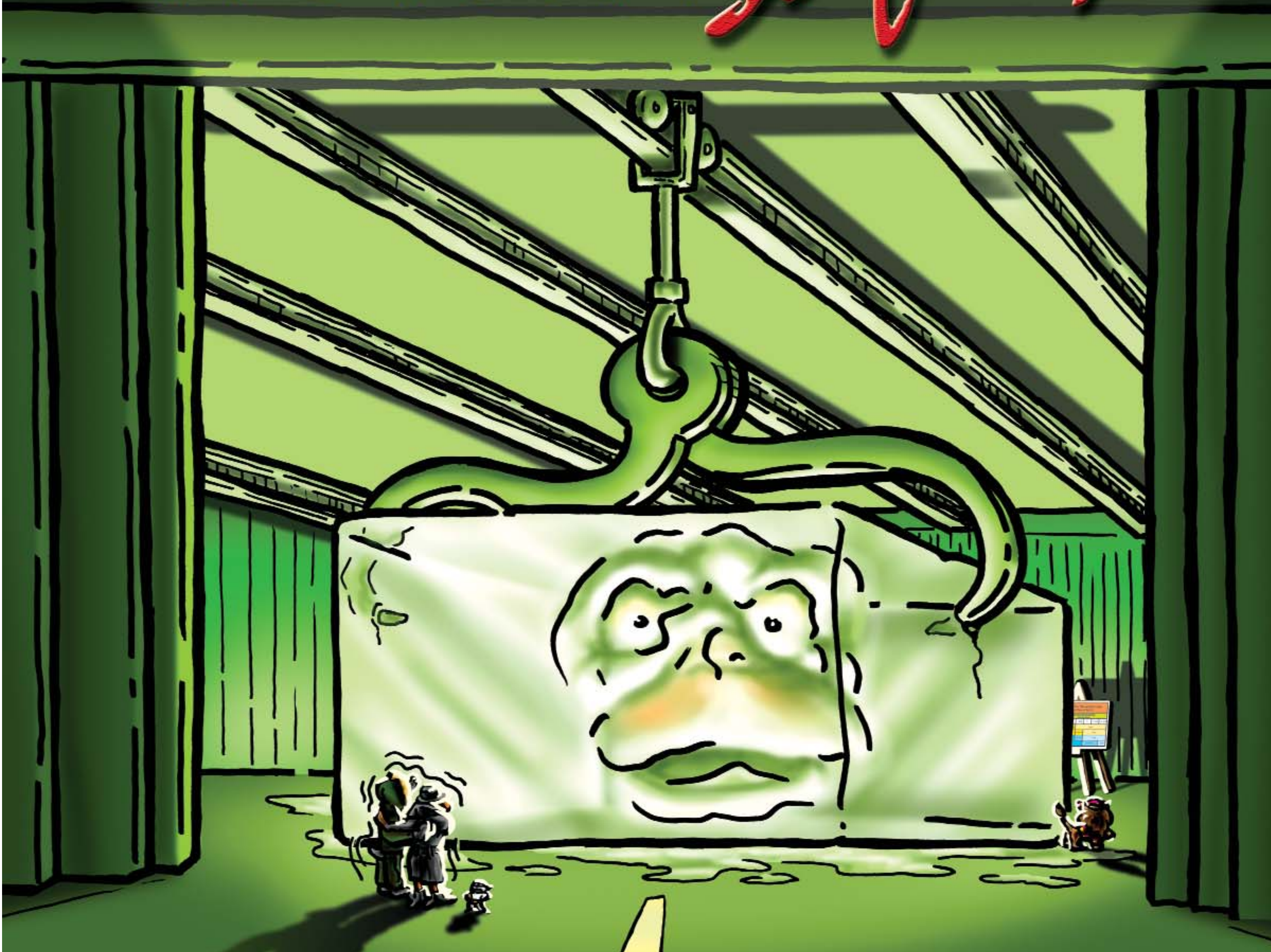
UNITED STATES AIR FORCE

FLYING Safety

MAGAZINE

November 2002



The Wizard of Ice

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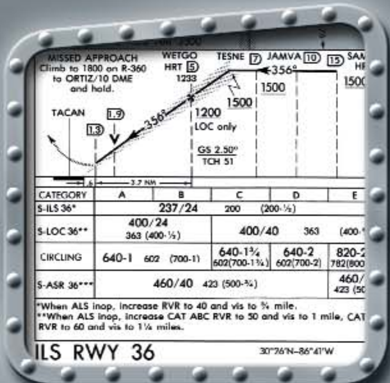

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GENERAL JOHN P. JUMPER
Chief of Staff, USAF

MAJ GEN KENNETH W. HESS
Chief of Safety, USAF

COL MARK K. ROLAND
Chief, Safety Education and Media Division
Editor-in-Chief
DSN 246-2968

JERRY ROOD
Managing Editor
DSN 246-0950

CMSGT JEFF MOENING
Maintenance/Technical Editor
DSN 246-0972

PATRICIA RIDEOUT
Editorial Assistant
DSN 246-1983

DAN HARMAN
Electronic Design Director
DSN 246-0932

TSGT MICHAEL FEATHERSTON
Photo Editor
DSN 246-0986

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Commercial Prefix (505) 846-XXXX
E-Mail — jerry.rood@kirtland.af.mil
Address Changes — patricia.rideout@kirtland.af.mil

24-hour fax: DSN 246-0931
Commercial: (505) 846-0931

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FSM notams

THE ARTFUL (WEATHER) DODGER

Courtesy ASRS *Callback* #272
NASA's Aviation Safety Reporting System

A GA pilot was repositioning an aircraft with no radios on a long cross-country flight. He was prepared for forecast rain showers, but not for worsening visibility.

I was repositioning a single-engine aircraft. However, the aircraft did not have any navigation or communication radios. Therefore, it was necessary to fly a course that avoided several controlled airports and do this by pilotage. All forecasts, including my destination [airport], called for VFR conditions during my flight and for several hours after my estimated time of arrival. The only weather that posed a problem was an area of rain showers that covered an area I had to fly through in order to avoid the controlled airports. As it turned out, this area of rain showers had ceilings that were 800-1000 feet, but the visibility was very good. However, as I left the rain showers, the visibility started to decrease to about six miles. As I neared my destination (about 20 miles out), the visibility dropped further. I was concerned that the visibility would decrease to less than three miles. (My destination was a controlled zone.) I did not have a lot of fuel to play around with, no electronic navigation and no ability to talk to anyone. Therefore, I determined that the best action would be to continue to my destination which was the closest airport and an area that was very familiar to me.

Shortly after I landed, I went to the pilot lounge and checked the automatic weather. It was reporting a special observation of 2-1/2 miles visibility. I do not know what I could have done differently when confronted by the conditions so far into my flight. The best action was to get the airplane on the ground as soon as possible.

This pilot might have also planned a fuel stop for the trip, which would have allowed time for a weather update and needed fuel reserves. A handheld transceiver would have provided communications capability for an emergency.

INOP COMPONENTS AND THE*

LT COL ROBERT ENGLEHART
Vice Commandant
USAF Advanced Instrument School

INOP COMPONENTS

INOPERATIVE COMPONENTS OR VISUAL AIDS TABLE

Landing minimums published on instrument approach procedures charts are based upon full operation of all components and visual aids associated with the particular instrument approach chart being used. Higher minimums are required with inoperative components or visual aids as indicated below. If more than one component is inoperative, each minimum is raised to the highest minimum required by any single component that is inoperative. ILS glide slope inoperative minimums are published on instrument approach charts as localizer minimums. This table may be amended by notes on the approach chart. Such notes apply only to the particular approach category(ies) as stated. See Flight Information Handbook for description of components indicated below.

(1) ILS, MLS, and PAR

Inoperative Component or Aid	Approach Category	Increase Visibility
ALSF 1 & 2, MALSR, & SSALR	ABCD	¼ mile

(2) ILS with visibility minimum of 1,800 RVR

ALSF 1 & 2, MALSR, & SSALR	ABCD	To 4000 RVR
TDZI RCLS	ABCD	To 2400 RVR
RVR	ABCD	To ½ mile

(3) VOR, VOR/DME, VORTAC, VOR (TAC), VOR/DME (TAC), TACAN, LOC, LOC/DME, LDA, LDA/DME, SDF, SDF/DME, RNAV, GPS, and ASR

Inoperative Visual Aid	Approach Category	Increase Visibility
ALSF 1 & 2, MALSR, & SSALR	ABCD	½ mile
MALS, SSALS, ODALS	ABC	¼ mile

(4) NDB

ALSF 1 & 2, MALSR & SSALR	C	½ mile
	ABD	¼ mile
MALS, SSALS, ODALS	ABC	¼ mile

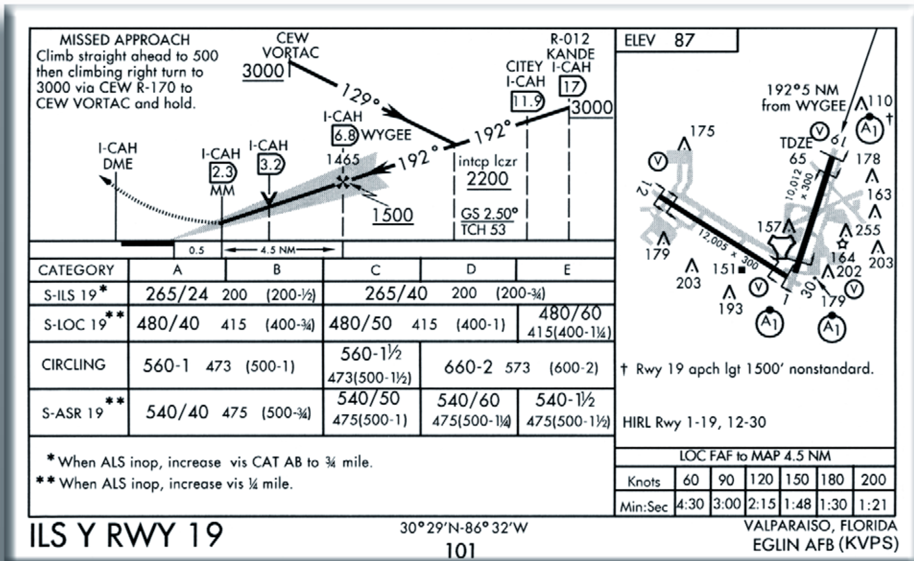
Before you get to any Instrument Approach Plate (IAP) in the DOD Approach Plate books, you have to wade through a host of legend information, the table of contents, a list of abbreviations, conversion charts, the take-off minimums and (obstacle) departure procedures, the alternate minimums, Land and Hold Short instructions, and the radar minimums, not to mention the index as well. It's almost 50 pages of junk, right? Well not exactly, but I bet most of you experienced pilots breeze through this section because, after all, it really only serves as fodder for your SUPT Instrument Check Ground Evaluation, right? Again, not exactly.

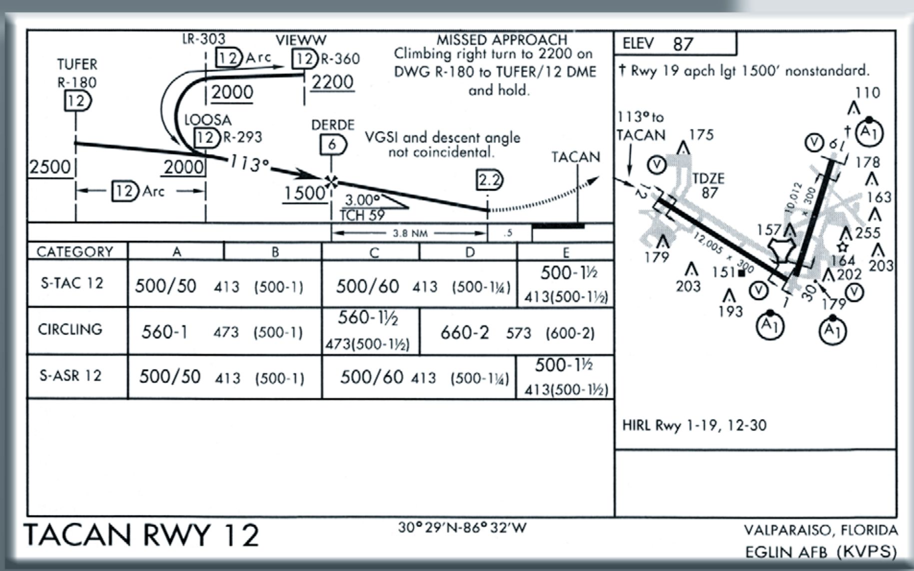
Of course, everyone who can't do a 6000+ FPM climb on departure has to look in the front of the IAP books for the IFR takeoff minimums/departure procedures. Even you 6000+ FPM guys should be looking up there too. All of us look up front for the ASR and PAR minimums, and some of us will even admit to looking at the index occasionally. But how many of you know how to use the INOP Components Table? "What table is that?" you ask. My informal survey shows most pilots don't even know it exists. I'll try to help you out some. Take a look at the table, this one from page XIX of the Low Vol 15.

OK, so now that you know it exists, the questions are: 1) Do I have to use it? and 2) If so, how do I apply it? If you haven't figured it out already, the instructions on the chart are pretty poor. There are no directions to tell the USAF (or DoD) aviator how to use the chart. But basically, the chart seems to tell me that if I lose a lighting component or visual aid, I'm supposed to raise my visibility minimums. But does that apply to USAF pilots? How about USN/USMC/USCG/USA pilots or a civilian flying the DoD approach plates? I don't see any CAT E Approach Categories listed, so I never have to increase my visibility minimums if I'm CAT E, right? Why, in some cases, does a CAT D pilot have to raise his minimums 1/4 of a mile, while the CAT C pilot has to raise his 1/2 of a mile? I would have thought the faster dude would raise his visibility more. Here we go, folks.

Most of us are familiar with the * in the minimum section on IAPs. We will look at three examples to help unravel the mystery and tie the * usage to the INOP Components Table. Grab a Low Vol 15, and let's start with Eglin AFB (VPS). Almost every IAP at Eglin, the ILSs to RWY 19, the ILSs to RWY 30, the TACAN to RWY 1, the TACAN to RWY 19, and the TACAN to RWY 30, have the familiar * printed on the IAP in the minimum section. The text following the * usually states something like "* When ALS inop increase vis 1/4 mile." OK, so why doesn't the TACAN to RWY 12 have the *? The answer is: There is no light group published (or in place) for Runway 12, and so the visibility minimums on the TACAN approach already account for no lights being in place.

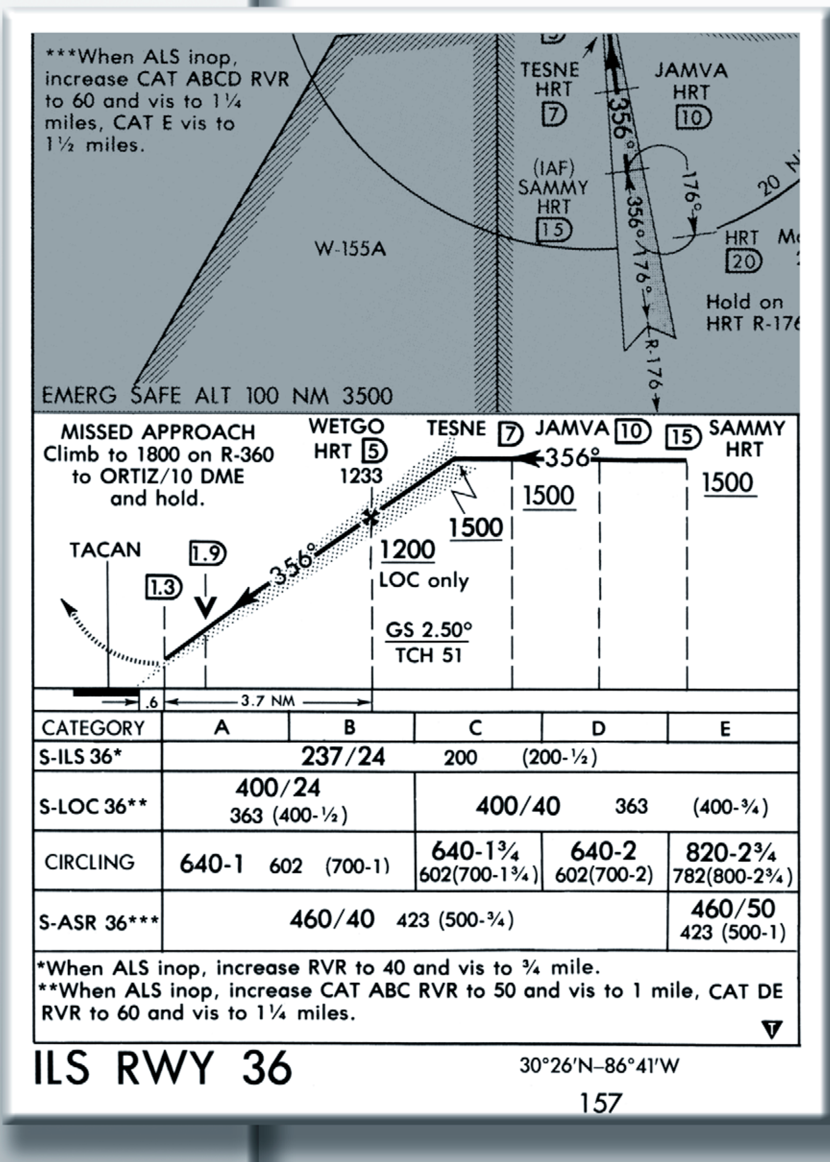
There are no directions to tell the USAF (or DoD) aviator how to use the chart.





But there are VASIs to RWY 12. What if those go out? As I read the text on the INOP Components Table, it seems to indicate the landing minimums were derived with "full operation of all components and visual aids associated with the particular instrument approach chart being used." Wouldn't that seem to indicate the VASIs are an important part of the visual aids associated with the IAP and the * should be there anyway? Or at least I should make some kind of correction if the VASIs are out? Nope, not in the TERPS world. I know, I know; I hated to use the T-word too, but stay with me.

Remember, VASIs (or PAPIs, PVASIs, APAPs, or LCVASIs) are designed for VFR use (as an aid to glidepath control) and are only "extra stuff" when it comes to instrument landing lighting. Lighting is broken down into three distinct categories: Runway Lighting Systems, Approach Lighting Systems (ALS), and Visual Glide Slope Indications. Despite the fact that the introduction paragraph says "all components and visual aids," you disregard operational status of VASI-type equipment. You also disregard the status of any Runway Lighting Components like HIRL, MIRL, LIRL, TDZL, REIL, Runway End, Centerline or Threshold lights. The introduction paragraph on the INOP Components Table does a great job of directing you to the Flight Information Handbook (Section B) where you can see the three types of lighting categories broken down.



As an aside, when you thumb through the Eglin Approaches, it gets a little more confusing because Eglin uses three different sets of terminology when describing what to do: "*When ALS inop, increase …", "*When apch lgt inop, vis increases to [or, in some cases, by] …", "*Vis increased by 1/4 SM for inop apch lgt." They all really mean the same thing and you have to read closely to apply the correct procedures.

At Eglin, the visibility is increased to 1 3/4 miles for ASR RWY 19 (Cat E) by the * usage and there is certainly no value that high on the INOP Components Table. How'd that happen? When a runway has good lights, the "TERPster" gets to take "credit" and reduce the visibility. Usually, it goes from one statute mile (SM) (no lights) to something less. As lights become inoperative, then the "credit" goes away and the visibility minimum published on the IAP must be raised. A civilian "TERPster" jumps into his TERPS Manual (Chapter 3, Table 9) and cranks the numbers for the approach and the inoperative lighting. The INOP Components Table in the IAP book was designed to allow the pilot to have access to the same information as "TERPster" (just different formatting). You, the pilot, can then account for the "credit/credits" no longer being in place (because the lighting is degraded) and raise your minimums accordingly.

Unfortunately for the Cat E driver, the chart doesn't tell you what to do. Because there is no CAT E listed on the INOP Components Table, a CAT E flyer must always look for the * (scan the IAP closely), listen to ATIS, and/or check the NOTAMs to see if CAT E minimums are affected by INOP components. In the above example at Eglin, a military "TERPster" would look at Chapter 3, Table 10 to discover Cat E minimums. The civilian or FAA "TERPster" can also look at Table 10 but will only do so when requested by a military customer. For you die-hard information addicts, look at FAA Order 8260.32, *USAF Terminal Instrument Procedures*, paragraph 8.

Let's move on and look at another wrinkle. Turn to Hurlburt FLD (HRT). At this field, the ILS to RWY 36, the TACAN to RWY 18 and the TACAN to RWY 36 all have the *, but now they give us both RVR and Prevailing Visibility (PV) numbers to work with. Look at the partial picture of the IAP for the ILS to RWY 36. Not all the data could be contained in the minimums section, so they had to move the *** to the Planview. Be careful to reference the correct number of *'s and if you don't see the * in the minimum section, scan the entire IAP.

You will notice that the INOP Components Table is primarily based on PV numbers. The first, third and fourth sections of the chart list PV. The second section only has RVR correction values for ILSs with 1800 RVR minimum values. If you are trying to correct an ILS that doesn't have RVR minimums of 1800 (for example the RVR value is 2400), then you need to use the PV Minimum numbers and correct those instead. Remember (for USAF aircrews only) according to AFI 11-202 V3, we must use RVR if it is reported and then PV when RVR is not available.

One of those "other useless" pages in the front of the IAP books is the METAR Conversion Chart. You might find the METAR Conversion Chart handy if you had to convert a non-1800 RVR value to a Visibility number. What if you were correcting an IAP that listed minimums in meters? You would need the METAR Conversion Chart and a calculator to do that math.

Did you realize the INOP Components Table listed in the Europe, North Africa, & Middle East Books, Caribbean & South American Books, and Pacific, Australasia & Antarctica Books are exactly the same as the US version? That is, the Table only offers corrections in Statue Miles to Prevailing Visibility. You would think they would correct the INOP Components Tables in the overseas books to avoid the US conversion process and list corrections in meters.

Another twist for overseas flyers is: What if my ALS isn't listed on the INOP Components Table? For example, the NATO Standard, the British Calvert, and the Singapore Centerline lighting systems are not referenced in the Table. My best advice to you is to make the overseas group match the FAA/US equivalent group as closely as possible and use that correction value. In the worst case, correct by 1/2 mile (more on that later). What if the approach I'm flying isn't listed on the INOP Table? For example, the LLZ/DME RWY 33 to Cairns, Australia. Well, an LLZ is just another name for a Localizer and so you would use Section 3 of the chart and correct via the Non-Precision Approaches listed. If in doubt, correct by 1/2 mile.

Now let's turn the pages in our Low Vol 15 to Patrick AFB, and the ILS to RWY 2, the ILS to RWY 20, the VOR/DME to RWY 2, the TACAN to RWY 2 and the TACAN to RWY 20. There isn't an * on any IAP. Did that "TERPster" forget? Not exactly. Runway 2 is the only runway that has an A2 light group, and so Runway 2 would be the only one affected by a change due to INOP components. But in this case the "TERPster" has made the visibility minimums one SM or greater for every Runway 2 approach and, as a result, the "TERPster" has no need to use the * telling you to increase your visibility minimums if the ALS is INOP. The * might not be there because it doesn't need to be.

How do you know if the "TERPster" didn't put the * there on purpose, or didn't forget? The answer is you don't. There is aviation history (back to the DC-3 days) when one Statute Mile was the standard instrument approach visibility minimum. In the old days, most airfields didn't have lights and we were principally a day VFR force. Today, because all our "TERPsters" use speed as the criteria for approach categories, one SM remains the "defacto standard" today. Without making this a TERPs article, as long as the HAT (straight-in) and HAA (circling) meet some listed criteria, then basic visibility stays at one mile. Of course, there are always exceptions: An ILS with a DH of 200 feet gets to use a 3/4 mile standard.

Be careful to reference the correct number of *'s

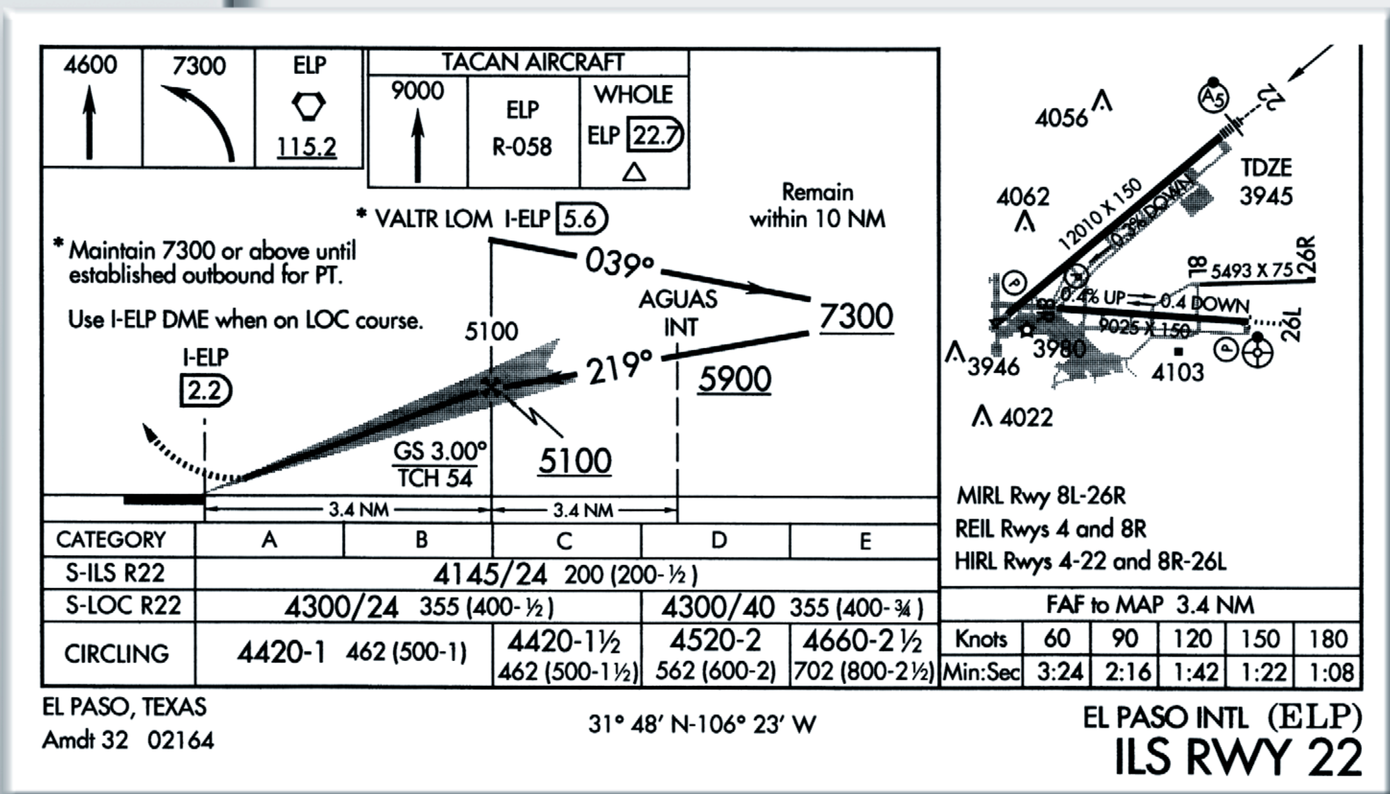
How do I really know when I'm supposed to make corrections using the INOP Table? If you are flying to a USAF or USN field and the IAP has been designed by a military "TERPster", then don't use the INOP Components Table. If you see the "(USAF)" or "(USN)" next to the IAP Approach numbering system, then you should see an * or just know that the visibility minimums are already set appropriately. You are going to have to trust the "TERPster". They do a fine job, trust me. Take a look at Pensacola NAS to see the USN "TERPster" using a combination of one mile visibility minimums and also the * usage. Stay right there at Pensacola, but now look at Pensacola Regional. See the "(FAA)" next to the approach numbering system? That means it was designed by an FAA "TERPster", and as a result there is no * anywhere on the IAP. So, now I use the INOP Components Table, right? Well, sort of. Here at the Instrument School we say, "It depends." You should (I didn't say "will") use the table when flying civilian IAPs and USA IAPs that were developed by the FAA, i.e., "(FAA)" next to the numbering system.

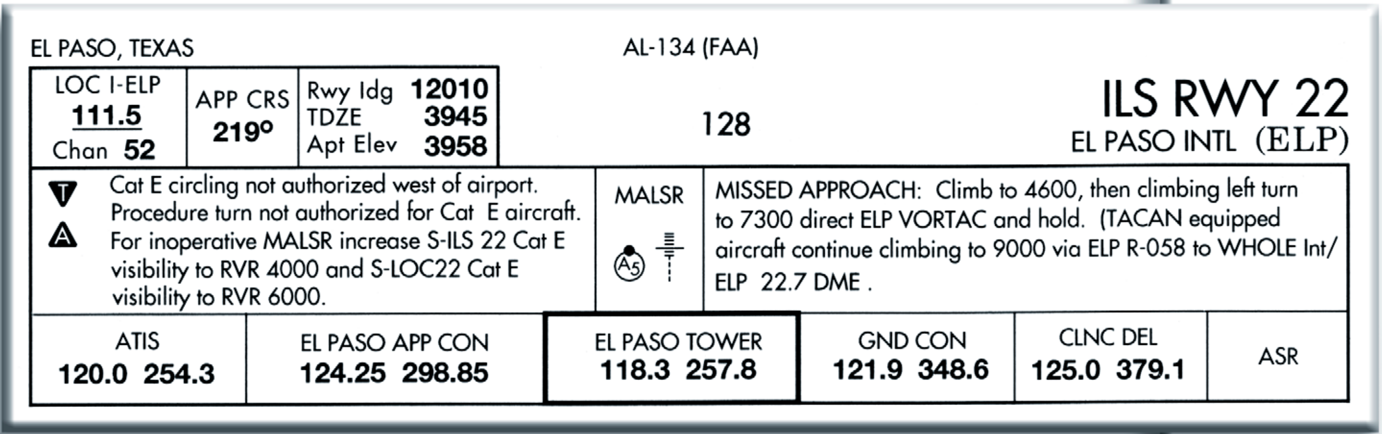
You are going to have to trust the "TERPster".

I hate that "should/will/might want to" quagmire. One of the real problems you face as an aviator is this: Now that you have a little bit of knowledge, how do you reconcile the use of the INOP Components Table (designed to be used when flying civil IAPs) when you have USAF guidance that tells you what to do when there are inoperative approach lights? Come again?

Chapter 8 of AFI 11-202 Vol 3, Section 8.14.2, says; "Inoperative Approach Lighting: Pilots shall increase the published visibility minimums of an instrument approach by 1/2 SM or as noted in NOTAMs, on ATIS, or on the approach plate, when the runway approach lighting system (ALS) is inoperative. NOTE: This paragraph applies only to the ALS itself, not to VASIs, PAPIs, and other lights that are not a component of the ALS."

Basically, the instrument gurus who contributed to AFI 11-202 Vol 3 didn't want you to search out the information on the INOP Components Table and designed a "one size fits all approach" to tell USAF aviators what to do if the lights are broken. The problem is that 1/2 SM might be more





than you need, but the USAF decided to err on the conservative side. Since the highest correction value in the INOP Components Table is 1/2 SM, guess what, 1/2 becomes the defacto correction standard.

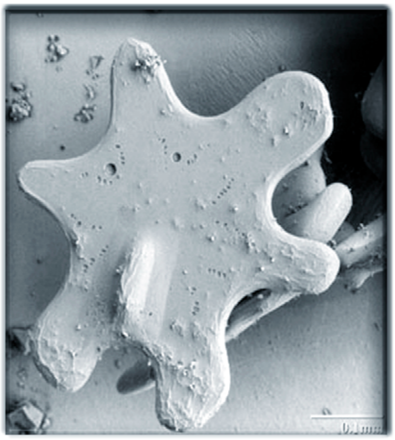
Let's take a look at the ILS to RWY 22 at El Paso (FAA designed). It has Cat E mins on the IAP because the military requested it. The ILS has an RVR value of 2400 and PV of 1/2 SM. The FAA goes to the different TERPS Manual Table (number 10 this time) and corrects the CAT E value to 4000 RVR if the MALSR is INOP. The FAA then lists that (with no *, by the way) following the General Remarks about circling and when the Procedure Turn isn't authorized. It is text within the VOLPE Strip Format and not easy to find. You can see that if we follow the USAF rules and add the 1/2 mile outlined in AFI 11-202 Vol 3, we would end up with one SM. That equates to 5000 RVR using the METAR Conversion Chart. So, by USAF rules, we need 5000 RVR, and the FAA says we only need 4000 RVR. Again, the USAF errs on the conservative side. But this example is very important for our Cat E flyers. You won't see the * on a "(FAA)" TERPS'd approach. And for all other users, Cat A, B, C and D, *if not using the USAF 1/2 mile standard correction factor*, you must use the INOP Components Table to correct the visibility numbers.

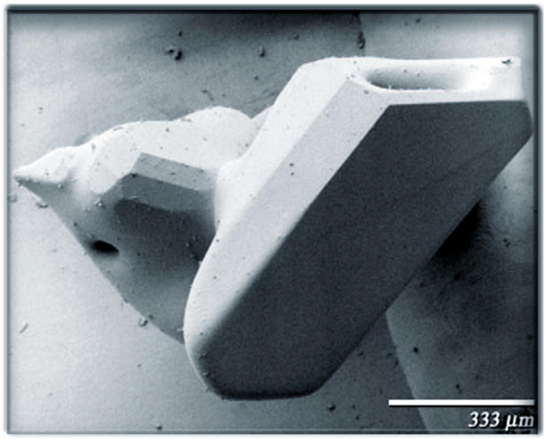
As a final "civilian" example, let's look at the Jeppesen minimum section. Jeppesen corrects the data on the IAP itself to show new minimums, as lighting is lost. They break out "TDZ or CL out of service" and then further expand the minimum section to "ALS Inoperative." Whether it is RVR or SM, US or International, the corrected numbers are right in the minimum section, and so you don't use the INOP Components Table (or other correction chart) when flying a Jeppesen IAP. Some pilots might ask, "Should I use the USAF standard 1/2 mile correction if a light component is out when flying a Jeppesen IAP?" The answer is no, as long as you understand how the Jeppesen was constructed and how to break out their adjusted minimums. If in doubt, add the 1/2 mile. Jeppesen corrects in meters, if appropriate, in the World-Wide Minimum Section.

Because the USA, USN, USCG, and USMC also fly with the DoD Approach plates produced by NIMA, the INOP Components Table remains in the book "unaltered" for their use. In fact, the USA actually requested the Table be added to our DOD books in Sept. 1995. All USA procedures require the use of the INOP Components Table unless otherwise specified. At some time in the future, AFI 11-202 is going to be re-worded to incorporate the INOP Components Table. What should you do for the time being? Use the * if it is on the IAP, use the correction printed in the NOTAMs, use the values broadcast on ATIS, or use the current AFI guidance of 1/2 mile.

Combined with your new knowledge of the INOP Components Table, you will be well on your way to flying smarter and safer, not to mention being all pooped-up for your SUPT Instrument Ground Eval. Check Six.

You won't see the * on a "(FAA)" TERPS'd approach.





Ground Icing
A Slippery Affair

Visibility estimates alone can be a poor indicator of ground icing potential.

Electron Microscopy Courtesy of Beltsville Agricultural Research Center

Major Elizabeth A. Coates
121 WF/DCANG

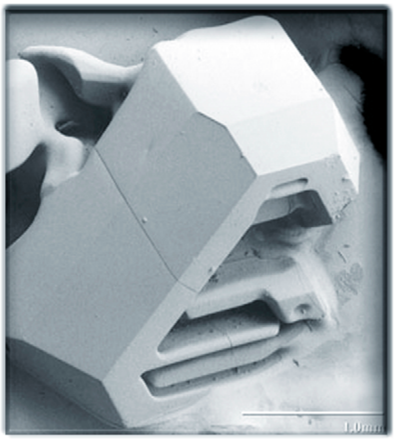
Flying Safety, Oct 98

Most of you probably don't realize that weather services use visibility estimates to categorize snowfall intensity. The problem with this method is that a visibility estimate alone can be misleading to pilots and ground deicing decision makers.

Recent research findings by Dr. Roy Rasmussen and Jeffrey A. Cole of the National Center for Atmospheric Research (NCAR), *How Snow Can Fool Pilots*, reports that visibility estimates alone can be a poor indicator of ground icing potential.

How is this possible? Well, simply put, snowflakes with large diameters and those formed from more than one crystal have a greater potential to obscure visibility. Depending upon upper-level cloud temperatures and cloud structure, a larger snowflake may contain less water. Likewise, snow can also form from a process known as "crystal riming." The crystal riming process makes snow appear white and frosty, and when it occurs, water content is higher. As a result the diameter of the snowflake is reduced and visibility increases.

So what does this mean to you? Imagine for one moment that you're preparing for a flight. You glance out of your window and observe 1/4-mile visibility with heavy snow (snowfall intensity based on reported visibility). Weather reports indicate the liquid precipitation rate is about .1 inch per hour. You observe the flakes are fairly large (about 3 to 5 mm) and not rimed. Well, for the same liquid precipitation rate (.1 in/hr), the observation could also be 3.4 miles w/light snow. These snowflakes could be small (about 1 to 3 mm) and rimed, which



would account for the higher visibility.

Although the crystals are smaller and the observed visibility is higher, the crystals could be formed from the heavy crystal riming process we discussed earlier and have a higher water content than the larger fluffy snowflakes. These differences in crystal type and size would account for the differences in visibility, similar water content, and in these two examples, an equal threat to ground icing hazards.

There is another related situation that could mislead one into underestimating icing potential. At night, light scattering from the snow decreases, and for the same snowfall rate, visibility is twice as good as during the day. In this scenario, one would need to pay attention to the crystal characteristics as well.

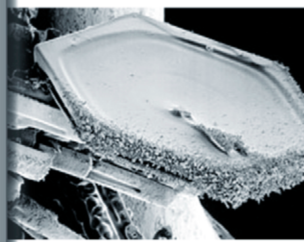
According to Rasmussen and Cole, "Accurate real-time measurements of liquid equivalent snowfall rates need to be made and reported to pilots and ground operations personnel, not just visibility measurements." In the same study, previous ground icing accidents had common values of (1) precipitation rate — .08 to .1 inch per hour; (2) temperatures — 25ºF to 31ºF; and (3) wind speed — 8 to 13 knots.

However, reported visibilities varied from .25 to 2.0 miles, demonstrating again that visibility alone may be a poor indicator for snowfall rates. It also points out that temperatures near 32ºF are particularly hazardous. As snowflakes melt, the diameters decrease and the process has the same effect as rimed snow. That is, visibility will increase.

(Editor's Note: Since this article was originally printed, Maj Coates has added the following information.)

Aimed at producing a systematic, comprehensive approach to providing support to deicing operations, the NCAR (Rasmussen and Cole) and FAA (Warren Fellner and Ken Leonard) are working on the Weather Support to Ground Deicing Decision Making (WSDDM) project. The WSDDM approach uses data extracted from a matrix of Doppler radar, snow gauges, and the Automated Surface Observation System (ASOS) network. Improvements to the WSDDM system are on-going. Since 1998, a private vendor operationally implemented the WSDDM technology at JFK, LaGuardia and Newark Airports. While the system provides 30-minute forecasts (nowcasts), plans for the future include developing forecasts out to 12 hours, an improved and less expensive gauge that measures the liquid water equivalent of frozen precipitation, and the inclusion of Terminal Doppler Weather Radar (TDWR) data.

The resulting improved forecasting techniques will improve situational awareness for operators by adding value to decisions involving deicing activities, snow removal efforts, and holdover times during winter ground operations.



For more information on the WSDDM project, see http://www.faa.gov/aua/awr/prodprog.htm and www.rap.ucar.edu/research/freeze.html/

Illustration by Dan Harman

LT COL CRAIG KING
Langley AFB VA

Like most of you, I've never spent much time worrying about wind chill computations. On the rare occasion when it was a factor in my predominately southern Air Force experience, the weather guy would tell me what the wind chill was, and I would consider it (in accordance with local guidance and common sense) before going outside to fly. End of story.

Truth is, I've never placed much faith in wind chill numbers anyway, as I always thought they overstated the "coldness" of a windy day. As it turns out, I wasn't the only one who questioned the validity of the old system. In November 2001, the Department of Defense, the National Weather Service and the Meteorological Service of Canada issued a whole new methodology for computing wind chill from the combination of ambient temperature and wind conditions.

How does this affect you? Wind Chill Temperature is what outside temperature *feels* like to unprotected people and animals. If the ambient temperature is above 32 degrees Fahrenheit, no amount of wind chill will make water freeze, including radiators and water pipes. Wind chill, however, *is* related to the rate of heat loss, and it translates into how cold you feel. Likewise, wind affects the amount of time it takes an exposed area of skin to suffer frostbite. It also affects the onset rate of hypothermia, which occurs when body temperature decreases below 95 degrees Fahrenheit. Because of these safety considerations, and the difficulty of operating effectively in mind-numbing cold, we in the Air Force have to consider wind chill temperature when assessing the risk of operating outside during winter months.

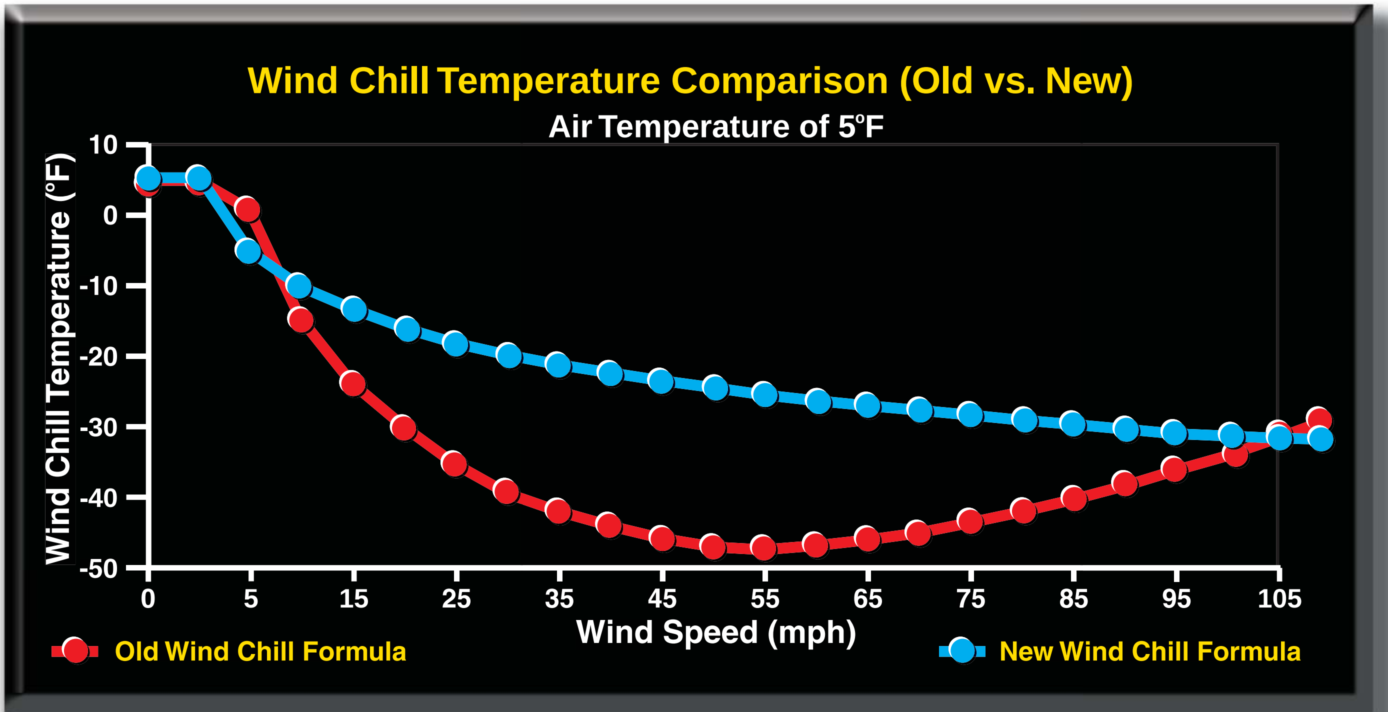
The old formula for computing wind chill temperature, based on experiments conducted over fifty years ago and relying on equally dated assumptions, resulted in wind chill temperature measurements that are now considered too low. In order to correct these previous deficiencies, the National Weather Service, along with federal, international and academic institutions, has applied more current science over the course of the last two years and produced a system that more accurately reflects the dangers of winter winds and freezing temperatures. This new methodology is now in place in both Canada and the United States.

I was surprised to learn that the charts I've seen at various bases, which attempt to correlate wind chill temperature with allowable exposure time, are not regulated by the Air Force. Rather, the degree to which personnel can be exposed to a particular wind chill temperature is regulated primarily at the local level, presumably because only local authorities can take into consideration the normal work activities, operating environment, and availability of cold-weather personal protective equipment unique to their situation.

Therefore, since the national standard for wind chill has changed, supervisors and commanders need revised information in order to operate safely. As of Nov. 01, 2001, everyone is using the new standard, including your local TV weatherperson and your Air Force weather forecaster. In certain conditions, the recent changes have significantly changed wind chill temperature computations. Without knowing the effects of these changes, you cannot make sound decisions during cold-weather operations.

For example, assuming an ambient air temperature of 5 degrees Fahrenheit as depicted on the chart and a wind speed of 35 mph, the old wind chill temperature measurement was -40 degrees Fahrenheit. The new computation is -19 degrees. Nevertheless, the amount of "cold" felt by an unprotected person is the same — the "warmer" temperature reflected under the new system does NOT mean it's safe to operate for longer periods of time during equivalent conditions (same ambient temperature, same wind). Likewise, the chilling effect at any "new" wind chill temperature is more severe than it would appear from previous experience.

I'm not going to presume to tell everyone *how* you should go about modifying local guidance to account for the new wind chill computing system. I'm sure that revised local guidance will follow as the new index of wind chill temperatures becomes more widely understood. In the meantime, however, you do need to be able to translate between the



new and the old systems (see the website with wind chill calculator below). No, it's not colder this year. However, it will seem that way if you step outside with a "new" Wind Chill Temperature and an "old" frame of reference.

For more information, visit the National Weather Service's Office of Climate, Water and Weather web site at http://www.nws.noaa.gov/om/windchill/ for a wind chill calculator. But be advised: The wind component of the calculation is expressed as miles per hour instead of knots. This may require additional conversions prior to using the calculator. The chart below, available at the same web site, depicts new estimations of the relationship between exposure time and frostbite (assuming unprotected skin).

The author wishes to thank the flight safety staff at Minot AFB, ND for bringing the recent change in wind chill estimation to our attention. Also, many thanks to the staffs at AF/XOW, AFMOA/SGZA, ACC/DOW, and ACC/SGPF for editing and technical assistance.

Wind Chill Chart

Temperature (°F)

Wind (mph)

Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 Minutes; 10 Minutes; 5 Minutes

Wind Chill (°F) = 35.74 + 0.6215T - 35.75 ($V^{0.16}$) + 0.4275T ($V^{0.16}$)

°Where T = Air Temperature (°F) and V = Wind Speed (mph)

Effective 11/01/01

New Dog, Old Tricks

USAF Photo by SrA Greg L. Davis

LT COL BRUCE E. ADRIANCE
USAF (Ret.)

"I was in contact, with about 5,000 pounds to go, when the nose of the E-8C aircraft started to come up. I was pushing on the yoke, fighting it. Then all of the sudden, the nose dropped and I had to pull. I eventually had to get a disconnect. When I tried to come back in to get the rest of my gas, the aircraft was so unstable, I simply couldn't get on the boom."

This paraphrased conversation with the Chief of Stan/Eval started a year long investigation into this one question: "What is unique about the E-8 that would cause this instability during air refueling?" Answering this question became complicated because of the unique configuration of the E-8.

The E-8C is a modified Boeing 707-300 series aircraft. The mission radar radome is 440 inches long, 42 inches wide and hangs from the bottom of the fuselage between the nose gear and the main landing gear. When combined with the on-board mission equipment, this gives the E-8 a noticeably forward center of gravity (CG) and an operational weight of about 183,000 pounds, which is heavy for a B707-type airframe. Also, adding surface area to the aircraft profile ahead of the center of gravity makes the E-8 less directionally stable than other B707-type airframes. It wasn't clear if any of these unique design features were to blame. What was clear was that there was a problem during heavy weight air refueling missions that many pilots were experiencing. At best, this was making it difficult for pilots to get their scheduled on-load of fuel. In the extreme case that happened to the Chief of Stan/Eval, it prevented him from getting the last several thousand pounds of fuel. My concern was that this could also result in nozzle binding and possible damage to both receiver and tanker. One way or another, we needed some answers to why this was happening, and what could be done to prevent it.

We dug into this problem further and discovered that most pilots who experienced this problem encountered it during heavy weight air refueling, when the aircraft total gross weight exceeded 300,000 pounds. Experience with other B707-type aircraft, including recce and AWACS, did not reveal this problem as a common B707 characteristic. Thus, we had to assume it was unique to the E-8 and therefore tied in some way to the aircraft's unique configuration. With the help of wing stan/eval and the senior wing flight engineer, CMSgt Charlie Costello, we began a data collection program. Our hope was that we could somehow narrow the focus of attention and eventually solve the problem.

Test flights seemed unlikely for a couple of reasons. First, the problem wasn't well documented. Most of the evidence was anecdotal. While the experience was real enough to the pilots at the time, there was no system in place to collect meaningful data. Also, there was the manufacturer. This really wasn't a B707 since there was a large radome hanging under the nose. In the past, the Air Force relied heavily on Boeing for aeronautical data and assistance with B707 airframes. Boeing was largely out of the picture in this case, so the necessary data for aeronautical analysis was simply not available.

Meanwhile, I contacted the aging aircraft engineer at Aeronautical Systems Division. He was able to quickly de-bunk some of the theories that had sprung to life. We thought it might be airflow interference from the mission radome impacting the horizontal stab. It turns out that the engineers thought of this during the aircraft development and designed the radome to prevent airflow interference problems. Then we thought that perhaps the forward CG was creating so much nose-up trim that we were experiencing air flow separation on the stab. Wrong again. It turns out the aircraft trim system was only using a couple units of trim and pitch attitudes, and were only about four to five degrees nose-high at forward CG limits and gross weight limits. The unique nose-heavy configuration would allow the crews to refuel to a point where they could exceed the forward CG of the airplane before they reached full tanks. The flight crews were well aware of this problem and monitored in-flight gross weights and CG accordingly. Limits were not being exceeded.

In the months that followed, crews were collecting data from air refueling missions. Throughout the post-September 11th deployments, the data collection effort continued. Over 130 missions were documented. When the air refueling mission took the total gross weight above 300,000 pounds, over 50 percent of the pilots reported some instability in the aircraft. In 32 pecent of the cases, this instability was very pronounced. Yet no clear pattern emerged to explain why this instability existed or why it did not occur every time. Nearly every tail number in the fleet had this instability reported at least once. In several cases, the same pilot flew the same aircraft to near identical gross weights over the course of two or three days. One day they would report experiencing some instability and the next day, none!

Two "Truths" began to emerge from this effort. Truth number one was that pilot technique must have been contributing to this problem in some way which was not yet clear. Truth number two was that it was not directly tied to aircraft design because of the erratic, inconsistent way in which this instability could occur on one mission and not be there on nearly identical missions. Then, an old "technique" came to mind.

Other B707-type airframes routinely refueled to gross weights over 300,000 without difficulty. It is a common technique in many of these aircraft to ask the tanker to let the airspeed build. As the B707 gets heavier, it can begin to run out of power (unlike its KC-135R tanker). If the tanker allows the airspeed to increase to about 285-295 knots, this improves the receiver's power situation slightly and also improves the handling. The light bulb came on! Perhaps the unexplained pilot "technique" which was contributing to this problem was actually the tanker pilot technique. We could not fully explain the interrelated aerodynamic forces at work between the tanker and receiver, and lacked the data and the expertise necessary for such a study. But, if the combination of receiver pitch attitude and aircraft airspeed was contributing to this problem, perhaps we could simply "make the problem go away."

A new study is underway to prove this theory. Initial results indicate that this change in airspeed is working. When the receiver pilots ask the tanker to slow to 275 knots, the aircraft control becomes more difficult. As the airspeed builds to around 285 to 290 knots, the feel of the airplane improves substantially, and pitch instability seems to disappear as well. All you old recce pilots out there… Thanks for the tip!

Lt Col Bruce E. Adriance (USAF, Ret.) is currently employed by Flight Safety Service Corporation as an instructor pilot and subject matter expert for the E-8 JSTARS program at Robins Air Force Base. He has nearly 5000 hours in the UH-1, CH-3, T-37, T-38, KC-135, and has spent 15 Years as Adjunct Faculty for Embry-Riddle Aeronautical University, specializing in Aeronautical Sciences, Undergraduate and Graduate Aerodynamics and Advanced Aircraft Systems.

Make The
Your

CAPT JOHN MCKNIGHT
HQ AFSC/SEFL

Your flight suit will lose some of its protective qualities as the material begins to wear thin.

Many times we put on our flight suit and never give a second thought as to what protection it can and will afford us if worn and cared for properly. Sure, we consider how it fits and whether we should wait one more day to wash it (since no one else has complained about the smell). But do we ever stop to think of the precautions, with regard to fit and proper wear, that we should be taking to ensure we are provided the highest possible measure of protection from fire? If your answer to this question is truthful, then you'll continue reading and learn some important facts about the CWU-27/P military flight suit.

How Nomex Works

The protection of our Nomex flight suit resides in the inherently flame-resistant fibers and the chemical structure of those fibers. When exposed to the intense heat of a flash fire, the fabric provides a stable layer between the fire and the wearer's skin, and the fabric forms a tough, carbon-based char (burned remnant) that stays supple until the fabric cools. So, it's not something that can be washed out of the flight suit, nor will it wear off. Yet, after a period of time (usually about the time your flight suit becomes a shade closer to brown than green), your flight suit will lose some of its protective qualities as the material begins to wear thin and discolor. At this point, it's time to part with your "favorite" flight suit and get a new one. The idea of "too many washings will erode its ability to protect me" is, indeed, a myth. Keeping your flight suit clean and free of dirt and oil is very important. Yet, there are some words of caution from the manufacturer of Nomex: Don't add fabric softener to the wash, or starch afterward. The fabric softener can act in the same manner as when oil or oil products get on the flight suit—it can actually serve as a source of ignition in the case of a fire. So, if you keep your flight suit free of contaminants, clean it regularly and without fabric softeners; and if you replace old, worn flight suits, you will achieve the highest level of protection in a fire.

How To Maximize Protection From Fire

The next consideration is something

Flight Suit “Bag”

HQ AFSC Photo by TSgt Michael Featherston

that many of us may not have realized. The fit of the Nomex flight suit is one more critical factor which, if overlooked, can remove another level of protection you may need to survive a fire. Yes, many of us would like to wear the same size flight suit we wore the day we began flying, but for some of us that's not a reality, at least not without ripping out a few seams in the process. And for those of us wanting to avoid the oversized, "bag look," wearing a tight-fitting flight suit is not the kind of fashion statement anyone should be imitating. A properly-fitted flight suit should be slightly loose-fitting in order to provide an air barrier between you and the suit. This seemingly small air pocket will provide you with an additional buffer from the searing heat of a fire that may save your life.

Finally, one very important consideration when donning your flight suit is what you wear underneath it. Certain fabrics can melt at temperatures as low as 300 degrees F, whereas Nomex can withstand temperatures as high as 700 degrees F for a very short period of time. So, wearing synthetic underwear, such as polypropylene, under the flight suit could be an invitation to pain in the event of a fire! Any product with polyester will behave in a similar manner and can adhere to your skin before the fire will burn through your flight suit, if temperatures are high enough. Yet, even so, some of our winter undergarments are made of polypro or other synthetic materials because they are better at keeping us warm because of their property of drawing moisture away from the body. So, the choice between warmth and ultimate safety throws us a curve. The bottom line is that you have a choice as to what you wear under your flight suit, so choose wisely. Definitely avoid wearing polyester "work-out" clothes under your flight suit, and choose cotton clothing to wear when conditions permit. This could reduce the seriousness of burn injuries while increasing personal comfort.

Wear It Right

The flight suit is an important piece of clothing that is critical to our flight crews and can provide a vital element of protection in a fire. Yet, the safety potential of the flight suit can be removed if not worn or cared for properly. While the flight suit cannot prevent us from being burned or thwart all burn injuries, it may afford you enough protection to escape a fire and live to tell the story.

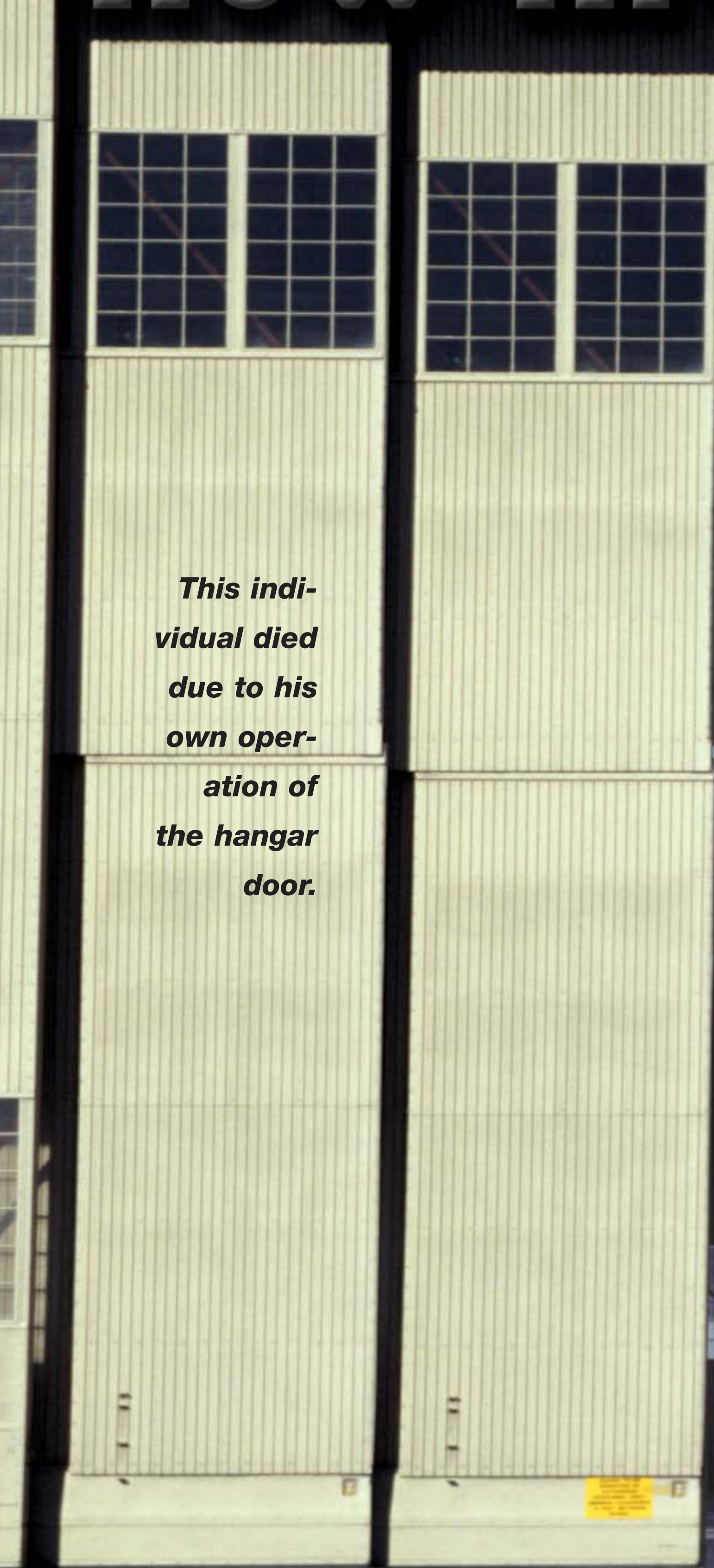
Wearing a tight-fitting flight suit is not the kind of fashion statement anyone should be imitating.

How Are Your H

MR. JOE VIGIL
HQ AFSC/SEG

When was the last time you opened or closed a hangar door? Sounds like a pretty simple operation…or how did it feel taking your life or someone else's life into your own hands? AFOSH Standard 91-100, paragraph 7.3.2., *Hangar, Dock, and Shelter Door Design Guidance and Operations,* established the minimum Air Force guidance on aircraft hangar door operations. Although the guidance is well established and well known, numerous personnel continue to place themselves at risk by not following the guidance established in the AFOSH Standard or the unit's own operating instructions.

I recall a situation several years ago when we lost one of our aircraft maintainers to a hangar door operation. Our airman was a seasoned aircraft maintainer, who was well versed on hangar door operations and was not rushed to close the doors. Yet, during a second of indecisiveness the individual stopped the operation just prior to completely closing the door and stuck his head in-between the leading edges of the doors. Lacking an understanding of the risk involved in this operation, the individual attempted to open the door (thus reversing the door operation) and pushed the closed button instead of the open button. This individual died due to his own operation of the hangar door. A tragic mishap occurred, but why? We will never know why this individual placed his head in-between the doors, or why he attempted to open the doors.



This individual died due to his own operation of the hangar door.

What can we do to keep our personnel safe? Follow the requirements as indicated in AFOSH Standard 91-100, paragraph 7.2.3.:

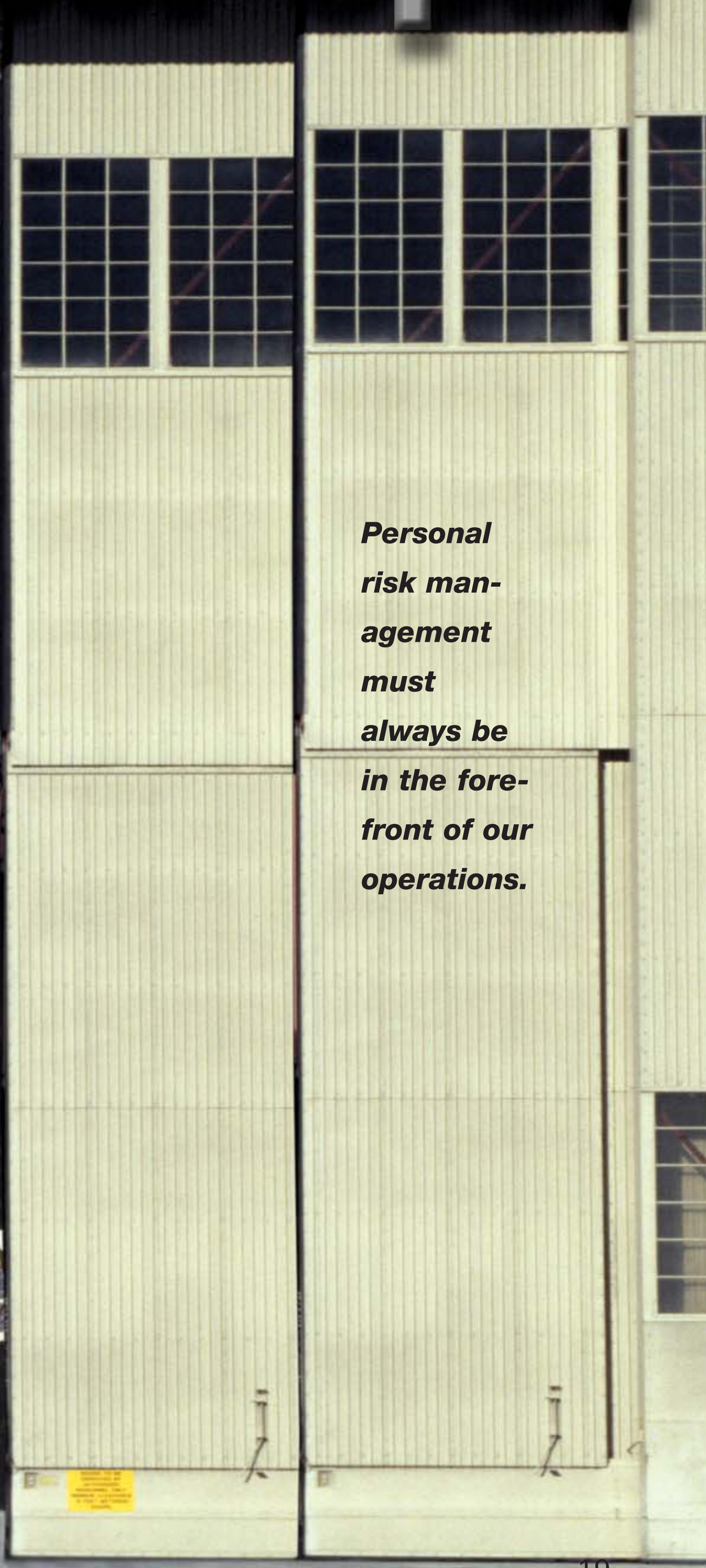
1. To prevent confusion, powered hangar door designs will incorporate alarm-sounding devices with a sound that is distinguishable from the facility fire alarm and audible above normal noise levels.
2. The warning device will automatically signal at least 5 seconds before any door section movement, and will sound continuously while the door is being operated and will reset immediately after movement stops.
3. Luminescent or reflective directional arrows will be placed adjacent to each control switch and horizontal sliding door to indicate the direction of door travel for each corresponding switch.

angar Door Ops?

4. For all center door switch operations, OPEN will be placed at the TOP position and the switches will be wired so the doors open when open is selected. A hinged cover should be installed over the CLOSED switch to prevent inadvertent activation.
5. Written operating procedures outlining all safety precautions to be followed will be published and posted next to the operating controls.
6. Only QUALIFIED personnel, approved by the squadron commander or designated representative, will be authorized to operate the hangar door. Operators will be thoroughly familiar with operating instructions and precautions necessary for safe operation.
7. Overhead hangar doors will be fully opened before aircraft are moved through the door entrance. Horizontal sliding doors will be opened to permit a *minimum* 10-foot clearance at each wing tip.
8. Under normal conditions, powered hangar shelter doors will always be opened to a width of at least 10 feet. For special operations, such as during extreme weather conditions, the door may be opened less than 10 feet only if the door control switch is locked out, and remains locked out until the door can be opened to 10 feet or more, or be closed.

Remember hangar door operations are not an inherently dangerous until the requirements indicated in AFOSH Standard 91-100 and the unit's operations listed are not followed. Some key deficiency items found during safety inspections: door labeling misleading, operating instructions are old and faded, untrained personnel operating the hangar door, authorized personnel listing is outdated and unreadable.

Do your hangar doors reflect the standards or non-compliance with standards? Personal risk management must always be in the forefront of our operations. Reduce your risk and follow the established rules.



Personal risk management must always be in the forefront of our operations.

HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

HQ AFSC Photos by CMSgt Jeff Moening

CMSGT JEFF MOENING
HQ AFSC/SEMM

Well, fellow maintainers and operators, if you did not attend the 23rd Annual FOD Conference held Aug. 13-15, 2002, you missed a great opportunity to prevent FOD to your aerospace vehicles. I applaud the National Aerospace FOD Prevention Inc. (NAFPI) Board of Directors, Northrop Grumman and all the sponsors for putting on a class act, and providing the opportunity to network with over 650 military and civilian aircraft maintainers, aircrew, manufacturers and airport operators. I think the different presentations from the panels of experts and the smaller interactive sessions provided a great variety of activities that presented some very useful knowledge about techniques and tools that everyone can use to help prevent FOD.

The 24 exhibitors provided a vast array of hands-on displays to show each attendee how they can prevent FOD through organized tool control, equipment designed to not produce FOD and processes that can help reduce the human factor in FOD.

From Oct. 2000 to Jul. 2002, we have spent more than $98 million on repairing FOD damage with 292 *preventable* FOD incidents. Just think how we could have better used $98 million. Think of the cost of rework that overworked maintainers had to accomplish because of a moment of carelessness. We are far too busy in today's activities to spend so much money and time for something we can control and eliminate.

A main theme I picked out from the panels is that the human factor is the biggest cause and preventer of FOD incidents. Two things would greatly reduce our FOD rates. First, instill in every worker that FOD prevention is a critical part of their job; they must clean as they go and follow good housekeeping practices at all times. Second, we must instill sound work practices, products and procedures in every department that can help take the human error factor out of the process.

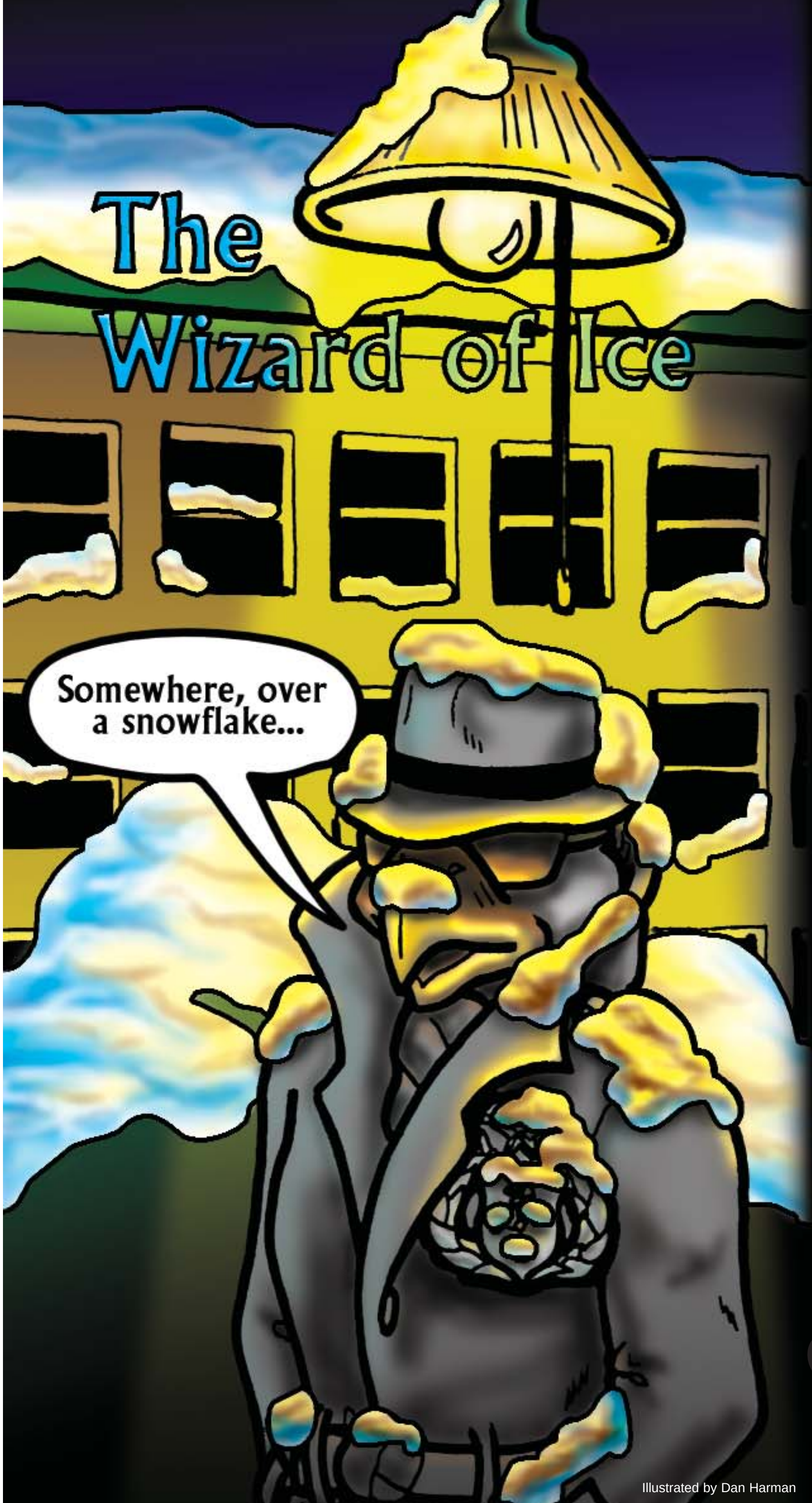
The aircraft manufacturers on the panels said they are moving away from technicians owning their own tools to company-provided tools, so the companies will have better tool control. Also, they said the companies are reducing maintenance time and increasing tool accountability through point-of-use machines. We heard about how military units are reducing FOD and giving more power to the unit FOD monitors. How unit supervision emphasizes FOD control determines what the troops will do. In other words, if the unit commander doesn't support a strong FOD program, then the airmen surely won't.

For those bases with bird problems, there was an interactive session with the Department of Agriculture to talk one-on-one about how to reduce the risk of bird strikes.

All in all, it was a great opportunity to talk with others who wear the same shoes as you, just at a different ramp or plant. This way you can learn from real-life experiences and find ways to reduce FOD at your location. If you work on a flight line, fly an aircraft or take part in the repair of any flying machine, I highly encourage you to attend next year's conference. You can find information about this year's conference, FOD prevention tools and techniques and FOD points of contact on the NAFPI Web site at www.nafpi.com. You military types can visit the Web site and/or contact your MAJCOM FOD manager:
CAF Lead HQ ACC – MSgt James T. Henry
HQ PACAF – MSgt Dave Hake
HQ USAFE – MSgt Patrick Flood
HQ AETC – TSgt Mark Cory
HQ AMC – SMSgt Mike Healy

See you at next year's conference!

The Wizard of Ice



Illustrated by Dan Harman

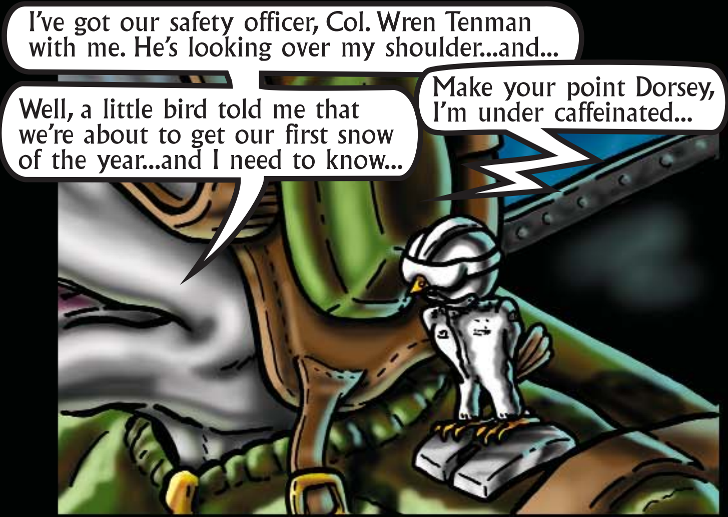
COL TIMOTHY MINER, AFRC
Reserve Assistant to the Director of Weather, AF/XOW

It was a cold dark night in Washington. Winter had gripped the capital city...

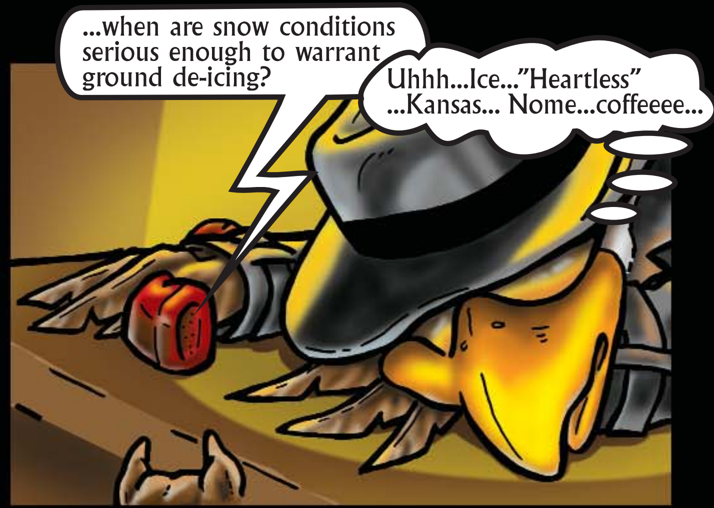
The ice on the Potomac was as thick as the foam on designer cappuccino...it was too cold to think of a more clever metaphor...

Just when we were pulling another all-nighter the phone interrupted my snit.

It was my old hapless friend Capt. Joe Cruedog somewhere over Kansas heading for a snowstorm.

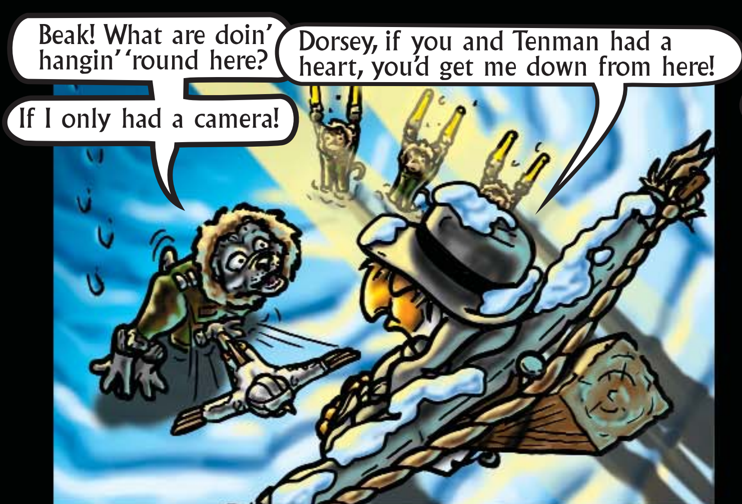


I knew Tenman. "Heartless" would be a modest description. What kind of bird schedules Wing Safety briefings on Friday afternoons before three day weekends?



Too late. Cruedog's whining became tedious and I was caffeine challenged...All that I could hope for now was that I didn't drool

If I only had half a brain I should have dreamed myself in the tropics.



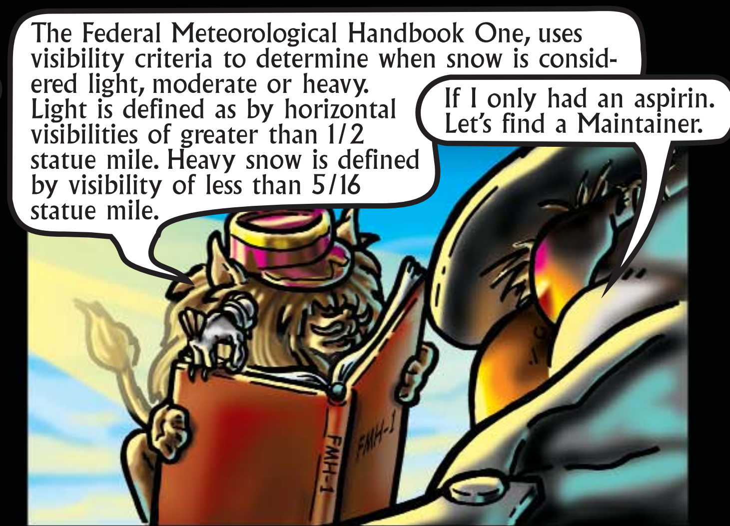
Not only was I stuck in a dream, it was "B" rated.

A winter storm had blown Dorsey off course. They weren't in Kansas any more.

Something was stirring beneath me.

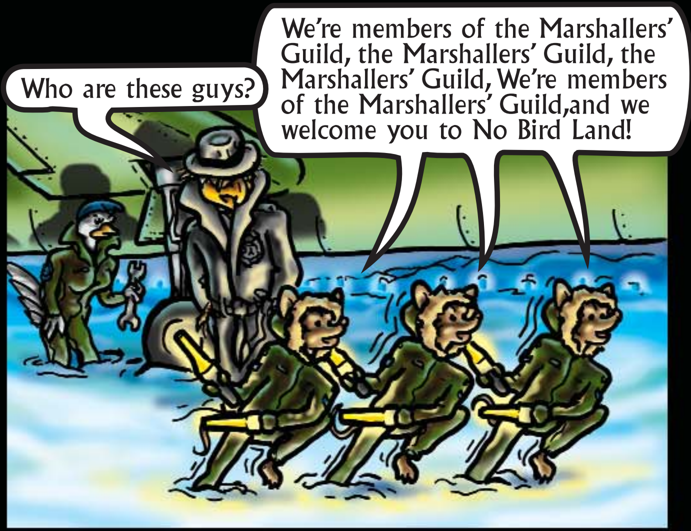
Pepper must have been in that drift for a while. He'd grown quite a coat.

Cruedog had to ask...now would be a good time to wake up.



Sidney's two cents always seemed more like two bucks.

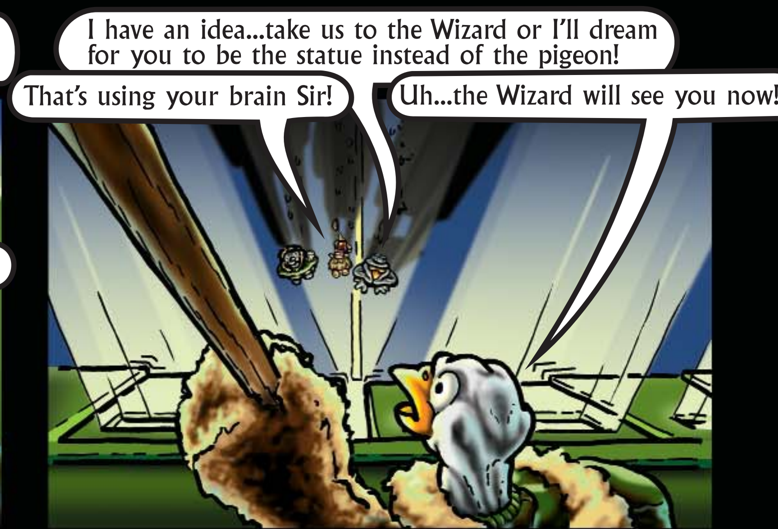
We headed back to the flightline to find the maintenance crewchief, Sgt Sandy Which (It's a dream, Goodwitch would have been over the top.)



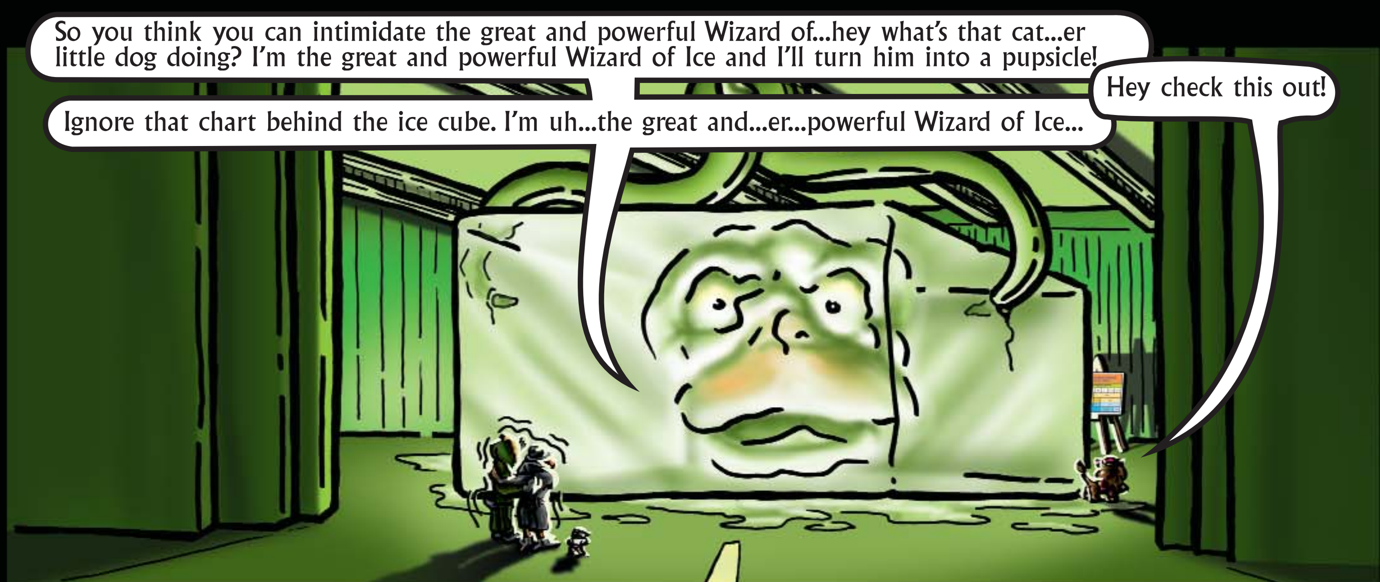
Before this dream got any weirder we decided we were off to find this Wizard.

Some people take everything literally...

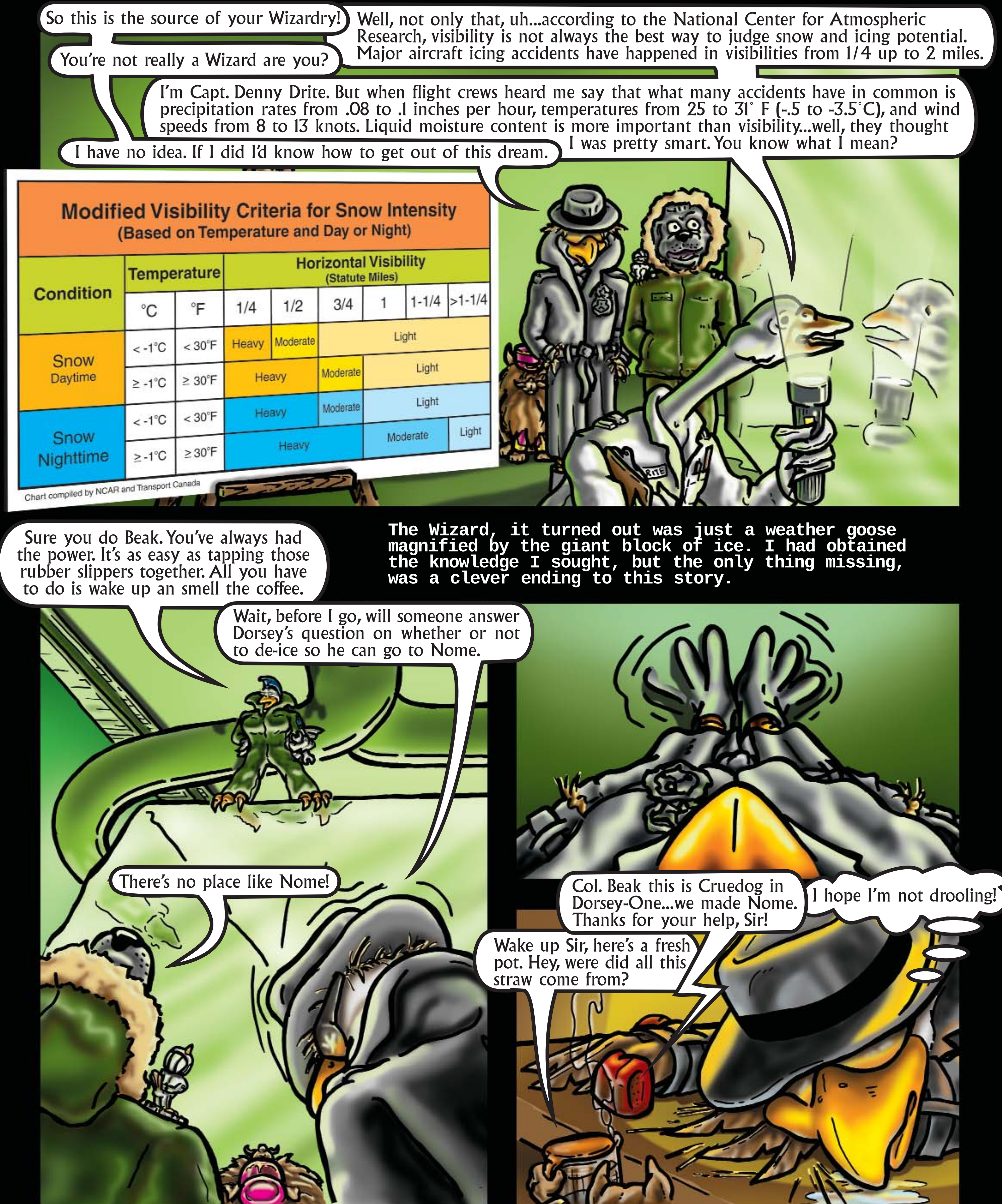
And as in all stories the unwitting main characters are about to get themselves in a mess.



That's the beauty of dreaming...we didn't have to fetch anything to prove ourselves worthy, like melting an Ice Witch or touching frozen metal with our tongues.



I may have spoke to soon. Once inside the hangar we found the source of the emerald glow...



So this is the source of your Wizardry!
You're not really a Wizard are you?
Well, not only that, uh...according to the National Center for Atmospheric Research, visibility is not always the best way to judge snow and icing potential. Major aircraft icing accidents have happened in visibilities from 1/4 up to 2 miles.
I'm Capt. Denny Drite. But when flight crews heard me say that what many accidents have in common is precipitation rates from .08 to .1 inches per hour, temperatures from 25 to 31° F (-.5 to -3.5°C), and wind speeds from 8 to 13 knots. Liquid moisture content is more important than visibility...well, they thought I was pretty smart. You know what I mean?
I have no idea. If I did I'd know how to get out of this dream.
Modified Visibility Criteria for Snow Intensity
(Based on Temperature and Day or Night)
Condition | Temperature °C °F | Horizontal Visibility (Statute Miles) 1/4 1/2 3/4 1 1-1/4 >1-1/4
Snow Daytime | < -1°C | < 30°F | Heavy | Moderate | Light
Snow Daytime | ≥ -1°C | ≥ 30°F | Heavy | Moderate | Light
Snow Nighttime | < -1°C | < 30°F | Heavy | Moderate | Light
Snow Nighttime | ≥ -1°C | ≥ 30°F | Heavy | Moderate | Light
Chart compiled by NCAR and Transport Canada
RITE
The Wizard, it turned out was just a weather goose magnified by the giant block of ice. I had obtained the knowledge I sought, but the only thing missing, was a clever ending to this story.
Sure you do Beak. You've always had the power. It's as easy as tapping those rubber slippers together. All you have to do is wake up an smell the coffee.
Wait, before I go, will someone answer Dorsey's question on whether or not to de-ice so he can go to Nome.
There's no place like Nome!
Col. Beak this is Cruedog in Dorsey-One...we made Nome. Thanks for your help, Sir!
I hope I'm not drooling!
Wake up Sir, here's a fresh pot. Hey, were did all this straw come from?

THE END

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

It's that time of the year again and winter weather is here or will be shortly. Here are a few cases where the weather got the better of some of our aviators. Be aware and remember it isn't always as it seems when it comes to Mother Nature.

Whoa Horse!

After an uneventful 6.6-hour flight, the E-3 crew obtained the ATIS information, which reported the runway as dry with patchy snow and a tailwind for Runway 5 (10,000 x 200 feet). It had started to rain at the airfield and the crew calculated a landing distance using a Runway Condition Report (RCR) of 10 with a 10-knot tailwind. This gave the aircraft a calculated landing distance of 8800 feet. No problem. They circled to land, and due to weather could not complete the circle and performed a missed approach. As they flew over the runway they observed it to be snow-covered, so they queried the ever-reliable supervisor of flying (SOF) for an update on the RCR. The SOF reported the RCR as an LSR 19. The crew then elected a straight-in approach to Runway 5. The old crusty evaluator pilot, with over 5000 hours in the aircraft, conducted the landing and touched down 2000 feet down the runway. Utilizing maximum landing effort, they reported poor braking and stopped with *only* 300 feet of landing surface remaining. Now that is cutting it close!

The crew reported the poor braking to the tower and requested a recheck of the RCR by the SOF. The recheck showed the RCR to be an "8," using the SOF truck decelerometer. This is not the official RCR, as only base operations are qualified to report this. The recalculated landing conditions for the E-3 crew using an RCR of 8 and 7 gave a landing distance of 9100 and 9900 feet, respectively. Didn't leave them much room for error, did it?

What happened to established procedures to prevent such things from happening? The RCR provided to the aircrew was taken 45 minutes prior to their landing, but snow removal operations had continued after the RCR check. The "book" states that when the runway surface changes a new RCR must be taken, which was not done when the snow removal operations stopped. The SOF also did not conduct a runway check as per base directives. A couple of minor misses and we endangered an aircrew and had the potential for severe damage to a very expensive piece of hardware.

As we start the winter months make sure we use *current* weather data and ask questions if not sure of the runway conditions. To those who are on the ground, remember a lot of people up in the air are counting on *you* to "Do it right the first time," so they can safely land.

It Looked Okay!

The 22nd Air Refueling Wing sent out a crosstell awhile back about icing on the KC-135R, and it still applies today. The aircraft took off on a local training mission with anti-ice turned on for the entire flight. Light rime icing was forecast for the climbout, but not for the cruising area of the refueling track. The aircraft flew in the overcast deck for the duration of the cruise portion, until the weather complicated the rendezvous with their receiver. The mission was otherwise uneventful until they turned the aircraft back over to maintenance.

During the post-flight engine inspection, maintenance found damage to 20 acoustical panels spread across *all four engines* aft of the N1 fan stage. Maintenance confirmed that the anti-icing systems were working as advertised. However, the system only protects the inlet cowling. The ice that did the damage came from the spinner cone and fan blades. The Dash-1 states that the level of icing required to do the damage found would have been moderate to severe.

In the crew's defense, there was no forecasted icing and they had no indication of any problems. The only way for a crew to be aware of this type of problem is for them to use a flashlight (modern technology!) and check the windshield wiper blades, etc., for evidence of icing during the flight. Their crosstell is to help raise awareness of the limits of ice forecasting, the possible lack of icing conditions and the limits of the aircraft systems. Maybe you should take a look at your procedures for icing, and how you could prevent damage to your high-priced air machines during the next safety meeting.

Another Case Of "I Need More Runway!"

An F-16C three-ship was returning to the airfield they share with the commercial airport after an uneventful night flight in support of Operation Noble Eagle. Then it became not quite so uneventful. Airfield management was aware of the flying schedule and had scheduled snow removal and inspections around these times. Good on them, as planning goes a long way, if done right. The main runway is 9000 feet of grooved asphalt 150 feet wide with a 150-foot overrun that is not maintained. There is also a BAK 12/14 barrier 1500 feet from each end of the runway.

That night the crew stepped with weather at 3500 feet, overcast, with visibility seven miles, tempo 2500 feet, overcast, visibility three miles and light snow showers. One hour prior to landing the SOF performed a ramp and taxiway check and reported the areas as wet with good braking action. The RCR was a 15-20 with an average of 18 using a Tapely device. The city reported the runway and all taxiways as wet with patchy thin snow, braking action good by vehicle. The city uses a modified Saab vehicle with a fifth wheel for its report, but it is subjective and up to the driver. To add to the issue, there were no other aircraft taking off or landing since the mishap aircraft took off to give an actual update on conditions. Twenty minutes prior to landing, the runway was reported as bare and wet with patchy, thin snow, braking action good by vehicle. Three minutes prior to landing, the tower reported the runway swept and sanded the full length, cable up and cleared to land. Should be an easy landing, right?

Now the fun starts! The aircraft landed about 1500 feet down the runway on speed with approximately 4500 feet remaining and 2500 feet from the cable. Things didn't seem right and the aircraft came to a stop in what was perceived as the overrun. A fun sled ride for the pilot. He actually came to a stop 160 feet *past* the overrun on deteriorated asphalt, with grass and dirt throughout the area. The pilot did not lower the hook or consider a barrier engagement. The tower asked if he was going to turn left at the end, and he replied, "Negative, I'm off the runway." The two aircraft following him in made immediate missed approaches and headed to the divert airfield. Luckily the aircraft was not damaged in any way by the off-runway work. The responding operations vehicle reported the runway to be frozen over and the RCR as a five or less.

How did this happen? The pilot had a sense that the runway was in good shape for landing and he didn't need anything special. But once again what is *perceived* and what *is* there can be two very different things. Should he have taken the barrier when things didn't feel right? That's a choice pilots will have to make for themselves. Could airfield operations have done things differently? The point here is to make pilots and airfield managers *think* about runway conditions. Mother Nature is not so friendly in the winter. Be aware that she can change things very fast.

Almost Got Blown Away.

Two T-37 crews, with students, set out to fly a formation syllabus sortie. Everything was uneventful until they started the takeoff roll. The SOF reported that winds were 330, 18 gusting to 20. This is within limits, so they continued the plan. The mishap aircraft was on the upwind side of the flight, and within seconds of starting their takeoff roll the mishap aircraft entered an uncommanded left bank towards the lead aircraft. The crew aborted the takeoff and the SOF notified the crew that during their abort actions their right wingtip had scraped the runway.

The weather that day was clear with strong gusty winds. The crew stepped for the flight with winds forecast at 330, 15 gusting to 25 with a maximum crosswind of 8.5 knots. When the aircraft were cleared for takeoff, the winds were 330, 18 gusting to 20 with a maximum crosswind of seven. The peak winds observed during the time frame were 320 at 26 knots with a maximum crosswind of two. All the winds were within the tech data limits for the T-37. Why did the crew scrape the ground? We weren't sitting in the cockpit, but I think anyone who has flown the T-37 and encountered gusting crosswinds will know. Remember, if things don't feel right, they probably aren't. Use the brains and training provided to you and make the right call before an accident happens.

Maintenance Matters

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

The cold winter weather is upon the unfortunate maintainers, and as such, it causes us a lot of extra work. The main things we have to do are slow down and remember Mother Nature creates the extra work, and we must just compensate.

I Don't Want To Go In The Hangar.

A maintenance team at a northern base had to tow a KC-135 into the hangar to take care of some gear work, and things didn't go quite according to plan. The day prior to the mishap the area received eight inches of snow and ice, and the taxiways and ramp were snow-packed and icy. The aircraft needed to be jacked, so they defueled the aircraft to the required weight, which made for a light KC-135, only 5600 pounds of fuel. The tow team consisted of the supervisor, vehicle operator and brake operator, with the wing and tail walkers to meet them at the hangar. Normal ops so far, right? The tow was normal until the aircraft had to make the 90-degree turn into the hangar. The taxiway in front of the hangar had a slight downhill slope of about 2.1 percent, and remember, it was snow covered. The tow super was still riding the tug, and as the tug made the turn, the aircraft decided it still wanted to go straight. The interphone connection got pulled loose, the tow bar hit the limits, the driver and brake rider couldn't talk, and the next thing they heard was a loud *bang*! Both driver and brake operator hit the brakes, and the aircraft came to a sliding stop. The aircraft tow bar was at about a 45-degree angle to the aircraft and the tug an even greater angle. The aircraft nose strut and the tow bar received severe damage.

What happened? How slippery is the ramp when it is snow packed? How easily will tires slide on packed snow going down a slope when the aircraft is very light? You all know the answer. We all have procedures in place for things like this, and sometimes we have to *just say no* and wait till the ramp is in better condition. One last note: Where is the best place for the tow supervisor to watch an aircraft when turning on a slippery ramp? The tug, or out in front where both tow driver and aircraft brake operator can see you?

Hot 20 mm Rounds, Literally!

A load crew in Alaska was preparing for an integrated combat turn (ICT), and started preparing the universal ammunition loader (UAL). Now the crew cranked up a heater and stuck the air duct, set at the mid-range temperature setting, around 200 degrees Fahrenheit, under the cover of the UAL at the tow bar end to warm-up the grease. A short time later the load crew pulled the heater duct out of the UAL and cranked the heat up to full, about 275 degrees Fahrenheit, to warm their hands and other body parts while they waited for the aircraft to arrive. The ICT supervisor, noticing the heat was being applied to the wrong equipment, took the heater hose and put it back under the UAL cover. Priorities were in the right place there, but then nobody on the load crew told the supervisor they had cranked up the heat.

A little background info on the 1900+ rounds of PGU-27/B ammunition in the UAL. According to the folks who make the rules on ammunition, the maximum temperature for the PGU-27/B round is +150 degrees Fahrenheit. Do you think anybody on the ICT team knew that? Now the rounds had been exposed to this heat for about 45 to 90 minutes when the ICT aircraft arrived. To celebrate the aircraft's arrival a 20 mm round from the UAL decided to detonate! The UAL was moved away from the aircraft and the area evacuated. Smart ammo troops. The second round detonated about 10 minutes later. All the ammo from the UAL was condemned after it had cooled down and the investigation was completed.

Simple lesson: Every action has a reaction. When you apply heat to an aircraft or piece of equipment, do you know what effect it may have on the equipment or what's inside? You can have too much of a good thing. Some equipment just can't handle the high heat the weapons troops can. Be warm and safe!

Have To Heat The Whole Thing!

A C-130 had been stuck at a TDY location for four days since weather prevented the crew from flying. Finally they got to go fly and the crew chiefs, flight engineer, and loadmaster headed to the aircraft to get things ready. A great team effort! The ramp and aircraft were covered in snow and slush as they prepared the aircraft for flight, which did make things difficult. The crew chiefs asked for a couple of heaters, and Transit Maintenance brought out two, but only one worked. So instead of heating the inlets and the prop domes, the crew chiefs elected to heat just the prop domes. Now, are there other options that could have been taken here? Like getting another heater? They continued on and finished the aircraft prep, to include the engine intake inspections.

The rest of the crew showed up and all four engines were started normally. About two minutes into the low speed warm-up, the number one engine bogged down. Transit maintenance brought out an engine mechanic to help with the problem, and when he inspected the number one engine intake he found a bent first stage blade. All flying for that day just stopped.

Further inspection revealed five inlet guide vanes with bent trailing edges, thirteen first stage blades damaged, and the first four stages of the compressor had minor bending due to FOD. Now it doesn't take a rocket scientist to figure this one out. What do you think went down the engine to cause the damage? When we inspect engine intakes it just isn't metal we are looking for. Mother Nature's products are just as deadly to an engine as any piece of hardware. Make sure we clear out *all* the ice and snow prior to start.

Old Sparky!

A C-130E came home from a sortie reporting sparks from the number four engine tailpipe. Maintenance inspected the engine and found nothing in the visual and borescope inspection of the fifth and tenth stages. The daytime engine run also found nothing. At the direction of supervision the engine troops waited to run the engines again that evening so they could see the sparks, if any, more clearly. Sparks were observed during the nighttime run, so they terminated the run and went looking. Suspecting fuel contamination, they pulled the fuel nozzles for inspection and used a borescope to check the fourteenth stage. To their surprise they found extensive damage to the compressor outlet guide vanes. The engine was then removed for further investigation.

The combustion and turbine sections were not damaged in any way, but the compressor's fourteenth stage exit guide vanes had eight pieces with deformation noted on all pieces. There was also evidence that the exit guide vane assembly had been rotating in the compressor case, and the last stage of the compressor blades had come in contact with the vanes as the metal had been rubbed shiny.

Looking at recent maintenance history, there was no engine maintenance documented. They did find that the aircraft had been washed prior to the incident, with no engine runs between the wash and the first flight; this was the third flight since the wash. Now keeping with the theme of the rest of the articles in this issue, what do you think was the temperature at this location? The average high was in the 40s with lows below freezing almost every night. The temp the morning of the flight was a comfortable minus 10 Celsius.

So how could the engine have received damage from an aircraft wash? For those who have suffered through the process, you know that water goes everywhere, and even though it isn't supposed to go in the tailpipes, some does. Especially if the plugs aren't in tip-top shape. So we wash an airplane and then tow it out into the cold. Water makes ice, and ice and engines don't mix. Once again, every action has a reaction. Maybe we have to relook at the process of returning an aircraft from a warm hangar after a wash to the cold outside temperatures. Take care and make sure the engines are free and clear of all foreign objects that may cause damage. Plus, if the engine won't turn by hand, don't force it. Something is giving you a clue!

USAF

Class A Flight Mishaps

FY02 Flight Mishaps (Oct 01-Sep 02)	FY01 Flight Mishaps (Oct 00-Sep 01)
36 Class A Mishaps **22 Fatalities** **19 Aircraft Destroyed**	**24 Class A Mishaps** **9 Fatalities** **21 Aircraft Destroyed**

14 Oct	♣	An HH-60 crashed into a river while flying a low-level training mission.
17 Oct		An F-16CG was severely damaged following an aborted takeoff.
25 Oct		An F-16C departed the runway after landing.
02 Nov	♣	An MH-53 crashed while performing a mission.
05 Nov	✶	An F101 engine undergoing Test Cell maintenance sustained severe fire damage.
12 Dec	♣	A B-1B crashed into the ocean shortly after takeoff.
21 Dec	♣✶	A C-141B sustained a collapsed wing during ground refueling operations.
30 Dec	♣✶	An RQ-4A Global Hawk unmanned aerial vehicle crashed while returning to base.
07 Jan		An MH-53M collided with a ground object (Upgraded to a Class A Aug 02).
08 Jan		A C-17 was damaged during landing.
10 Jan	♣	An F-16C crashed during a surface attack training mission.
10 Jan		An MH-53J crashed during a search and rescue mission.
17 Jan	♣♣	Two A-10As were involved in a mid-air collision. Only one pilot ejected safely.
24 Jan		An MH-53 crashed while performing a mission.
25 Jan	♣✶	An RQ-1 Predator crashed on landing.
31 Jan	♣	A T-37 crashed during a training mission. The two crewmembers suffered fatal injuries.
02 Feb	♣	A C-21 crashed while landing. The two crewmembers suffered fatal injuries.
12 Feb		An F-15 was severely damaged due to an engine fire.
13 Feb	♣	An MC-130P crashed during a mission.
18 Mar		An MH-53 crashed during landing.
20 Mar	♣	An F-16 crashed during a training mission and the pilot did not survive.
10 Apr		A KC-10 experienced FOD damage to an engine. (Upgraded to Class A 08 May 02.)
15 Apr	♣	An F-16 crashed into the sea during a training mission.
22 Apr	✶	An F-22 suffered a birdstrike that severely damaged the right engine.
30 Apr	♣	An F-15C crashed during a test mission. The pilot did not eject.
13 May		An E-4B experienced damage when the HF wire broke loose and struck the fuselage.
15 May	✶	A B-2 suffered major damage when a main landing gear collapsed.

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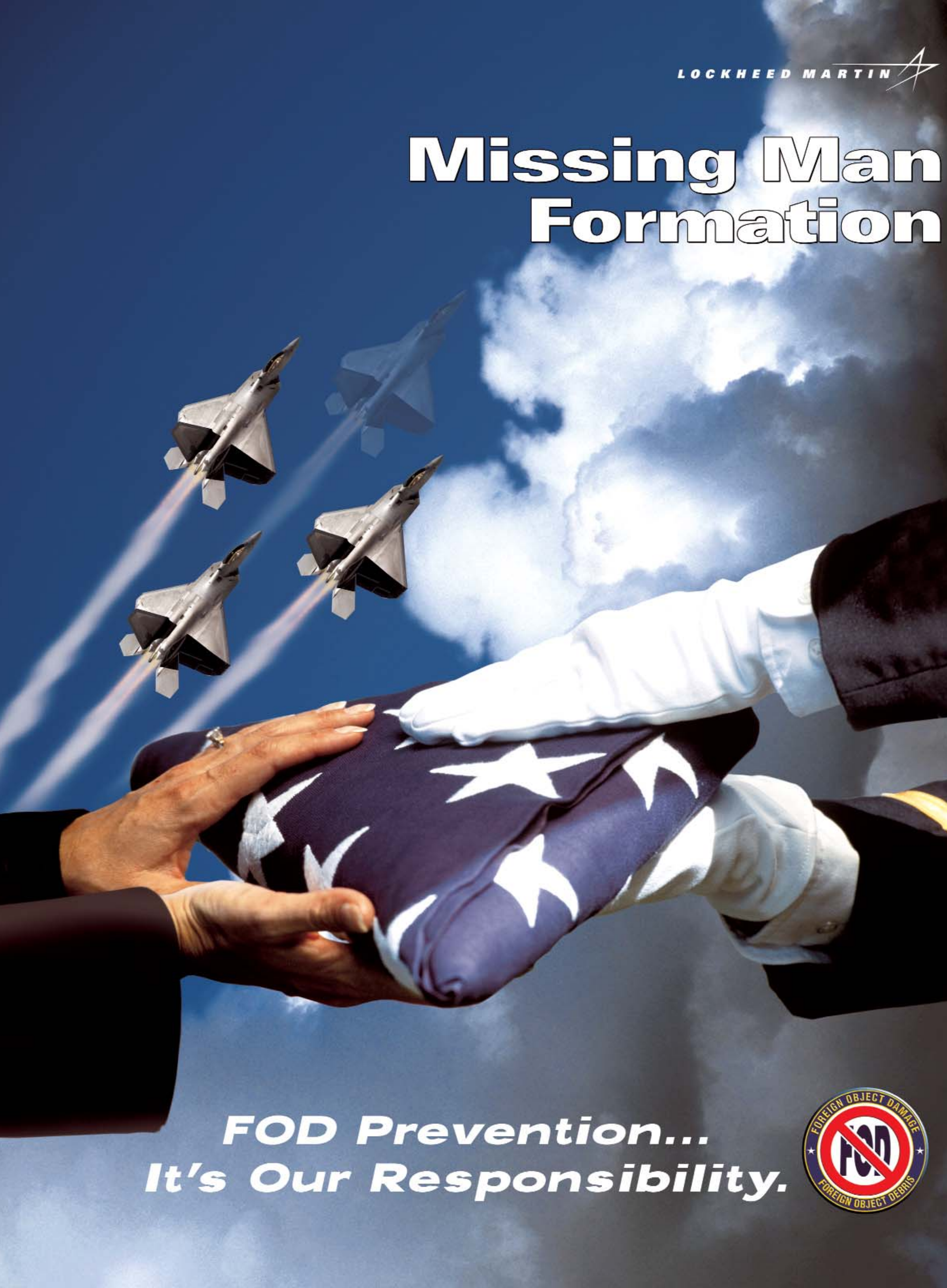
18 May ✶	An RQ-1 Predator crashed returning from a routine mission.
25 May	An MH-53M main rotor struck the fuselage (Upgraded to Class A Aug 02).
29 May ♣✶	An F-16CJ crashed during a training sortie.
30 May	An HH-60 crashed during a rescue mission.
12 Jun ♣	An MC-130H crashed shortly after takeoff. Three crewmembers suffered fatal injuries.
27 Jun ♣	An A-10A crashed during a training mission and the pilot did not survive.
03 Jul	An F-15 experienced an engine failure. (Upgraded from a Class B Jul 02)
10 Jul ♣✶	An RQ-4A Global Hawk crashed during a mission.
21 Jul	A KC-135E had a Number 2 engine fire. (Upgraded from a Class B Jul 02)
24 Jul	A C-17 suffered a hard landing. (Upgraded from a Class B Jul 02)
07 Aug ♣	An MC-130H crashed during a proficiency sortie. All 10 crewmembers did not survive.
08 Aug	A UH-1N crashed during a student training mission.
09 Aug	A U-2S departed the runway during a touch-and-go landing.
13 Aug	An HH-60G crashed during a mission.
21 Aug ♣	An F-15C crashed into the ocean during a training mission.
03 Sep	An F-15C departed the runway and was severely damaged.
09 Sep ♣	An F-16C crashed during a night training mission. The pilot did not survive.
11 Sep ♣	An F-16 crashed during a training mission.
17 Sep ♣✶	A RQ-1 Predator crashed during a mission.
27 Sep	A KC-10 boom was severly damaged during an air refueling.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF military fatalities.
- ”♣” Denotes a destroyed aircraft.
- “✶” Denotes a Class A mishap that is of the “non-rate producer” variety. Per AFI 91-204 criteria, only those mishaps categorized as “Flight Mishaps” are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A “Flight-Related,” “Flight-Unmanned Vehicle,” and “Ground” mishaps that are shown here for information purposes.
- Flight and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html
- **Current as of 30 Sep 02.** ✈


LOCKHEED MARTIN
Missing Man Formation
FOD Prevention...
It's Our Responsibility.
FOREIGN OBJECT DAMAGE
FOD
FOREIGN OBJECT DEBRIS