sunlight. On the other hand, if you review Tables I and II and determine you might have either Major Depression or SAD, that's a far different story—in that case you ought to be consulting your flight surgeon. I like to think Joe Btfsplk would have agreed.

Note: Thanks for assistance from Elliott Caplin, brother of the late Al Capp, creator of *L'il Abner*.

I'd strongly advise crewmembers against self-medicating with melatonin.

TOP 10 MISADVENTURES

MAJ BRIDGET CARR
MAJ RAY KING
AFSC/SEPR

The question is often asked of those of us who work at the Safety Center: "What do you do with all the data you make us collect?" Sometimes we even hear: "What good is it?" A recent look at unintentional errors that led to Class A reportable mishaps serves as a valuable "lessons learned" for aviators. We hope the following list might sensitize you to some not uncommon practices that can lead to big trouble. Unfortunately, we don't have an opportunity to try all aviation misadventures ourselves, so here is a list of those tried by others, as culled from the Safety Center database:

This "Top 10 List" might not be as fun as one of David Letterman's, but his won't save your life. These situations were not just dreamed up. Some of these aviators paid with their lives to teach us these valuable lessons. These aviators were not deliberately attempting to have a mishap. Maybe you have done some of these things yourself. Maybe the next time they will end up in a Class A report. Tape this list into your checklist, watch for opportunities to make these errors, and then consciously try to avoid them. In our business, no news is good news.

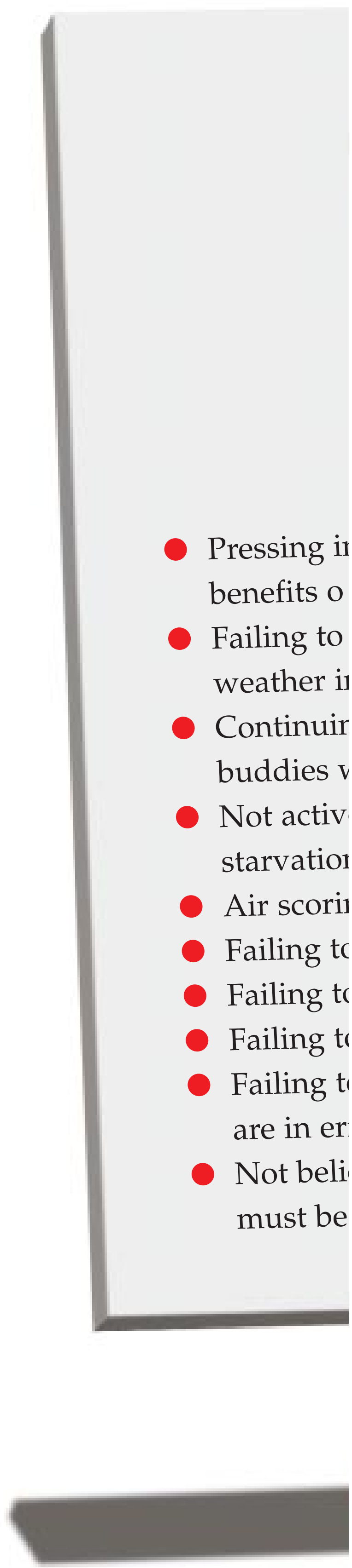


Photo By Gerald C. Stratton

AIR FORCE SAFETY CENTER

nto bad weather, rather than making a conscious appraisal of the risks and f continuing a mission in the face of deteriorating weather.

have the most current weather information, especially winds, or not taking nto account.

ng an unstable approach rather than executing a go-around. Maybe your will give you a hard time, but you will live to fly another day.

ely managing your fuel, either by not recognizing imbalance or impending n.

ng your own bombs.

o execute lost wingman procedures.

o execute proper rejoin procedures.

o adequately preflight your aircraft and your life support equipment.

o challenge a dominant member of the crew, even when you know that they ror.

eving your instruments. (Many aviators' last words are: "This instrument wrong...")

TSGT PHILLIP N. DAVIS
319 ARW

"Blue 81 heavy request flight conditions."

"Approach, Blue 81 heavy, the bases were one thousand two hundred overcast, tops four-thousand, negative turbulence, and we picked up a little ice."

This was an actual dialogue I had with a pilot a few months back and one I've had quite a few times over the last twelve years in the ATC business. After I questioned the pilot on what he actually meant by "a little ice," I decided to glance at the Aeronautical Informational Manual (AIM) for a quick refresher on icing.

I'll share my definition of "a little ice" later, but let's first take a look at what icing is, the different types, and intensities as outlined in the AIM. Icing, of course, is the accumulation of airframe ice. The types of icing come in the "flavors" of rime, clear, or mixed. Rime ice is rough, milky, opaque and formed by the instantaneous freezing of small super-cooled water droplets. Clear ice is glossy, clear, or translucent and formed by the relatively slow freezing or large super-cooled water droplets. Mixed icing, of course, is a mixture of clear and rime ice.

Now, let's turn our attention to the different intensities we may encounter. A **trace** of ice is when ice becomes perceptible and the rate of accumulation is slightly greater than the rate of sublimation. Deicing/anti-icing equipment is not utilized unless encountered for an extended period of time (over 1 hour).

Light ice is the rate of accumulation that may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. Light icing does not present a problem if the deicing/anti-icing equipment is used.

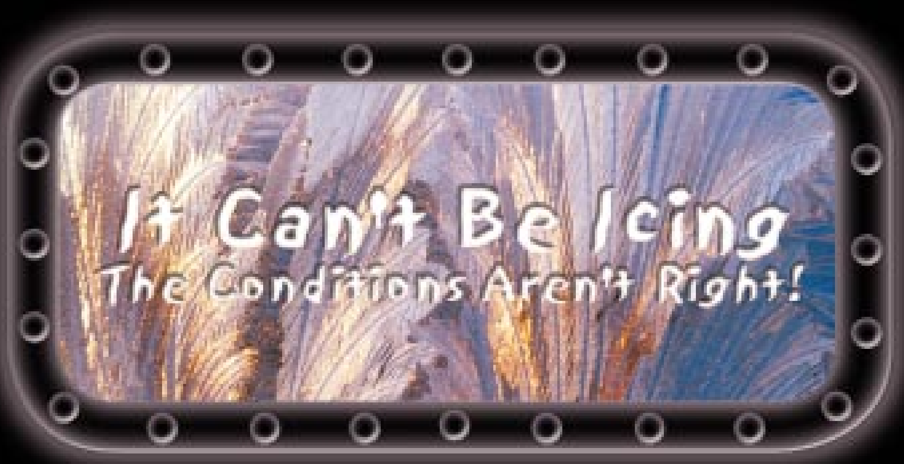
Moderate icing is when the rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.

Finally, **severe** icing is when the rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary if severe icing is encountered. So, with the definitions clear in your mind, let's get back to the point of my article.

You have just received your weather briefing, either by the local Weather Shop, or as in the case of ATC, from your "trusty" Watch Supervisor: Light to severe icing has been reported in the local area. At this time a mental flag with the words, "Proceed with Caution" should be going up in the back of your mind. Additionally, for my pilot audience out there, do the words "informed risk" or "pointless risk" mean anything to you? How about my controller counterparts? What are you thinking about when you hear the words "light to severe icing"? I would hope solicitation of Pilot Reports (PIREPS), possible alternate routes and/or altitudes, and the little extra effort that may be needed to provide our customers with the best possible service in austere conditions comes to mind.

Okay, Captain, you find yourself climbing through the 4000 foot deck the weather folks briefed you on and you encounter light rime icing. Not a real big deal to you, but being the professional pilot you are, you relay a PIREP to ATC on the conditions you encountered; except it contained the phrase "a little icing." Hmm, maybe a little to you and your "turbojet," but what about the inexperienced aviator attempting to land his Cessna 182 at the civilian airport nine miles to the east of the base you just departed? This little amount of ice will most likely be a big deal and even a possible threat to the safety of the C182 pilot if he does not know about the "real" conditions.

So my answer to the question is simply that there is no such thing as "a little ice." To this controller, it's just a poorly given PIREP disguised as something that may be useful. Please, for your sake and everyone else who operates in the friendly skies, if you encounter icing of any type or intensity, let ATC, Metro or the nearest Flight Service Station know of your findings in a clear and concise manner using the descriptions outlined in the AIM. We would love to hear from you. ✈



CAPT RUSSELL A. MUNCY
305 AREFS
Grissom AFB
Combat Crew, Nov 90

The week of 4 December looked like a good week to fly. We had three interesting flights scheduled with plenty of flying time. The week's first flight was a night air refueling against a C-5 on a double track followed by 1 hour of transition. Little did I know this straightforward flight would be the first of that week's two IFEs and a ground emergency. This story is about the C-5 refueling and what we learned about flying the KC-135R. Hopefully, you'll be able to extract some useful information from it.

The night began uneventfully with the weather forecaster giving us a pretty good weather outlook. Takeoff and landing weather included some scattered and broken clouds, but nothing significant. The air refueling track forecast called for some scattered clouds and possible turbulence. Once again, nothing major or even threatening. It was shaping up to be a good night to fly.

Preflight and takeoff were normal. We had VFR weather en route to the air refueling control point (ARCP) for AR 315W/E, and the rendezvous went great. We began refueling westbound at FL 210, proceeded to the turnaround point, and then back eastbound for an uneventful refueling, or so we thought! Approximately 10 minutes prior to the end air refueling (EAR) point, we began to pick up a thin deck of clouds well below our flight level.

To be on the safe side, we elected to turn on the engine anti-ice. Five minutes prior to EAR, we were preparing for our final contact with the C-5 before heading home when we entered IMC conditions. The receiver called "Precontact Ready" and was moving in for the hookup. About 10 to 20 feet from the boom, the receiver reported he was picking up ice and descending. Immediately thereafter, the boom operator reported heavy icing on the boom ruddevators. I pulled out my flashlight to check my windscreen, expecting to find some trace icing on the wipers. Instead, I found my entire windscreen covered with rime ice. I directed the receiver to level at the bottom of the block, FL 200, while I climbed to the top of the block, FL 220.

We terminated air refueling and began working clearances out of the icing conditions. The C-5 pilot elected to descend, and I decided to climb in an attempt to sublimate the ice. Passing FL 230, we departed the IMC conditions and leveled at FL 240. Total time in the icing conditions was approximately 3 minutes.

During the climb, we began to pick up moderate to severe vibrations throughout the entire airframe. This was accompanied by a burning smell entering the cockpit. We suspected the engines, but all engine instruments indicated normal operations. Just the same, we began alternating the inboard and outboard throttles in an attempt to determine the vibration source. Little did I know damage to all four engines was the source of our vibrations. We did discover flying on the inboard engines only (with the outboards at idle) minimized the vibration. However, the vibrations were still light to moderate. We flew the aircraft back to home station in this configuration and made an uneventful two-engine (the outboards were left in idle) landing.

After landing, I inspected the engines but didn't detect any damage. Likewise with the maintenance personnel. We did note the significant ice buildup on the nose and leading edge of the wings. The ice accumulation was at least 1/4-inch thick. Upon further inspection, maintenance personnel discovered extensive damage to the acoustical panels in all four engines. They looked as if Freddie Krueger had gotten into the engines and slashed away. All 12 panels between the two fans in each of the four engines were damaged. Parts of some panels were missing entirely. Fortunately for us, the anti-ice was turned on well before entering the icing conditions. Also, the R-model engines directed the ice to the outside of the engine fans and not through the core of the engines. Had the engine anti-ice not been on, there is a strong possibility we would have done a great deal of damage to the compressor blades as well. This experience made me a believer. When in doubt, activate the anti-ice.

After the flight, we notified the Weather Shop of our icing conditions. They initially replied it was impossible to encounter ice within parameters we were flying in—FL 210 and -21 Celsius.

After further extensive study with information available from various sources, the Weather Shop determined the conditions were, in fact, favorable for ice formation. The combination of lifting mechanisms and moisture were just right for this episode. It was impossible to predict this combination of factors would suddenly come together.

The bottom line is be prepared to handle the situation you find yourself in. Just because it wasn't forecast doesn't mean it can't happen. **Fly Smart, Fly Safe.** ✈

"THE ICEMAN GOETH"

LT COL JEFF THOMAS
HQ AFSC/SEPP

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

Several years ago, 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, Deicing 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 1424 Type I (deicing fluid) and AMS 1428 Type II/III/IV (anti-icing fluid).

Among the revisions was approval for Air Force use of AMS 1428 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 AMS 1424 Type I (typically called AMS Type I, or simply deicing fluid) is used to remove accumulations of frozen precipitation from aircraft surfaces. The AMS 1424 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). This fluid is an improvement over MIL-A-8243 Type I fluid, which offers **zero** holdover time.

Photo by TSgt Lance Cheung

Anti-icing is the process of *preventing* further accumulations of snow, frost, slush, and/or ice by the application of fluids.

Anti-icing fluids Type 1428 Types II, III, IV (typically called AMS Types II, III, IV, or simply anti-icing fluid) are thickened materials formulated to coat clean aircraft surfaces (after AMS 1424 Type I fluid removes the snow, frost, slush and/or ice). Application results in a thick black 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). These fluids provide anti-icing protection (i.e., holdover time), the length of which is dependent on several factors. The AMS 1428 Type IV fluid has been approved by the SAE G-12 committee and has improved holdover times compared to the AMS 1428 Type II.

If AMS 1428 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.

The Air Force has begun procurement of propylene glycol-based AMS 1428 Type II/IV fluids. (Note: Type III fluids are designed for commuter-type aircraft and are still in development.) These anti-icing fluids present new and unique problems, as older Air Force deicing trucks equipped to dispense the Military Specification fluids cannot properly apply the AMS 1428 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, several years ago the Air Force began the acquisition of deicing trucks capable of dispensing the AMS 1428 Type II/IV fluids. At this printing, there are approximately 120 deicing trucks fielded throughout the Air Force with the capability of applying both deicing and anti-icing fluids. One word of caution... Many Air Force aircraft (i.e., C-5, C-130 and C-141) are not yet approved for *anti-icing* because of the potential for degraded performance of the airfoil. For those of you who frequently transit commercial airports, most major airports now have anti-icing capability. Before allowing a commercial operator to anti-ice your aircraft, be sure the airframe has been approved for application of anti-icing fluids.

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.

continued on next page

What You Can Do

Several studies have shown that attempting to take off in an aircraft which 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 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 wing tips, rolling to 45° of bank after liftoff due to ice on one flap, etc.

Wind tunnel and flight tests have revealed that 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, the aircraft may stall at higher airspeeds 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) take off, 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.")

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

One of the least understood and most important concepts when dealing with deicing/anti-icing is that of holdover times. 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 1424 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 one to three 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 1424 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 1428 Type II/IV fluids being adopted offer significantly longer holdover times under the same conditions because the thicker fluid adheres to the treated surface longer. However, like the above discussion on AMS 1424 Type I fluids, the time is highly dependent on environmental factors.

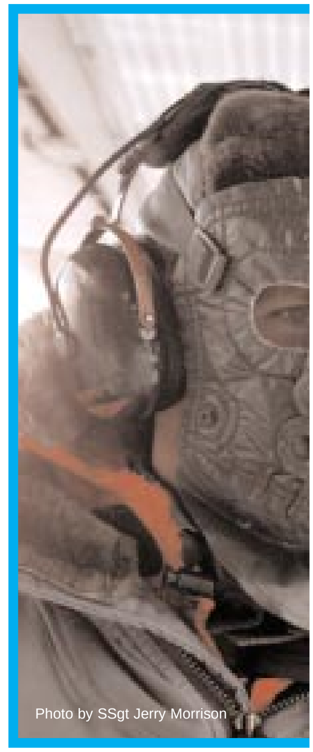


Photo by SSgt Jerry Morrison

Ground Deicing Problems

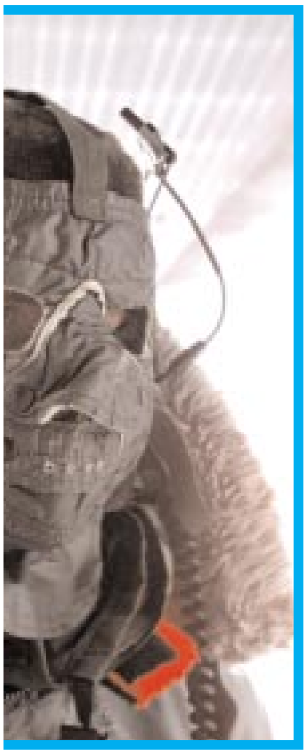
NASA conducted an in-depth review of reports filed with the Aviation Safety Reporting System (ASRS) between January 1986 and January 1993 with regards to air carrier deicing incidents. Although the reports reviewed were limited to air carrier operations, the findings are equally applicable to military 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 phenomenon 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 mixture 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 follow-up 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 take-off:

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

continued on next page

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.

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 accumulations 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!

> ***Never assume that a "light layer" of snow on your wings is "inconsequential" and that it will blow off during taxi or 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 1428 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 a "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 rapidly get colder. 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 it is 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 communication between the deicing ground crew and the flight crew. Be sure ground crews communicate 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 has 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.

"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 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 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 deicing/anti-icing procedures!

(Our thanks to CMSgt Robert McDonald, HQ AMC/LGBE, for his assistance in updating this article, which originally appeared in our October 1997 issue.)

Spray fluids from front to back on all wing/tail surfaces.

USAF Photo

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

The $198,000 Landing

(When we come across mishap messages that have applicability to a large segment of the aviator population, we prefer to tell the stories in our own words so they sound a little less sterile and technical. Sometimes, though, the nonprivileged portions of a mishap message tell a story so well that reworking the words couldn't make the scenario any more clear and dramatic. Here's an example. Ed.)

The air mobility aircraft was scheduled to fly a day/night CDS airdrop training sortie at the home drome. Weather was VFR throughout the mission and after four successful airdrop passes, the mishap crew proceeded direct for a night VFR overhead approach to the runway.

At approximately five miles, the mishap pilot (MP) briefed a throttles "idle all the way around" overhead. Tower reported winds as 30 degrees off the nose at 14 kts and cleared the aircraft for a left, approach-end break and landing. The MP delayed descent in the turn to final until acquiring runway visual cues.

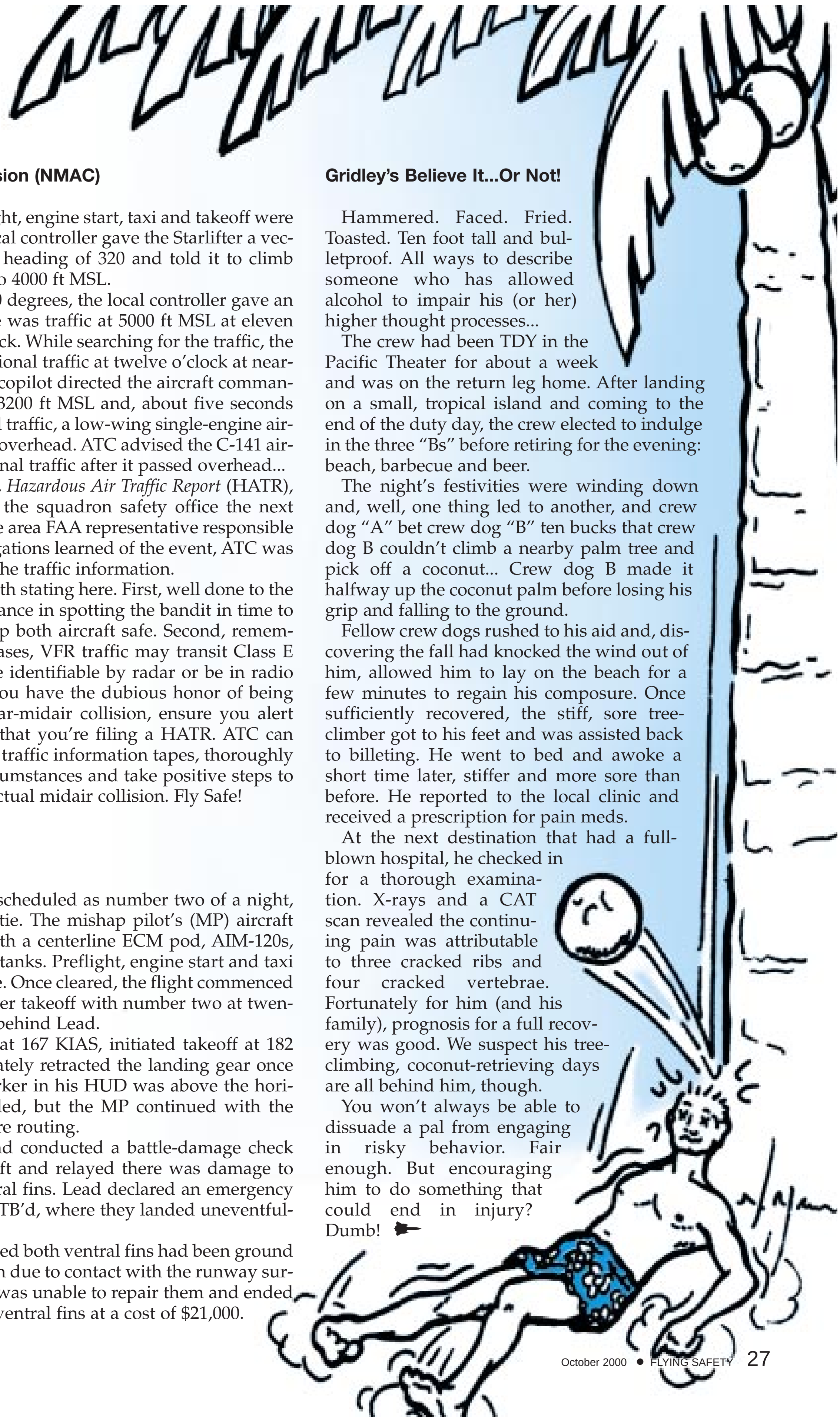
Ninety seconds from touchdown, the MP called for landing flaps and descended through 2050 ft. With PAPI lights indicating well above glidepath on final, the MP increased the descent rate until, at 760 ft AGL, the big aircraft's airspeed started sliding below the 123 KIAS approach speed. At 710 ft and one mile out, with airspeed at 118 KIAS and still bleeding off, no one in the mishap crew made an airspeed deviation call.

Descent rate had increased to 1700 fpm when the GPWS began a series of "Whoop, whoop. Pull up!" warning cycles, but the MP didn't add power (or halt the descent rate) as required for a GPWS warning at night. Did we mention throttles were still at idle? After seven seconds of GPWS warnings, the MP raised the nose to slow the descent rate. At 200 ft AGL, and after eight complete GPWS "Pull up!" warning cycles, the descent rate had been slowed to 1000 fpm and the GPWS warnings ceased.

But now, airspeed started decreasing at a rate of about one knot per second from 113 KIAS. The big aircraft crossed the threshhold at 105 KIAS, eight knots below computed threshhold speed with a sink rate of 1000 fpm. Touchdown ultimately occurred eight degrees nose-high, three knots below computed touchdown speed, with a sink rate of 870 fpm. At touchdown, the aft fuselage/tail section contacted the runway.

Postflight inspection revealed four large scrapes on the aft fuselage/tail section and other aircraft damage. Total bill to repair airframe damage? A shade under $198,000. Surely, better risk management and CRM would have been far less expensive. Would you have called for a go-around before the eighth "Pull up!" warning at 200 ft AGL? Do you check the airspeed and sink rate when crossing the threshhold and call out deviations? If you do, you'll improve your odds of surviving.

By the way, there were no injuries in this Class C mishap. We do, however, suspect aircrew required a change in undergarments once safely shut down in the chocks...



Near-Midair Collision (NMAC)

The C-141 preflight, engine start, taxi and takeoff were uneventful. The local controller gave the Starlifter a vector to an assigned heading of 320 and told it to climb from 2000 ft MSL to 4000 ft MSL.

In the turn to 320 degrees, the local controller gave an advisory that there was traffic at 5000 ft MSL at eleven o'clock to one o'clock. While searching for the traffic, the crew spotted additional traffic at twelve o'clock at nearly co-altitude. The copilot directed the aircraft commander to level off at 3200 ft MSL and, about five seconds later, the additional traffic, a low-wing single-engine aircraft, passed 300 ft overhead. ATC advised the C-141 aircrew of the additional traffic after it passed overhead...

An AF Form 651, *Hazardous Air Traffic Report* (HATR), was filed through the squadron safety office the next day. By the time the area FAA representative responsible for NMAC investigations learned of the event, ATC was unable to retrieve the traffic information.

Three things worth stating here. First, well done to the crew for their vigilance in spotting the bandit in time to maneuver and keep both aircraft safe. Second, remember that in some cases, VFR traffic may transit Class E airspace but not be identifiable by radar or be in radio contact. Third, if you have the dubious honor of being the victim of a near-midair collision, ensure you alert ATC immediately that you're filing a HATR. ATC can then safeguard the traffic information tapes, thoroughly investigate the circumstances and take positive steps to prevent a future, actual midair collision. Fly Safe!

What A Drag!

The F-16CJ was scheduled as number two of a night, two-ship OSW sortie. The mishap pilot's (MP) aircraft was configured with a centerline ECM pod, AIM-120s, HARMs and wing tanks. Preflight, engine start and taxi were unremarkable. Once cleared, the flight commenced a rolling, afterburner takeoff with number two at twenty second spacing behind Lead.

The MP rotated at 167 KIAS, initiated takeoff at 182 KIAS and immediately retracted the landing gear once the flight path marker in his HUD was above the horizon. The F-16 settled, but the MP continued with the climb and departure routing.

Once joined, Lead conducted a battle-damage check on the MP's aircraft and relayed there was damage to both of two's ventral fins. Lead declared an emergency and both aircraft RTB'd, where they landed uneventfully.

Inspection revealed both ventral fins had been ground down about an inch due to contact with the runway surface. Maintenance was unable to repair them and ended up replacing both ventral fins at a cost of $21,000.

Gridley's Believe It...Or Not!

Hammered. Faced. Fried. Toasted. Ten foot tall and bulletproof. All ways to describe someone who has allowed alcohol to impair his (or her) higher thought processes...

The crew had been TDY in the Pacific Theater for about a week and was on the return leg home. After landing on a small, tropical island and coming to the end of the duty day, the crew elected to indulge in the three "Bs" before retiring for the evening: beach, barbecue and beer.

The night's festivities were winding down and, well, one thing led to another, and crew dog "A" bet crew dog "B" ten bucks that crew dog B couldn't climb a nearby palm tree and pick off a coconut... Crew dog B made it halfway up the coconut palm before losing his grip and falling to the ground.

Fellow crew dogs rushed to his aid and, discovering the fall had knocked the wind out of him, allowed him to lay on the beach for a few minutes to regain his composure. Once sufficiently recovered, the stiff, sore tree-climber got to his feet and was assisted back to billeting. He went to bed and awoke a short time later, stiffer and more sore than before. He reported to the local clinic and received a prescription for pain meds.

At the next destination that had a full-blown hospital, he checked in for a thorough examination. X-rays and a CAT scan revealed the continuing pain was attributable to three cracked ribs and four cracked vertebrae. Fortunately for him (and his family), prognosis for a full recovery was good. We suspect his tree-climbing, coconut-retrieving days are all behind him, though.

You won't always be able to dissuade a pal from engaging in risky behavior. Fair enough. But encouraging him to do something that could end in injury? Dumb!

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

"Panel Party" Ends On Sour Note

Two F-15s were scheduled to engage in a little dogfighting. Engine start, taxi, takeoff and airspace work went pretty much as planned, but as the mishap pilot (MP) maneuvered to rejoin his wingman and raised his speed brake to slow down, there was a puff of smoke. Then a dense stream of fuel started flowing from the MP aircraft's speed brake area...not good.

The MP declared an emergency, expedited his return to the home drome and landed safely, shutting down on the runway. Natch, the Eagle was impounded immediately. So, what had happened?

A quick look under the speed brake revealed that panel 66 was MIA. When the MP deployed his speed brake during the join-up, panel 66 contacted a fuel vent crossover line and ripped a hole in a fuel cell access cover, allowing fuel to vent—unrestricted—out of two fuel cells.

Turns out that six weeks prior to the mishap flight, the F-15 had been downed for extensive maintenance, where several parts were CANN'd and numerous panels had been removed to FOM. Once the aircraft was placed in CANN recovery, the shift held a "panel party" to reinstall all the FOM'd panels. A well-intentioned five-level singlehandedly signed off all of the panel installation "Corrected By" write-ups and one seven-level was tasked to inspect and clear all the panel Red Xs.

Reminder: While noble, it's not always a good thing to sign off work you didn't accomplish yourself. And if you're tagged to inspect and clear Red Xs, be sure to inspect as though lives depend on your inspection—*because lives depend on your inspection*. If not for the fact the MP was close enough to land at a suitable airfield, this mishap could have ended with the loss of one each F-15.

A second reminder: We refer you to Murphy's Law, Corollary 3 (see *Flying Safety*, Sep 99), which states: "If there is a possibility of several things going wrong, the one causing the most damage will be the one to fail." True enough.

And now, a few short bursts from the "What was I thinking?" department...

The F-16 driver arrived at the HAS (hardened aircraft shelter) and preflighted the jet for the day's mission. All was well until the crew chief gave the pilot an "All Clear" for engine start. The pilot initiated the engine start sequence but since the intake plug was still installed... Well, let's just say the aircraft didn't didn't make its mission. After an engine change, the jet was declared "in commission" once more. And after extensive retraining, the pilot and crew chief were also returned to FMC status. 'Nuff said.

The maintainer was dispatched to R&R an overwing fairing seal. Holes in the new seal didn't line up precisely with pre-existing holes on the wing, so he retrieved an awl to help stretch the seal into alignment. Unfortunately, the awl slipped...and went into his left eyeball. This was undoubtedly an excruciatingly painful injury, but after some delicate surgery and 25 days on quarters, the doctors predicted the maintainer would make a full recovery. Moral of the story? Just because tech data doesn't require use of eye/face protection, doesn't mean you can't assess risks of the task you're performing and decide to wear protective gear anyway.

The troop was on a B-4 stand installing an aircraft panel. When he paused to catch his breath and leaned against one of the stand's guard rails, it swung out and he fell backwards seven feet to the ramp below. While his injuries—a dislocated shoulder, lower back strain and bruised knee—weren't life-threatening, they certainly could have been. Bottom Line: Appearances may be deceiving. Always verify guard rails are properly secured *before* you depend on them to save your life.

Enthusiasm for your profession is a very, very good thing. But when working around machines that can quickly take your life, you've got to temper that zeal with caution if you want to go home—instead of to the hospital—at the end of your shift. The exercise was in full swing and everybody was hustling to launch, recover and turn jets, including this young troop, who was pinning the gear on his F-16 that had just blocked in. He pinned the gear and moved backward away from the aircraft, and hit the back of his head and neck on a main landing gear door. He sustained a cervical sprain and a concussion. Let's be careful out there.

We often hear the words "*maintain situational awareness*" associated with the aviator community. But those words apply equally to those of us who fix jets...Two maintainers on the graveyard shift were assigned to perform power-on checks and LOX servicing on their F-16s. They had completed half the jets. Eager to finish up the rest of the squadron's aircraft, maintainer 1 (M1) hooked up the LOX cart to the metro and returned it to the LOX servicing area, while maintainer 2 (M2) hooked a dash-60 up to the F-16 that was next in line. M1 returned with the metro and parked it near the dash-60 while waiting for M2 to complete the power-on check. When M2 was finished, he hooked up the dash-60 to the metro's pintle hook, climbed aboard the metro to annotate power-on check results and both of them proceeded to the next jet. When M1 got out of the metro at the next F-16, he discovered the dash-60 power cord hadn't been disconnected from the previous F-16. The Falcon suffered $13,000 damage to the external power receptacle and nose gear door, and the dash-60 needed a new power plug.

Wounded Warthog

Aero Repair troops had applied electrical and hydraulic power to an A-10 and were performing operational checks on the speed brakes. When the speed brakes failed a critical step, they requested an Electro/Environmental (E&E) assist and turned the problem over to two qualified E&E troops.

During the course of troubleshooting, the E&E troops determined the right speed brake cam limit switch linkage was loose and needed to be adjusted. In accordance with tech data, they obtained the required speed brake holding fixture and, with electrical and hydraulic power still applied, deployed the speed brakes in order to install the holding fixture on the right speed brake. With the fixture properly installed, and electrical and hydraulic power removed, the speed brake would then remain open, allowing access to the switch.

A few notes now for those of you unfamiliar with the A-10 and its speed brake system. First, the speed brakes and ailerons are integral units. When the speed brakes are deployed, each of the two ailerons separate into upper and lower surfaces that deploy into the windstream, providing pretty effective aerodynamic braking. Second, the speed brake system is designed so that if electrical power is lost, hydraulic power will automatically drive the speed brakes closed. Finally, the speed brake holding fixture is not a safety device. It's simply a device to prevent gravity from closing the speed brakes after hydraulic power has been removed. Speed brake safety pins are just that: Safety pins used to prevent the speed brakes from closing even when hydraulic power is still applied. Now, back to our story...

The E&E troop supervising the job installed the holding fixture, then disconnected the cannon plug from the cam limit switch. With electrical power now removed and hydraulic power still applied, (and as we know) the speed brake holding fixture not designed to serve as a safety device and hold the speed brakes open under hydraulic pressure, well, you can imagine what happened next...Uh, oh!

On the "plus" side, the E&E troop who had disconnected the electrical plug from the cam limit switch was able to escape injury by removing his hands from the speed brake area before the boards closed. On the "minus" side, hydraulic power did drive the speed brake boards closed on the holding fixture, causing $14,000 damage to the Warthog's right aileron.

USAF Class A Mishaps

FY00 Flight Mishaps (Oct 99 - Aug 00)

15 Class A Mishaps
6 Fatalities
11 Aircraft Destroyed

FY99 Flight Mishaps (Oct 98 - Aug 99)

29 Class A Mishaps
9 Fatalities
24 Aircraft Destroyed

03 Oct	♣	While conducting a SAR mission, a UH-1N went down.
17 Nov	♣	Two F-16Cs flying an NVG upgrade sortie collided during a VID intercept. One F-16 was destroyed; the other F-16 recovered safely.
22 Nov		An OA-10A departed the departure end of the runway.
06 Dec	✶	An RQ-4A Global Hawk UAV was extensively damaged while taxiing after landing.
10 Dec		A C-130E touched down short of the active runway, then diverted to another airfield and belly-landed. Three personnel were fatally injured.
15 Dec		An HH-60G rolled over at an LZ following a hard landing.
20 Jan	♣	An A-10 crashed on RTB. The pilot was fatally injured.
16 Feb	♣	An F-16CG on a routine training mission experienced an engine malfunction.
16 Feb	♣	An F-16DG crashed while flying an NVG upgrade sortie.
28 Feb	✶	A maintainer sustained fatal injuries after falling from the lower crew entry ladder on a C-5.
19 Mar	♣	An F-16C crashed while performing at an airshow. The pilot was fatally injured.
31 May	✶	An F-15E was damaged after a high-speed abort.
16 Jun	♣	An F-16C on a routine training mission had an engine malfunction.
21 Jun	♣	During egress off target during a ground attack sortie, the pilot ejected successfully from an F-16CG.
02 Aug		An MH-53M's tail rotor contacted the ground during a tactical NVG approach.
03 Aug	♣	An F-15C crashed during a Green Flag sortie.
03 Aug	♣✶	An unmanned QF-4G crashed 10 minutes after takeoff.
08 Aug	♣	Two F-16s experienced a mid-air collision. An F-16CG was destroyed; the F-16CJ recovered safely.
11 Aug	✶	An F-15E was damaged during a ground maintenance run.
28 Aug	♣	An F-16C crashed during RTB. The pilot was fatally injured.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- "♣" denotes a destroyed aircraft.
- "✶" denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.
- Flight, ground, and weapons safety statistics are updated daily and may be viewed at the following web address by ".gov" and ".mil" users: http://www-afsc.saia.af.mil/AFSC/RDBMS/Flight/stats/index.html
- **Current as of 28 Aug 00.** ➤

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WELL DONE AWARD

UNITED STATES AIR FORCE

THE Well Done AWARD

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Mishap Prevention Program.

CAPTAIN CHARLES D. SANDERS, JR.

75th Airlift Squadron

Ramstein AB, Germany

On 4 May 1998, Captain Charles D. Sanders, Jr., and his crew were enroute to NAS Sigonella, Italy in a C-9A for the first leg of an air medical evacuation mission with twenty passengers and aircrew. The mission was going as planned when Capt Sanders' copilot, Lt Eric Mitchell, told him he was having to use excessive aileron trim because the autopilot was drifting left. Capt Sanders gradually rolled the aileron back to neutral and the aircraft began to fly straight. Capt Sanders tried to initiate a twenty-degree right bank with the heading bug and the aircraft began an uncommanded left turn. Disengaging the autopilot, Capt Sanders tried to roll the aircraft upright and found that the control column was binding to the left. He was unable to roll the aircraft to the right, and Lt Mitchell could not fly the aircraft from his side. To get the aircraft back to level flight, Capt Sanders started to "Dutch" roll the aircraft using right rudder inputs.

Capt Sanders continued to fight to get the aircraft upright while Lt Mitchell coordinated with the Italian air controllers for a descent to flight level 100. Capt Sanders turned the hydraulic pumps to "high" in an attempt to assist the aircraft roll capability with the spoilers. He couldn't obtain more than two to three degrees of control column movement to the right. Due to IMC weather conditions at local airfields and the inability to maneuver the aircraft or execute a go-around, if needed, the crew coordinated with the Italian controllers to land in Pisa, Italy, which had VMC conditions. Capt Sanders turned on all anti-icing systems trying to melt suspected ice on the aileron cables. He continued to use "Dutch" rolls and elevator authority to turn the aircraft. As he continued to turn the aircraft, a pressurization warning indicator illuminated. He immediately locked the pressure controller to manual, donned his oxygen mask, and instructed the crew to don their oxygen masks and execute the crash landing checklist. As the aircraft approached Pisa, Capt Sanders performed a controllability check. The aircraft was flyable, but required 50-60 pounds of pressure on the control column to maintain level flight. Capt Sanders safely landed the aircraft and ironically stated that it was his smoothest landing ever. Post incident investigation revealed that a defective aileron control box may have caused the aileron cables to bind.

The superior flying skills and crew coordination of Capt Sanders and his crew prevented the loss of life and destruction of a valuable Air Force resource.

Imagery by SSgt Jeffery Allen