UNITED STATES AIR FORCE

FLYING Safety

MAGAZINE

January/February 2001

A Mishap by any other name...

AIR FORCE RECURRING PUBLICATION 91-1

JANUARY/FEBRUARY 2001, VOL 57, NO 1-2

UNITED STATES AIR FORCE

FLYING Safety MAGAZINE

This Issue:

Cover: Photos by USAF and
TSgt Michael Featherston
Photo Illustration by Dan Harman

Air Force Safety Center web page:
http://kirtland.safety.af.mil/
***Flying Safety* Magazine on line:**
http://kirtland.safety.af.mil/magazine/
htdocs/fsmfirst.htm

Commercial Prefix (505) 846-XXXX
E-Mail — roodj@kafb.saia.af.mil
Address Changes —
patricia.rideout@kafb.saia.af.mil

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

DEPARTMENT OF THE AIR FORCE — THE CHIEF OF SAFETY, USAF

PURPOSE — ***Flying Safety*** is published monthly to promote aircraft mishap prevention. Facts, testimony, and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. The contents of this magazine are not directive and should not be construed as instructions, technical orders, or directives unless so stated. SUBSCRIPTIONS — For sale by the Superintendent of Documents, PO Box 371954, Pittsburgh PA 15250-7954; $32 CONUS, $40 foreign per year. REPRINTS — Air Force organizations may reprint articles from *Flying Safety* without further authorization. Non-Air Force organizations must advise the Managing Editor of the intended use of the material prior to reprinting. Such action will ensure complete accuracy of material amended in light of most recent developments.

DISTRIBUTION — One copy for each three aircrew members and one copy for each six direct aircrew support and maintenance personnel.

POSTAL INFORMATION — ***Flying Safety*** (ISSN 00279-9308) is published monthly by HQ AFSC/SEMM, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670. Periodicals postage paid at Albuquerque NM and additional mailing offices. **POSTMASTER:** Send address changes to ***Flying Safety***, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670.

CONTRIBUTIONS — Contributions are welcome as are comments and criticism. The editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning.

MESSAGE From the Chief of Safety

MAJ GEN TIMOTHY A. PEPPE

Just about any way you look at it, FY00 was a record year. We had the lowest ever number of Class A mishaps—22—the lowest number of aircraft destroyed—14—and the lowest number of total aviation deaths—seven. Our mishap rate—the number of Class A mishaps per 100,000 flying hours—was the lowest in the history of the Air Force at just 1.04. The previous low was 1.11, in FY91.

These record lows show a continuing downward trend that we've seen over the past few years. We had 24 Class A's in FY98, with 20 aircraft destroyed, and nine total fatalities in FY99. So you can see we're headed in the right direction.

The fighter/attack mishap rate of 1.91 was also a new record and a drastic reduction from 4.11 in FY99. We only lost three AF pilots; the previous record was five, set last year. Our total of seven flight-related fatalities was down from last year's record nine. The majority of the pilot losses occurred in fighter aircraft. Considering that fighter/attack aircraft were involved in 13 of the 22 Class A's, the low fatality figure indicates that our life support equipment works when we use it and most pilots are making timely ejection decisions.

So it was a phenomenal year, especially when you factor in the increased ops tempo, deployments and operations in austere locations such as Southwest Asia. This fiscal year's aviation record is a stellar effort that reflects the Air Force's team effort. Clearly, commander awareness and emphasis, increased funding for spare parts and a commitment to operational risk management all contributed to these superb aviation safety records.

We're optimistic that with continued focus and commitment to make operational risk management a part of on- and off-duty life, we can do even better. Even one fatality is one too many.

My congratulations, and my thanks, to all of you who made this possible.

Still, all the news is not good. Our Class B flight mishap rate is alarming. FY00 saw 48 Class B mishaps for a Class B mishap rate of 2.25, the highest rate since 1978. I'm certain we have room for improvement because a Class B is often merely a few feet, or seconds, away from being a Class A.

There are always areas that need improvement, and we all need to identify and work to eliminate hazards. SIB recommendations also highlighted several. The best solutions are not normally simple, quick, or cheap, so until they are implemented we must continue to learn from our mistakes and avoid the hazards.

In this year's Mishap Review issue of Flying Safety, I want to call attention to "Anatomy of an Aircraft Accident Investigation," which readers will find valuable. Major Kurt Saldana has provided an excellent overview of the work of the Safety Investigation Board on a Class A mishap, as it works to investigate the mishap, ascertains the cause, and provides recommendations to prevent future mishaps of the same kind. These boards do a monumental job, and you'll probably find some information you didn't know in this excellent article. I recommend it highly.

In his message to the field, AF Chief of Staff General Michael E. Ryan said, "Congratulations on achieving the safest flying year in AF history. This tremendous achievement, while flying in demanding worldwide operations, is truly a team effort and a testament to the professionalism, dedication and talents of all our airmen... We did an outstanding job focusing on our previous logistics problems and reduced our logistics mishaps from 20 in FY99 to a maximum of 7 this year pending board completions. Kudos to all who worked this issue...

"Overall, the trends are very good; however, we must always strive to minimize the loss of lives and resources—zero is the goal! Taking risk management practices to the individual level, both on- and off-duty, is a must if we are to preserve our combat capability while accomplishing the Air Force mission. Thanks for a great year—let's make FY01 even safer!"

I'll second those sentiments. The tremendous accomplishments of FY00 give us a high bar to jump over, but I think we can do it. Of course, our goal is to attain a zero mishap rate, and we'll continue to work toward that. FY01 will undoubtedly present new challenges—let's do our best to prepare for them and make sure we learn from the past.

Again, my thanks to you all, and my challenge: Let's make the new year an even greater success!

C-130

LT COL DEAN NELSON
HQ AFSC/SEFF

It's the beginning of the new millennium and the "Mighty Herk" is still flying high and delivering the goods. We passed the 15 million flying hour mark and the airframe continues to be the best aircraft available to do the job of intra-theater airlift and special operation missions to austere airfields around the world.

Yes, they had been to the field once before the mishap, but I would contend they were still very unfamiliar with the airfield.

I am new here to the Safety Center but not new to the Herk. I've been flying around in it for the better part of my 20-year career. While it is a forgiving aircraft and we have to really try hard to screw things up, this past year has seen a number of instances of aircraft damaged, and unfortunately, people have died. We continue to support worldwide operations out of remote and less-than-desirable locations, and the spirit of the troops, operators and maintainers continues to put iron in the air. As long as we put aircraft in the air, we should insure the safety of the individuals involved and be diligent in our efforts to provide the safest operation possible.

The Air Force, as a whole, experienced a good news, bad news type safety record this past year. Class A mishaps were at an all-time low rate, yet we had a significant increase in Class B mishaps. This was also true for the Herk world. FY98 and FY99 saw no Class A mishaps, but FY00 included one Class A mishap. The previous two years had no Class B mishaps but this past year we had 15 Class B mishaps. Over half of this increase is due to reclassification of Class J, engine-confined mishaps (no longer a mishap class), to the appropriate Class A, B or C. This probably kept the previous two years' Class B rate looking so good. The total dollar figure for Class A and B mishaps totaled $8.56 million and inlcuded three fatalities. Class C mishaps for FY00 totaled 41 (includes 10 former Class Js), which is still a decrease from 43 the previous year. I would like to review our performance in these classes of accidents to provide "food for thought" or "hangar flying" topics for your next gathering around the table in the squadron.

The Class A mishap in Kuwait with the aircraft impacting the ground short of the main runway should remind us all of the importance of each and every mission we fly. This mishap fits into the all-too-familiar category of Controlled Flight into Terrain (CFIT). During my research on CFIT, I came across an article in the April 96 *Aviation Week & Space Technology* magazine called "Reducing CFIT Risk." The first paragraph had a very important statistic that I feel applies to this mishap. A study conducted by the Flight Safety Foundation determined that flying precision instrument approaches, especially at unfamiliar airfields, was five times safer than flying a non-precision approach. It is my contention that had the crew flown the available instrument approach the accident chain would have been broken and the aircraft would have recovered successfully. Yes, they had been to the field once before the mishap, but I would contend they were still very unfamiliar with the airfield.

We've been in the Southwest Asia theater since the beginning of the Gulf War, with lots of missions to airfields that are familiar to operations of the airlift system, but not necessarily familiar to the crewmembers. Since day one, the Herk has been a crew airplane, and it takes the individual talents of each crewmember to come together during critical phases of flight to ensure the aircraft is recovered without incident. Food for thought.

Sometimes, the difference between a Class B and a Class A is the actions of an individual (or individuals) that stopped the chain of events before it became catastrophic. So the good news from our Class B mishaps is actions were taken to safely recover the aircraft and prevent more serious damage. One of the year's Class B mishaps brings up a point about flying in the local pattern. We all spend a great deal of time flying around the flagpole and sometimes we get very comfortable with these "routine" operations. Well, the crew at Elmendorf flying in the local pattern experienced a "shock to the system" that is a good example to review. They were flying a night pro sortie with good weather, good visibility and light winds. After shooting an uneventful approach to the main runway (05), they accomplished a touch-and-go approach/landing to a cross runway (33). Approach and landing were uneventful until they hit the snow berm that was formed by snow removal operations on the main runway. Now, snow removal in Alaska is not a new phenomenon but, as it happened this particular day, somebody forgot to notify the right people to avoid this mishap. Local crew, local airfield, local procedures; no problem, been there, done that. But maybe a little bit of complacency by key people creeps in, and "ouch," the Mighty Herk loses its nose landing gear and bends a few other pieces of metal. One tidbit of information overlooked or not passed on, and a major impact to daily operations. Food for thought again.

Another area of concern for the Herk world is the rise this past year in lightning strikes. In FY99 we had only one Class C report. This past year we had two Class Bs and three Class C reports. Lightning may be a natural phenomenon, or as some folks say, "an act of God," but we do have procedures in place to lower the risk associated with flying in adverse weather. In reviewing these mishaps, it was clear that one or more of the known conditions for lighting strikes was present in every instance (sort of disproves the "act of God" theory). It bears reminding when we find ourselves in these situations that prompt action to extricate ourselves from the conditions that increase the likelihood of a strike is our first and best defense. The dollar cost of these five mishaps was just over $950K. If we could have avoided these, maybe that money would be available to get the Herk that lighting harness we need to make our cockpit night vision goggle-compatible. Fodder for your next bar stool discussion.

I'll just tie up a few loose ends, and we're outta here. Funny thing popped up while I was reviewing all the mishap reports. There were several instances of aircrew members being overcome by heat and dehydration. Now we all know that we spend a good portion of our time in Southwest Asia where temperatures are astronomical, so you would think that we would get one of these during our time in the desert. Not so; all the incidents occurred on local training sorties. Folks, it looks like we do a great job of keeping ourselves hydrated and conscious of the heat when we are in the desert, but we seem to forget about it when we're back home. Keep filling up those water bottles and drink up. One of these could be the factor that keeps a mishap sequence going, and we have a catastrophic event. Not a good thing.

In closing out this first year of the millennium, I extend my congratulations to all the Herk operators and maintainers for keeping this bird in the sky. It is through your dedication and professionalism that we can command the respect of the world as the finest air force. Let's keep the focus on safe operations and show the American people and the world that when "You call, we haul." Have a safe 2001.

Another area of concern for the Herk world is the rise this past year in lightning strikes.

C-135/KC-10

MAJ PHIL SCHROEDER
HQ AFSC/SEFF

The air refueling business is always busy and challenging. Whether passing gas, hauling cargo, training students, or a combination of the above, there is always plenty to watch out for. Fiscal Year 2000 saw no flight-related fatality or lost aircraft for both the C-135 and KC-10 community. Let's continue that trend!

The KC-10 went home with about 12 inches of F/A-18 air refueling probe.

KC-10

In the KC-10 community, Fiscal Year 2000 saw a Class A, a Class B, and various Class C, E, and FOD mishaps.

The single Class A involved an abort due to the number two engine that wouldn't reach takeoff power. The Class B resulted during a towing operation when the tow vehicle was disconnected from the aircraft on sloping terrain and the brake system was not pressurized. The aircraft rolled backwards and impacted a stationary tail stand.

The Class Cs were varied. In one case drogue mount bolts were improperly installed or left out, a hairline fracture developed, and during flight the drogue broke away from the coupling. In another situation the centerline drogue would not retract due to a failed V-6 valve. While air refueling with an AV-8B during turbulence, the hose was separated from the basket, leaving the basket attached to the AV-8B refueling probe. While refueling with Navy F/A-18s, one of the pilots attempted to engage the wing air refueling pod with excess closure. As a result the KC-10 went home with about 12 inches of F/A-18 air refueling probe. A flock of birds caused a KC-10 to abort at 140 KIAS, resulting in failure of the number 10 tire. On another sortie the number three tire experienced a sidewall gouge after running over a hole in the runway. During traffic pattern work, the number three engine was shut down due to a failed weld on the 14th stage bleed air duct that allowed extremely hot bleed air to vent into the engine nacelle. The hot bleed air caused significant damage to components.

In the Class E area we saw a KC-10, during a three sortie period, where the crew had problems with inadvertent stick shaker activation without auto-slat extension; inadvertent stick shaker *accompanied* by auto-slat extension; and unscheduled auto-slat staff warning. After each sortie, maintenance replaced various components, including a loose cannon plug on the flap transmitter, the number one and two auto-throttle speed control computers, and the left and right AOA vanes. No further problems were noted.

Another KC-10 experienced inadvertent, unscheduled auto-slat extension accompanied by the stick shaker. At approximately the same time the crew noticed the number one generator load reading fluctuating accompanied by large generator frequency variations. Maintenance replaced the CSD after landing. The unscheduled auto-slat extension and stick shaker were the results of false electrical signals. During the next sortie, similar generator load and frequency variations to the previous sortie were observed. No auto-slat extension or stick shaker occurred. After landing, maintenance replaced the load controller box. No further problems occurred.

Next we saw a KC-10 departing a deployed location with numerous pallets of maintenance equipment, including three air-conditioning units that were not properly drained and purged of fuel. During initial climb out, the fuel in one of the air-conditioning units shifted and leaked out. Due to the cargo configuration, the crew couldn't determine the extent of the spill and where it might leak, so they terminated the mission and landed.

In the FOD area, three KC-10s experienced acoustic panel damage from ice. In all cases, the engine anti-ice system was used. Two of the events occurred in the traffic pattern, with visible moisture present, broken cloud layers, and temperatures between 10-15 degrees Celsius. The third incident occurred when the crew completed air refueling and climbed from FL200 to FL260 through a layer of moderate icing.

Another good year for the KC-10 community. Keep up the good work.

C-135

InFY00 the C-135 saw no Class A mishaps, one Class B, and a variety of Class Cs, Es, and HAPs. A high interest item in the C-135 community continues to be uncommanded stabilizer trim inputs.

KC-135E engine damage, discovered during a maintenance inspection, accounted for the Class B.

Class Cs came from a variety of scenarios. During air refueling with a C-17, a disconnect was initiated. As the C-17 continued to the forward lower limit, the boom operator called a breakaway. During the breakaway, the C-17 continued beyond the forward limit, the nozzle appeared to bind in the receptacle before retracting, and the boom hoist cable failed. The KC-135E landed with the boom in trail.

In another case, while attempting to refuel with an F-16, the boom hoist cable snapped and separated from the fuselage, but remained attached to the boom. The KC-135R also landed with the boom in trail.

Next, we had a Tornado that underran its tanker. It removed the drogue basket assembly from the tanker, FODing out the number one Tornado engine after ingesting pieces of the assembly, and taking the basket home on the refueling probe.

While air refueling with an E-4 in marginal VFR conditions (one to three nautical miles visibility and no discernible horizon), the E-4 crew was having a challenging time staying on the boom. In addition, a fine mist of fuel was spraying on the pilot's windows. During the third contact, a disconnect was initiated when the E-4 approached the lower limit. As the E-4 corrected back to center, the boom nozzle struck the pilot's number one window, damaging the outer pane. The E-4 turned off its window heat and landed uneventfully.

Bird strikes during pattern activity accounted for two Class Cs. On two different occasions, KC-135R engines were shut down. Ice caused acoustic panel damage while being vectored for an approach and flying through moderate icing. An improper RCR reported to an aircrew resulted in the aircraft coming to a stop in the overrun and damaging a barrier. An engine pod was scraped on one sortie. An incomplete tow briefing and poor risk assessment resulted in a towing incident on an ice- and snow-packed sloping taxiway which damaged the aircraft nose gear and tow bar. The APU and ground power source shorted and heavy smoke rolled into the cockpit—the crew performed an APU emergency shutdown and evacuated the aircraft.

In the Class E category, six different occurrences resulted in some type of flight control malfunction, although none of these involved uncommanded horizontal stabilizer input. Four sorties resulted in smoke and fumes in the cockpit coming from the air cycle machine. An RC-135 experienced smoke and fumes coming from the aircraft battery. Smoke and fumes from the galley oven circuitry also happened during another sortie.

HAPs included numerous uncommanded horizontal stabilizer trim inputs. During air refueling with a stable receiver aircraft 75-100 feet aft, the autopilot disconnected and the pilots noticed the stab trim wheel moving "very rapidly" nose-up. The pilot activated the trim cutout switch, which stopped the nose-up trim at approximately 5.5-6.0 units nose-up.

On another aircraft, during the descent with the autopilot disconnected, the aircraft entered a sudden pitch-down maneuver, requiring pilot input, to recover the aircraft.

The next mishap aircraft had stiffer-than-normal controls when activating the elevator. Lateral controls were normal. After landing, maintenance found failed ball bearings due to corrosion in the elevator drum and bracket assembly that caused the binding/stiffness in controls.

The final event was an aircraft taxiing out for takeoff when the trim wheel slowly began turning. Neither pilot was activating the trim and the autopilot was not engaged. All other HAPs were varied and single occurrences.

The C-135 is an old airframe—probably older than most of the people flying it. We need to monitor it carefully and document any problems to maintenance and the wing flight safety office, as appropriate. We have started out the fiscal year with an ALSAFECOM message for uncommanded stabilizer trim inputs. The paperwork trail is a must to keep communication going and ensure the C-135 is maintained properly and safely. ✈

An improper RCR reported to an aircrew resulted in the aircraft coming to a stop in the overrun and damaging a barrier.

The Bombers...
B-1, B-2 and B-52

MAJ GREG SMALL
HQ AFSC/SEFF

The Year in Review

Overall, FY00 was another excellent year for safety in the B-1, B-2 and B-52 fleets. There were no Class A flight mishaps, and only five Class B flight mishaps. Achieving this while maintaining a high ops tempo is significant. A breakdown of the Class B and C flight mishaps is listed below.

Nineteen FOD mishaps cost well over 2.5 million in repair dollars.

B-1 (14 Total)

Engine Related—5 (One Class B)
Landing Gear Damage—2 (One Class B)
Birdstrikes—4 (Class B)
Hydraulic System Problem—1
Improper Part Installation—1
Damage to WF Seal—1

B-2 (Zero)

B-52 (Four Total)
Engine Related—2 (Class B)
Birdstrikes—2

Lessons Learned

Due to restrictions on the release of privileged information, the best way to get the lessons learned from this year's mishaps is to read the following messages. Your wing Safety Office should have copies of them.

• DTG 071946Z Feb 00 (B-1 Engine Mishap)
• DTG 180253Z Aug 00 (B-1 Landing Mishap)
• DTG 211707Z Apr 00 (B-1 Wing Surface Delamination Mishap)
• DTG 011505Z Mar 00 (B-52 Engine Mishap)
• DTG 300841Z Jun 00 (B-52 Engine Mishap)

FOD

Last year we told you that FOD mishaps had increased for all three bombers, and this year, the story is almost the same. The B-1 had eleven FOD mishaps, one fewer than last year, while the B-2 had two, one more than last year, and the B-52 FOD mishap rate climbed from three to six. However, these 19 FOD mishaps still cost well over 2.5 million in repair dollars. Like last year, no real FOD trends are inidentifiable. FOD mishaps affect all of us, so we all share the responsibility of trying to prevent them.

The Future

Results like we've seen the last two years don't just happen. They are the result of conscientious individuals and effective wing and squadron-level flight mishap prevention programs. Keep up the good work. Continue to fight complacency, and continue to exercise good judgment, and next year we'll be congratulating you on another safe flying year.

707 Variants:
E-3 AWACS and E-8 JSTARS

CAPT CHRISTIAN DOLLWET
HQ AFSC/SEFF

Following my return from a recent mishap investigation, a person made a comment that it must have "not been very exciting," after all there was no aircraft lost—no twisted pieces of metal. Well, "not very exciting" is fine with me, because that equates to no loss of life.

As we advance in technology, what happens when expensive "high-tech" equipment as employed on today's aircraft takes a dive? Well, FY00 showed us. For the AWACS it was a Class B and a Class A for the Joint STARS. Here's an ABC refresher:

- A Class A mishap is defined as a mishap resulting in one or more of the following:
  - Cost of $1,000,000 or more
  - A fatality or permanent total disability
  - Destruction of an Air Force aircraft
- A Class B mishap results in one or more of the following:
  - Cost ranging from $200,000 but less than $1,000,000
  - A permanent partial disability
  - In-patient hospitalization of three or more personnel
- A Class C is a mishap which results in one or more of the following:
  - Reportable damage between $10,000 and $200,000
  - An injury resulting in a lost workday case involving 8 hours or more away from work beyond the day or shift on which it occurred; or an occupational illness that causes loss of time from work *at any time.*

Note! Look for an upcoming change to AFI 91-204. This change will raise the lower threshold of a Class C mishap from $10,000 to $20,000.

Please visit your local wing safety office to read the messages that give all the details on the mishaps discussed here.

AWACS

The E-3 AWACS had one Class B and three Class C mishaps in FY00. A closer look reveals no operational trends. In fact, all but one occurred on the ground. The Class B, as mentioned in the beginning of this article, was damage to a piece of high-dollar equipment and associated components.

AWACS Class C Mishaps

Two of the three Class C mishaps occurred while conducting maintenance actions. Both of these mishaps were catastrophic failures of the auxiliary power units. The third Class C took place when a strut locking plate broke and separated during flight. Following a touch-and-go landing, the crew noticed an unsafe gear door indication when the gear handle was placed in the up position. The gear was lowered, and safe gear indications were noted. During rollout the pilots had to use "opposite" aileron inputs to keep the wings level.

Joint STARS

The E-8 JSTARS logged one Class A and two Class B mishaps this FY. The Class A (unfortunately, the first for the program) is an illustration of how the advancement in technology is re-shaping the "what we used to think of" as the "typical" Class A mishap. Again, damaged radar components elevated this mishap. The two Class B mishaps were engine FOD discovered during post flight. In the first, a bird was ingested on final approach, and the second was undetermined damage to a number of fan blades.

So what lessons were learned in these communities during FY00? We can't predict equipment failure or how people will carry out their duties in various situations, but we can recognize operations well done. Keep up the safe operations! ✈

What happens when expensive "high-tech" equipment as employed on today's aircraft takes a dive?

A-10

MAJ KURT SALADANA
CANADIAN AIR FORCE
HQ AFSC/SEFF

Once again, the A-10 community had an admirable mishap rate of 1.63 per 100,000 flying hours in FY00. Unfortunately, one of the two A-10 Class A mishaps cost the life of a pilot.

The first Class A of the year involved a relatively inexperienced pilot recovering from a routine training mission to a wet runway, which could have been icy. According to the Accident Investigation Board (AIB), the pilot landed softly rather than firmly, depleting little energy at touchdown. He deployed speed brakes and performed aerodynamic braking, but did not retard the throttles all of the way to idle. At no time did the pilot visually confirm that the throttles were at idle, nor did he check the engine instruments. Rather than testing braking action after the nose gear touched the runway, the pilot delayed braking until well down the runway. Unable to stop the aircraft, the pilot ejected after passing the departure end barrier. The aircraft continued off the end of the runway, the nose gear collapsed, and the nose section sustained severe structural damage forward of the cockpit seat rails.

Unable to stop the aircraft, the pilot ejected after passing the departure end barrier.

While it is easy to read an account of this mishap and criticize the pilot, it is difficult to determine exactly what control measures would have prevented the accident from occurring. When you teach students or are conducting mission-ready training, do you discuss cold weather or icy runway conditions? It's doubtful that the schoolhouses, because of their locations, stress ice- or snow-covered runway techniques, which do differ from landing on a wet runway. A student could conceivably leave the schoolhouse in the spring and complete mission-ready training prior to ever seeing cold weather operations. Do units have the resources, hours and time to conduct thorough cold-weather work-ups? Lack of a trainer or a simulator makes it difficult to assess technique. HUD tapes could be used, but the tendency is to review tactical work rather than scrutinize how a line pilot lands his or her aircraft. Does anyone ever pull Turbine Engine Monitoring System (TEMS) data to see how a pilot set the throttle on landing? Before this mishap, it's doubtful anyone would have thought of looking at this type of record, and even if they did, would they have the time and would they get the required support from maintenance? How do you assess a pilot's crosscheck? Flying on the wing permits instructors to assess a student's air work, but is there a way to really confirm that all of the necessary cockpit work is completed? People make mistakes—the best way to make sure they don't is to provide them with the best information available and to validate their understanding of this information. The mishap rate is low, but it is stagnating—the only way to further reduce it, yet keep flying tactically, will be to identify possible

areas of increased risk and come up with innovative ways of reducing this risk. Maybe pulling TEMS data is worthwhile as a random sampling method of confirming student or upgrade pilot actions.

FY00's second Class A mishap cost the life of an experienced aviator. Recalled from a night training mission due to worsening weather, the mishap pilot flew an instrument approach through clouds based at 500 feet AGL and topped at 4500 feet MSL. He deviated below minimum altitudes and, while in a turn, impacted the ground and sustained fatal injuries.

This type of mishap is usually attributed to either pilot disorientation or instrument failure, which can lead to disorientation. Spatial disorientation is not unusual, but pilots are trained early in their careers to trust their instruments and work through the symptoms until it's possible to use external references. Mistrust in the instruments would make it very difficult to compensate for the effects of spatial disorientation. The A-10 fleet suffers from main ADI problems with reported failures including off flags, jittery behavior, and bank and pitch errors, all of which remain failed or return to normal operation. Maintainers replaced the main ADI six times in the year prior to the mishap. The mishap aircraft also experienced other malfunctions, including the heading and altitude reference system, directional gyro and the inertial navigation unit, all of which could affect the ADI presentation. No physical evidence indicated any instrument or aircraft failure prior to ground impact.

What could have been done to prevent this mishap? If the pilot did become disoriented because of an ADI anomaly, or could not work through the symptoms of spatial disorientation because of mistrust in the ADI, the answer lies in replacing the instrument or using other available trustworthy instruments. The ADI is being replaced. Unfortunately, the field was late identifying that the ADI needed replacement; when pilots started reporting the malfunctions in numbers great enough to flag a problem, the time delay to procure and install a suitable substitute took the USAF to a date well past that of this accident.

Relying on available trustworthy instruments means being proficient flying partial-panel. Pilots practice partial-panel regularly using the standby attitude indicator, but if it were off by 20 degrees in bank and five degrees in pitch, would it be good enough to help overcome disorientation? The standby attitude indicator can also precess rapidly. It used to be common to practice true partial-panel, i.e., using the altimeter and airspeed, vertical velocity, turn and slip and heading indicators. This type of flying is demanding and takes practice, but it pays dividends, particularly when a standby attitude indicator is added to the crosscheck—the pilot can quickly determine any errors and compensate for them.

Although spatial disorientation trainers exist, they are really only good at demonstrating the effects of the problem; they don't teach how it can be overcome. Simulators can provide some valid disorientation training, and the A-10 Full Mission Trainer (FMT) will start delivery in June 2001. While not a full-motion apparatus, the FMT has good fidelity and will permit pilots to practice a lot of things they can't do in the air because of safety limitations (double-engine failures) or time.

The A-10 fleet suffers from main ADI problems with reported failures including off flags, jittery behavior, and bank and pitch errors.

The A-10 weapons system is continuing to evolve. The ADI problem will be resolved. A simulator is on the way. Even new engines are in the works; however, nothing is easy. The engines, for example, will be an engineering challenge. Any difference in weight between a new engine and the current engine will mean a change in the center of gravity and require a shift and/or addition of ballast. Likewise, because of the location of the engines, any additional thrust will add to the already significant nose-down moment. Therefore, it shouldn't come as a surprise to the operators to find that the new engines will likely be detuned to approximate the current thrust, but will last almost forever because they will never be operated at the high end of the operating temperature range.

With diligence on the part of the operators, the maintainers and people at the System Program Office (SPO), the A-10 should continue to do what it does best, putting weapons on the target—and safely—for a long time.

Helicopters:
H-53, H-60 and H-1

CAPT CHRISTIAN DOLLWET
HQ AFSC/SEFF

As we at the Safety Center put together our end-of-the-year issue, we look back to the mishap year in review, and summarize the Class A, B and C mishaps (and events) which took place during the fiscal year. We look for trends and present this information to you, with the hope that similar mishaps and events won't occur in the future. However, due to privilege safeguards, we are unable to provide every detail. Your local Safety Offices can provide more specifics—contact them for "the rest of the story."

The helicopter community (H-53s, H-60s and H-1s) had three Class A mishaps in FY00. Though each airframe was represented in the Class A category, I am happy to report that there were no fatalities. The TH-53 had the only Class B, and the Class C mishap rate was spread to all, with a total of 14.

The tip caps on the tail rotor blades disintegrated and sent shrapnel into the cabin striking the mishap student pilot (MSP) in the face.

MH-53 Class A Landing Zone Mishap

This was the night portion of a planned day-night training profile. The mishap aircraft (MA) assumed lead of a three-ship formation, following a delay at the mishap landing zone (MLZ). The MA flew a pattern to a 30' fast rope, and then led another pattern, concluding with a 15' rope ladder. The Accident Investigation Board's report said the mishap sequence began with the MA leading the formation for an air land approach. At approximately 100' AGL, 100 KGS, 0.7 NMs from the MLZ, and following a scanner cadence profile for the night tactical approach, the mishap crew (MC) came to a momentary 30' hover over the MLZ. The MC proceeded to the ground with "clear down" calls from the scanner positions. The MA descended into a large depression (approximately 100' diameter and 6.5' deep) where the tail rotor and skid simultaneously impacted the ground in a near-level attitude; close to the upper edge of the depression. The tail rotor and 90 degree gear box separated from the MA. Three crewmembers received minor injuries as a result of the right yawing and rolling motion from all rotor separation. The mishap pilot countered the motion with control inputs, and the MA came to rest upright. Crew and passengers egressed the aircraft without further injury. The mishap resulted from the aircrew's inability to observe the previously unmarked depression as they descended.

TH-53A Class B High Sink Rate/Tail Rotor Ground Contact

The mishap approach was the fourth autorotation of the day and it was flown by the mishap student instructor pilot (MSIP). The MSIP executed a flare and, during a final attitude adjustment, the MA developed a rapid sink rate and the tailskid and tail rotor blades contacted the ground. The tip caps on the tail rotor blades disintegrated and sent shrapnel into the cabin striking the mishap student pilot (MSP) in the face. The MA landed immediately, and the MSP was transported to a local trauma center, where it was determined that the MSP permanently lost vision in one eye.

H-53 Class Cs

There were three Class C mishaps in the H-53 world, but no performance trends were noted. The first mishap occurred during live fire training when spent brass links damaged a tail rotor. The second occurred when the number two engine inboard aft cowling separated from the aircraft and crushed three tail rotor tip caps. Lastly, while lifting off from a helicopter landing zone (at night), the mishap aircraft drifted into trees, damaging the main rotor blades.

HH-60G Class A Landing Zone Mishap

The mishap aircraft (MA) was the second ship in a two-ship formation conducting tactical training while deployed. After completing day water training, the formation proceeded to the Landing Zone (LZ). At the site, the lead aircraft flew an unaided [without night vision goggles (NVG)] approach into the landing zone while the MA remained airborne. While orbiting the site, the mishap crew (MC) donned their NVGs for the night tactical portion of the sortie. The lead aircraft's gunner then developed intercom problems, and the decision was made to terminate the night portion of the event. While recovering to base, the intercom problem was resolved, and the decision was made to return to the LZ for a simulated survivor recovery. From loose trail position, the mishap pilot (MP) started a normal approach to an intended brown-out landing. After starting a normal approach, the pilot allowed his crosscheck to break down and failed to properly respond to crew inputs. Concentrating almost exclusively on trying to identify his intended landing spot in a featureless desert, the MP allowed airspeed to get too slow and developed an excessive sink rate. Between 75 and 100 feet above the ground the aircraft began a nearly vertical descent, landed hard and rolled over. The MC egressed and two crewmembers sustained minor injuries. The Accident Investigation Board's report said the primary cause of the mishap was pilot error. Contributing factors included the crew not being in position to see the landing spot, and the crew's lack of experience. In addition, this NVG training mission was conducted during nautical twilight, in hazy conditions, which made NVG performance less than optimal.

HH-60G Class C Mishaps

• Two of the eight Class C mishaps were a result of aircraft landing in soft terrain which damaged the forward looking infrared (FLIR) unit.

• Two more in this class came during air refueling—no injuries, except for the refueling probes.

• In another, during cruise flight, the number one engine cowling came open, resulting in minor structural damage.

• A preflight revealed FOD damage to the left stabilator wing from a previous sortie.

• During rappel training a PJ suffered neck and back injuries following a hard landing after he lost control of the rope with his brake hand (two days quarters, but lucky).

• Finally, a postflight inspection revealed main rotor blades had damaged the infrared countermeasures housing.

UH-1N Class A Ground Impact

This mishap occurred during the fourth sortie of an operational search and rescue (SAR) mission. Due to low ceilings and visibilities, the mishap crew (MC) flew to the search area via a highway. According to the Accident Investigation Board report, after the MC flew over the Base Camp, the mishap copilot (MC) sensed the helicopter sinking. The MC pulled up to maximum power in an effort to arrest the sink rate. The mission pilot (MP) came on the controls and (also) tried to increase power and airspeed. The mishap aircraft (MA) impacted trees and came to rest on a sloped, rocky mountainside at approximately 8,600 feet. Though the aircraft was damaged beyond repair, only two of the five crewmembers required hospitalization. This mishap occurred primarily due to the mission pilots flying too low and slow for the altitude, terrain, and winds/turbulence. Once the aircraft began to sink, they didn't have enough power, airspeed, or altitude to recover—they had no escape route. A contributing factor to this mishap was the unit's over-confidence in their high-altitude flying abilities coupled with high motivation to succeed at the SAR mission.

H-1 Class Cs

There were three Class Cs in the H-1.

In the first, during takeoff, the MA contacted a three-strand set of power lines. The MP recovered the aircraft and landed. Crew and passengers egressed safely.

The second was the discovery of cracks in the tail boom under the 42-degree gearbox while accomplishing a basic postflight inspection. The tail boom wasn't repairable and had to be replaced.

In the the third Class C, thirty minutes into flight, the number two engine chip detector light illuminated on the caution panel. The mishap instructor pilot descended and accomplished a "power on" precautionary landing. The chip detector light remained illuminated until engine shutdown. Metal shavings were discovered in the engine oil system.

As Safety Center Representatives, we are continually asking the "why" to get to the root cause of a mishap. Why did the aircraft crash? Because it couldn't remain airborne. Why couldn't it remain airborne? Because the part failed. Well, why did the part fail? You get the idea. So, if after you read this article, you find yourself asking questions like: "Why did they do that?" or "Why did that happen?" then get with the folks to view the complete mishap message. Don't be the one to repeat a lesson which has already been learned. Fly safe!

Once the aircraft began to sink, they didn't have enough power, airspeed, or altitude to recover—they had no escape route.

Trainers

MAJ KURT SALADANA
CANADIAN AIR FORCE
HQ AFSC/SEFF

The difference between a High Accident Potential (HAP) mishap and a Class A mishap, for the aircrew, is often only a matter of seconds, degrees, or feet.

Safety Investigation Board (SIB) Presidents and senior officers receiving SIB briefings frequently comment that pilots seem to be less knowledgeable about aircraft systems than in the past. One theory about why this may be true ties the observation to the change in how the USAF conducts academic training.

In years gone by, it was normal for Instructor Pilots (IPs) to teach ground academics. Classroom instruction ability was inconsistent—the IPs were professional officers and professional pilots, but they were not, for the most part, professional classroom teachers. That said, they were current on the aircraft and had to become experts in the subject matter.

Flying during their non-teaching time, these instructors were available to students and other IPs as ready sources of answers or explanations to questions pertaining to their area of expertise. When they returned to the flightline as full-time IPs, they were the gurus for their particular subject matter. As they went to other airframes, they carried their expertise with them and frequently became a "guru" at the new unit. This was particularly true with more complex weapon systems, when questions would arise without an answer being obvious in the Dash-1.

Nobody can question the quality of instruction provided under the current contracted system. The instructors are professional classroom teachers and almost all have experience in their respective weapon system. Their system knowledge is at least as good as that of the instructors employed under the previous system. They are willing to answer any question regarding their area of expertise. They are not, however, normally available at the squadron or on the flight line where the bull sessions between pilots tend to generate questions.

T-1A

Looking at the T-1A mishaps for FY00, it's apparent the year was fairly uneventful. There were maintenance errors, pilot errors and mechanical malfunctions; however, in each case, the aircrew was able to respond appropriately and prevent or mitigate damages.

That said, the difference between a High Accident Potential (HAP) mishap and a Class A mishap, for the aircrew, is often only a matter of seconds, degrees, or feet. For maintainers, this difference can be a few millimeters, foot-pounds or a single digit on a stock number. While it is difficult to improve upon "zero" Class A and B mishaps, there were enough FY00 Class C, E and H mishaps to realize that the potential for a serious accident existed.

Because of the T-1A's outstanding safety record, the major flight safety concern is complacency. History has shown, all too many times, that the success of a safety program can be self-destructive. It is frequently difficult to maintain the same level of caution and vigilance when there hasn't been a major accident for an extended period. Likewise, it can be challenging to justify the continued allocation of resources to a safety program when operations appear to be safe without any obvious action by the program managers. All personnel involved in T-1A flying operations should be proud of their accomplishments, but at the same time should guard against complacency. This is the time to scrutinize maintenance and flight training and procedures and try to identify possible future areas of concern.

T-6A

As a new weapon system, the T-6A Texan II can be expected to suffer some growing pains. All aircraft tend to have a fairly high mishap rate during their first few years in service. The following chart compares the Class A mishap rate for the initial few years of several airframes compared to their current statistics.

MDS	Years	Number of Class A Mishaps
A-10	1972-80	22
F-15	1975-81	30
F-16	1975-83	44
T-37	1956-62	52
T-38	1962-70	76

Unlike many other airframes and propulsion systems, which were designed for and first flown by the USAF, the T-6A's airframe and engine are variations of tried and proven systems. This should mean that the T-6A will *not* generate high mishap rates normal to newly introduced aircraft. Contrary to the previous statement, the one T-6A Class A mishap in FY00 accounted for a mishap rate of 340.14.

The First T-6A Class A Mishap

The only T-6A Class A mishap for FY00 occurred during an Instructor Enhancement Program flight. This program permits qualified flying instructors (QFIs) rated on the type of airframe to fly in another type to gain exposure to a different environment. Guidance on how to conduct this type of mission does not specify exactly what the “visiting” QFIs can do, but does prohibit them from landing the aircraft. It is up to the Aircraft Commander (AC) to determine what will be permitted and to brief accordingly. At the time of the mishap, there were no Cockpit Familiarization Trainers (CFTs), Emergency Procedure Trainers (EPTs) or simulators delivered for ground training. Aircraft were available for cockpit familiarization, but weren’t being used for this purpose.

The mishap pilots took off, conducted aerobatics, dropped down for a short low-level navigation route and climbed for a Global Positioning System instrument approach at a nearby municipal airport. At approximately 1430 feet AGL, while passing the final approach fix (FAF) and configuration for landing, the engine cut off. The aircraft type on which the “visiting” pilot was qualified has a flap lever in the same location and of a similar shape to the Power Control Level (PCL) Cutoff finger lift in the mishap aircraft, and the flap label is closer to the PCL Cutoff finger lift than it is to the flap lever. Additionally, the PCL Cutoff finger lift offers very little resistance and is very easy to actuate.

When the engine shut down it no longer provided bleed air to the On Board Oxygen Generating System (OBOGS) and left the pilots with three options: (1) activate their individual emergency oxygen bottle, (2) breathe ambient air against the Anti-Suffocation Valve (ASV), or (3) remove their oxygen masks. Pressure from the emergency oxygen bottle is difficult to breathe against, impairs communication, is a distraction, and provides only 10 minutes of air under ideal conditions. Breathing against the ASV is also difficult and distracting and the ambient air will carry any smoke or fumes present. Dropping the mask permits easy breathing, but detracts from communications, and, like the ASV, permits breathing possibly contaminated air.

Average Class A Rate Per 100,000 Flying Hours	Average Class A Rate From 1990-2000
4.53	1.8
8.75	1.7
127.21	3.7
27.73	0.4
3.48	0.3

Even though when the engine quit, there was no suitable landing area within gliding distance and the aircraft was below minimum recommended airstart and minimum recommended controlled ejection altitudes, the Pilot in Command delayed ejection and unsuccessfully attempted to restart the engine. The pilots ejected at approximately 186 feet AGL and 81 KIAS. Both received minor injuries during the ejection sequence. These injuries included burns and superficial wounds from the detonation cord in the Canopy Fracturing System. Because the “visiting” pilot wore his mask, his face was protected, but he did receive burns on the back of his neck where skin was exposed. He also received burns to his legs. These would likely have been avoided had he been wearing two layers of clothing. Double layer protective clothing is not commonly worn at the mishap base because of high ambient temperatures and the likelihood of thermal stress. The AC’s right parachute riser did not separate upon parachute opening and, as a result, he could not get to the right hand steering toggle. The “visiting” pilot’s risers separated correctly. The pilots landed in a cornfield and suffered no unusual parachute landing fall injuries. The delay in ejecting did not give the pilots enough time to complete their post-ejection actions and it put them close to the aircraft impact fireball. The aircraft impacted the ground 2-1/2 seconds after the pilots ejected. They had approximately nine seconds under their canopies before hitting the ground. Had the winds been slightly different, either pilot could have been blown into the post-impact fire.

The delay in ejecting did not give the pilots enough time to complete their post-ejection actions.

Lessons Learned

The introduction of a propeller-equipped aircraft with only one engine and tandem seating is a major change to the way the USAF trains its pilots. Instructors are going to have to get used to not being able to see everything that the student does. This

continued on next page

means that anytime the aircraft is near a critical speed, the prudent instructor will guard the flap lever or landing gear handle to prevent an overspeed. Developing a habit of guarding the throttle to prevent a student from inadvertently selecting cutoff, particularly during the response to a simulated emergency, is something else to consider.

The T-6A is equipped with a through-the-canopy, zero-zero ejection seat, a significant improvement from the seats in the T-37. But the minimum recommended ejection altitude has *not* changed since the days of rudimentary egress systems—it's still 2000 feet AGL. This minimum recommended ejection altitude purposely does not take into account the advances in ejection seat technology and the better than "zero-zero" capabilities of today's egress systems. That's because 2000 feet gives pilots adequate time to perform all of the required post-ejection actions and steer away from ground hazards, particularly the aircraft impact fireball. By delaying ejection, pilots greatly increase the chances of sustaining significant (or fatal) injuries. The "zero-zero" capability of seats was not designed, and is not intended, to allow pilots to get closer to the ground prior to ejecting—it was designed to permit ejection during all stages of takeoff or landing, something that the old systems could not do.

Through-the-canopy ejection systems, like that found on the T-6A, involve an explosive charge fracturing the transparency prior to the pilot ejecting. The necessary explosion occurs very close to the pilot, i.e., less than a foot away. Some shrapnel and molten metal is going to be sprayed inside the cockpit. Common sense and self-preservation dictate that the pilots try to cover every possible piece of skin prior to ejecting. Pilots should leave themselves enough time to be fully prepared to leave the aircraft at the minimal ejection altitude.

While the T6-A is a good aircraft and a significant advancement in technology for USAF flight trainers, it does have only one engine. Engine failures will occur, and pilots will eject. The seat is extremely capable, but delaying ejection will reduce or remove any existing safety margin. No Texan II pilot should have to pay the ultimate price due to mechanical problems.

T-37

Apart from FY00's one T-37 Class A mishap, which unfortunately took the life of a student pilot, the year was average for the aircraft. The preponderance of reported incidents were engine-related, many to do with perceptible vibration in flight or loss of oil pressure. There were also instances of departure from the prepared surface and physiological incidents due to improper anti-G straining technique. In short, the T-37 community reported nothing out of the ordinary during the year. That said, for the first time since 1997, a T-37 was destroyed in a Class A mishap, and for the first time since 1992, a pilot died in a T-37 mishap.

September 00 Class A Mishap

The mishap occurred during a syllabus, solo sortie, which called for the student to remain in the local traffic pattern to increase proficiency in normal patterns and landings. The weather was clear and the surface wind was 20 knots giving a crosswind component from the left front quarter on the active runway. After takeoff, the pilot turned crosswind and proceeded via the locally established pattern ground track, entering initially to the active runway. The mishap aircraft appeared to configure properly and roll off the perch slightly long. During the turn to final, the aircraft was observed overshooting the extended final approach course. The aircraft overbanked, stalled, entered a steep nose low attitude, impacted the ground and exploded approximately one mile short of the approach end of the runway. The post-crash fire consumed most of the aircraft.

Final turn stalls have killed many aviators, civilian and military, throughout the history of manned flight. Although stall recognition and recovery are taught in virtually all flying courses for all aircraft, every few years the USAF loses an aircraft and pilot because the decision was made to continue to try to make the runway rather than accepting the error, rolling out and flying through. This type of mishap is not based on experience level—only a few years ago, an attack aircraft pilot max-performed his aircraft around the final turn, stalled, recovered and then pulled right back into the stall in an attempt to make the landing. He was an extremely experienced and capable pilot, yet even with the aircraft obviously in the second stall, he just held the stick against the aft stop until he flew into the ground.

The training system does a very good job teaching pilots how to recognize and recover from stalls, and stresses that a stall on short final is the most dangerous type. So, why does the USAF keep losing planes because of final turn stalls? Mishap records

No one in today's Air Force is going to criticize a pilot, student or otherwise, for making the decision to go around.

almost invariably show that the pilot tried to tighten the turn to prevent overshooting the extended runway centerline. This raises two more questions, the first being: *Why did they think that making the runway was that important?* No one in today's Air Force is going to criticize a pilot, student or otherwise, for making the decision to go around. It will not be seen as a sign of weakness and, unless the same thing happens on consecutive attempts, it will only be a debriefing item. The second, and perhaps the most important question is: *Why did they think they could make it?* Aviation history is full of dead pilots who were not IFR certified or equipped and flew into weather, who attempted to fly under a bridge or wires, who tried to cross a mountain range, who tried to take off with a tailwind or from an intersection, who didn't top off the fuel tanks, who did a loop at Uncle Jake and Aunt Ida's farm, etc., all because they "thought they could make it." For pilots, any time the phrase: "I think I can make it" pops into their head, mental warning lights should start flashing and the sirens should be wailing. For the pilot who "thinks he (or she) can make it," the odds are very good that he can't. The obvious answer is: Don't even make the attempt.

FY01

The T-37 fleet is aging and due for replacement, but the process is going to take years. Maintenance is doing a great job keeping the aircraft operational and safe, but due to aging, the number of mechanical problems will likely continue to increase. The majority of FY00's mishap reports were related to engine anomalies, and this trend is not going to change. Operators should continue to stress the importance of being prepared for an engine failure.

T-38

As is often the case, the T-38 safety record for the year was very similar to that of the T-37, i.e., with a normally low mishap rate. This is as it should be in trainers. Most reported incidents were engine-related, but there were also instances of departure from the prepared surface, physiological incidents due to improper anti-G straining technique, and canopy loss. The T-38 has not suffered a Class A mishap since 1996, but did have a single Class B mishap.

December 99 Class B Mishap

During a syllabus offensive Basic Fighter Maneuver sortie, the upgrade pilot in the front seat of the offensive aircraft maneuvered for a gun shot. The pilot in the defensive aircraft, the flight lead, performed a reversal, forcing the upgrade pilot to reposition. Both pilots re-oriented their lift vectors up and toward each other. The instructor pilot in the upgrade pilot's back seat realized that the aircraft were on a collision course and took control to try to prevent a collision.

The flight lead, recognizing the situation, transmitted for number two to go low. Because of the relatively low speed, neither aircraft could react rapidly. The resulting collision caused substantial damage to each aircraft, but neither lost control. Following damage and controllability checks, both aircraft recovered at their home base with no further complications.

This type of mishap may be preventable, but the USAF's mishap record shows that it is not uncommon—anytime two aircraft maneuver in close proximity to one another, particularly with one attempting to get closer while the other tries to prevent this action, there is an inherent risk. Because the difference between a miss and a hit can be measured in seconds, degrees or feet, and the decision to react is subjective and based upon experience, errors will occasionally occur. This is an accepted risk. While these errors do not often result in midair collisions, the most important aspect of this type of mishap is that it provides a valuable learning tool. The lessons to be learned aren't new, but they are extremely important and if a Class B costing $305,415 reinforces them, it was a cost-effective training exercise. The lessons? Live the bubble! If in doubt, err on the safe side! If the hair on the back of your neck is standing up, or the seat cushion is suffering from vacuum cleaner effect, knock it off, analyze what happened and, if able, reset.

FY01

The obvious trend for the T-38 fleet is single engine failure. This has been identified for many years and the community is doing a commendable job ensuring that none of the frequent mishaps results in the loss of an aircraft. Canopy loss has also occurred several times recently. As is the case with the T-37, the fleet is aging. Mechanical problems will increase in number every year. Those flying the T-38 have demonstrated their capabilities by keeping the mishap rate extremely low. Keep it up!

The lessons? Live the bubble! If in doubt, err on the safe side!

F-117

The bases from which the F-117 routinely operates are aware of the aircraft's susceptibility to FOD.

MAJ KURT SALADANA
CANADIAN AIR FORCE
HQ AFSC/SEFF

There were no rate-generating mishaps for the F-117 in FY00; however, the potential for a Class A or B was, as always, high. While the total of mishaps reported was low, those reported identified several areas where there appear to be more incidents than in other fighter or attack communities.

Foreign object damage (FOD) was reported twice, totaling over $600,000 damage to engines. In a community as small as the F-117, this gives a rate of approximately 15.4 per 100,000 flying hours. Interaction with weather also occurred with what appears to be a higher-than-normal rate. The reported incidents resulting from flying through heavy precipitation or hail, and the two reported incidents of lightning strikes cost almost $400,000. These mishaps generated a weather-related mishap rate of approximately 38.5.

Statistically, these FOD and weather mishap rates appear high. From a cost perspective, the total amount of money that these mishaps represent is not really significant. However, as possible precursors for Class A mishaps, these incidents are important. Time spent in repair is also very important. During the Safety Investigation Board for the 1997 Class A F-117 mishap at the Chesapeake Bay Airshow, when the F-117 fleet was temporarily grounded, one of the world's many dictators started rattling his saber. Tacticians tied his actions directly to his belief that the 117 was out of business. Operations are impacted adversely when aircraft are out of service because of system malfunctions or routine maintenance, but mission capability becomes severely restricted when preventable mishaps ground aircraft.

No matter how good the FOD program, some debris is occasionally going to find its way to a place where it poses a hazard. The bases from which the F-117 routinely operates are aware of the aircraft's susceptibility to FOD. Other bases, particularly those not maintained by the USAF, will likely not run as intense an anti-FOD program.

In the past, damage due to weather was usually reported as caused by the weather. This has changed—if adverse weather was reported and the pilot chose to fly through it, he or she accepted the risk and the consequences. While a certain level of risk may be unavoidable on a real-world mission, how much is acceptable on a training mission or a cross-country flight? There may be cases where it is worthwhile to try to negotiate weather, but for most peacetime missions, flying a different route, changing destinations, changing the type of sortie, or canceling the mission are likely better options. If weather is encountered or reported en route, turning around or diverting (if possible) is the smart option. This type of risk management is not popular—nobody wants to turn off a mission, particularly the pilot scheduled to fly.

Although certain mishap rates appear to be high for the F-117, most are well within normal limits when compared to other small communities such as the U-2, E-3, etc. The most important safety goal is to eliminate the preventable mishaps, which easily have the potential to destroy aircraft and cost lives. ➤

U-2

MAJ JON GUERTIN
TSGT JIM BRABENEC
BEALE AFB
CAPT CHRISTIAN DOLLWET
HQ AFSC/SEFF

Congratulations to Team Beale. Fiscal Year 2000 saw no Class A or B mishaps in the U-2 program. This was achieved despite a heavy flying schedule including more than 2,500 training sorties (at Beale AFB) and the high operational demands of five overseas operating locations. The program logged only one physiological incident, and two Class C aircraft mishaps in FY00.

The year's success was due to the teamwork displayed by operations, physiological support and maintenance personnel, as well as U-2 upgrades, facilities improvements and new training systems and equipment.

In late spring, the first two U-2s equipped with an updated electrical system and improved sensor capability arrived at Beale. Called Power EMI, these modified aircraft will produce less electromagnetic interference—thus providing the platform for a new generation of highly sensitive intelligence gathering equipment. In addition, a new one-piece windscreen will improve pilot cockpit visibility and reduce maintenance time.

New training equipment and facilities at the 9th Physiological Support Squadron have improved Beale's ability to meet the physiological and training requirements for pilots. The first U-2 egress simulator was brought on line in June 2000. The simulator can produce smoke and be tilted to various angles to give pilots a better appreciation for an actual in-flight or ground emergency situation. Facility renovations and added construction will increase the squadron from 33,000 square feet to about 55,000 square feet, greatly improving the unit's ability to meet its mission requirements.

U-2 maintainers working in the 99th Reconnaissance and 9th Maintenance squadrons are reaping the benefits of a focused maintenance commitment. Improved and updated technical orders, with the continued emphasis on Quality Assurance for the U-2s has improved reliability and the safety record.

U-2 pilot training now includes advanced tactics and sensor training immediately following initial certification. This improvement gives pilots a vastly improved understanding of the threats they face on operational missions and the complexities of the communications architecture used to exploit U-2 intelligence products.

Because of its high-interest mission and demanding operations environment, the U-2 program showcases the critical importance of teamwork. The application of Operational Risk Management (ORM) in daily flight and maintenance activities, coupled with current upgrades have produced a safer and more productive schedule everywhere the U-2 flies.

It takes many dedicated Air Force professionals to create one successful U-2 sortie and the first-rate safety record the 9th Reconnaissance Wing now enjoys.

The year's success was due to the teamwork displayed by operations, physiological support and maintenance personnel.

FY00 Mishap Stats

***W**elcome once again to the annual "Aircraft Statistics" pages. Just like last year, you'll note that we're only showing stats for the most recent 10 years (if applicable) of each aircraft. These stats are for "Flight Mishaps" only, and don't include any from "Flight-Related," "Ground" or other mishap categories.*

Before proceeding, a couple of notes. First, this data is correct as of this printing. However, ongoing investigations may result in a mishap being upgraded or downgraded at a later date. If so, corrections will appear in next year's annual round-up. Second, please note that since tallies haven't been finalized, flying hours for FY00 for all aircraft are estimated for Jul-Sep 00. Finally, you'll see a single asterisk appear here and there throughout the aircraft stats in the far left-hand column. When you see an asterisk, it indicates that there is a correction—flying hours and/or data—from last year's stats. For our readers who carefully review these annual statistics, you need only compare this year's asterisked data to the same lines from last year's pages to see what was changed.

Those interested in earlier numbers may view them at the AFSC web page at: www-afsc.saia.af.mil/AFSC/RDBMS/Flight/stats/index.html (".mil" and ".gov" users only).

A-10

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY91	2	0.88	0	0.00	3	1.31	2	2	228,273	2,641,768
FY92	3	1.79	0	0.00	3	1.79	1	1	167,648	2,809,416
FY93	2	1.74	0	0.00	3	1.74	1	1	115,064	2,924,480
FY94	4	3.35	0	0.00	5	4.19	1	1	119,329	3,043,809
FY95	2	1.69	1	0.84	2	1.69	1	1	118,602	3,162,411
FY96	2	1.63	0	0.00	2	1.63	1	1	122,953	3,285,364
FY97	3	2.40	1	0.80	3	2.40	2	2	125,100	3,410,464
FY98	1	0.81	0	0.00	1	0.81	0	0	124,119	3,534,583
*FY99	2	1.63	3	2.45	1	0.82	0	0	122,629	3,657,212
FY00	2	1.63	13	10.60	1	0.82	1	1	122,594	3,779,806
LIFETIME CY72-FY00	92	2.43	62	1.64	92	2.43	47	54	3,779,806	
5 YR AVG	2	1.62	3.4	2.75	1.6	1.30	0.8	0.8	123,479.0	
10 YR AVG	2.3	1.68	1.8	1.32	2.3	1.68	1	1	136,631.1	

U-2

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	19,820	257,427
FY92	1	6.03	0	0.00	1	6.03	1	1	16,597	274,024
FY93	0	0.00	0	0.00	0	0.00	0	0	18,085	292,109
FY94	2	12.79	0	0.00	2	12.79	1	1	15,643	307,752
FY95	1	5.64	0	0.00	1	5.64	1	1	17,726	325,478
FY96	2	12.11	0	0.00	1	6.05	1	2	16,518	341,996
FY97	1	8.62	0	0.00	0	0.00	0	0	11,601	353,597
FY98	0	0.00	0	0.00	0	0.00	0	0	11,431	365,028
*FY99	2	17.49	0	0.00	0	0.00	0	0	11,436	376,464
FY00	0	0.00	0	0.00	0	0.00	0	0	11,435	387,899
LIFETIME CY63-FY00	27	6.96	1	0.26	20	5.16	7	12	387,899	
5 YR AVG	1	8.01	0	0.00	0.2	1.60	0.2	0.4	12,484.2	
10 YR AVG	0.9	5.99	0	0.00	0.5	3.33	0.4	0.5	15,029.2	

YEAR	CLASS A #	RATE	CLASS B #	RATE	DESTROYED A/C	RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	2	8.56	0	0.00	0	0.00	0	0	23,355	107,634
FY92	3	11.12	0	0.00	0	0.00	0	0	26,970	134,604
FY93	1	3.31	1	3.31	1	3.31	2	4	30,179	164,783
FY94	0	0.00	1	3.40	0	0.00	0	0	29,383	194,166
FY95	0	0.00	3	10.80	0	0.00	0	0	27,781	221,947
FY96	0	0.00	1	3.79	0	0.00	0	0	26,371	248,318
FY97	1	4.03	3	12.10	1	4.03	2	4	24,803	273,121
FY98	1	4.21	2	8.42	1	4.21	0	0	23,744	296,865
*FY99	0	0.00	1	4.37	0	0.00	0	0	22,884	319,749
FY00	0	0.00	5	21.85	0	0.00	0	0	22,884	342,633
LIFETIME CY84-FY00	12	3.50	23	6.71	6	1.75	6	11	342,633	
5YR AVG	0.4	1.66	2.4	9.94	0.4	1.66	0.4	0.8	24,137.2	
10 YR AVG	0.8	3.10	1.7	6.58	0.3	1.16	0.4	0.8	25,835.4	

B-1

CLASS A YEAR	CLASS B #	RATE	DESTROYED #	RATE	FATAL A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	0,225	0,285
FY92	0	0.00	0	0.00	0	0.00	0	0	0,378	0,663
FY93	0	0.00	0	0.00	0	0.00	0	0	0,455	1,118
FY94	0	0.00	0	0.00	0	0.00	0	0	0,976	2,094
FY95	0	0.00	0	0.00	0	0.00	0	0	2,415	4,509
FY96	0	0.00	0	0.00	0	0.00	0	0	3,248	7,757
FY97	0	0.00	0	0.00	0	0.00	0	0	3,743	11,491
FY98	0	0.00	0	0.00	0	0.00	0	0	3,078	14,569
*FY99	0	0.00	1	21.74	0	0.00	0	0	4,600	19,169
FY00	0	0.00	1	21.74	0	0.00	0	0	4,600	23,769
LIFETIME FY90-FY00	0	0.00	2	8.41	0	0.00	0	0	23,769	
5 YR AVG	0	0.00	0	10.38	0	0.00	0	0	3,852	
10 YR AVG	0	0.00	0	8.44	0	0.00	0	0	2,371	

B-2

YEAR	CLASS A #	RATE	CLASS B #	RATE	DESTROYED A/C	RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	1	1.09	0	0.00	1	1.09	0	3	91,454	7,219,597
FY92	0	0.00	0	0.00	0	0.00	0	0	69,056	7,288,653
FY93	0	0.00	1	1.88	0	0.00	0	0	53,293	7,341,946
FY94	1	3.11	1	3.11	1	3.11	4	0	32,146	7,374,092
FY95	1	4.13	1	4.13	0	0.00	0	0	24,223	7,398,315
FY96	0	0.00	0	0.00	0	0.00	0	0	25,506	7,423,821
FY97	0	0.00	1	4.29	0	0.00	0	0	23,297	7,447,118
*FY98	0	0.00	0	0.00	0	0.00	0	0	22,852	7,469,970
*FY99	0	0.00	0	0.00	0	0.00	0	0	21,643	7,491,613
FY00	0	0.00	6	27.72	0	0.00	0	0	21,644	7,513,257
LIFETIME CY55-FY00	97	1.29	171	2.28	76	1.01	100	311	7,513,257	
5 YR AVG	0	0.00	1.4	6.09	0	0.00	0	0	22,988.4	
10 YR AVG	0.3	0.78	1.0	2.60	0.2	0.52	0.4	0.3	38,511.4	

B-52

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	1	0.60	0	0.00	0	0	166,676	1,244,660
FY92	0	0.00	1	1.51	0	0.00	0	0	66,324	1,310,984
FY93	0	0.00	2	2.55	0	0.00	0	0	78,319	1,389,303
FY94	0	0.00	4	5.49	0	0.00	0	0	72,899	1,462,202
FY95	0	0.00	1	1.55	0	0.00	0	0	64,608	1,526,810
FY96	0	0.00	0	0.00	0	0.00	0	0	67,499	1,594,309
FY97	0	0.00	1	1.58	0	0.00	0	0	63,120	1,657,429
*FY98	0	0.00	0	0.00	0	0.00	0	0	64,506	1,721,935
*FY99	0	0.00	0	0.00	0	0.00	0	0	56,988	1,778,923
FY00	0	0.00	2	3.51	0	0.00	0	0	56,968	1,835,891
LIFETIME CY68-FY00	15	0.82	39	2.12	4	0.22	5	168	1,835,891	
5 YR AVG	0	0.00	0.6	0.97	0	0.00	0	0	61,816.2	
10 YR AVG	0	0.00	1.2	1.58	0	0.00	0	0	75,790.7	

C-5

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	26,728	617,590
FY92	0	0.00	0	0.00	0	0.00	0	0	27,260	644,850
FY93	0	0.00	0	0.00	0	0.00	0	0	26,072	670,922
FY94	0	0.00	0	0.00	0	0.00	0	0	25,087	696,009
FY95	0	0.00	1	3.83	0	0.00	0	0	26,119	722,128
FY96	0	0.00	0	0.00	0	0.00	0	0	24,602	746,730
FY97	0	0.00	0	0.00	0	0.00	0	0	23,260	769,990
FY98	0	0.00	0	0.00	0	0.00	0	0	21,361	791,351
*FY99	1	4.95	0	0.00	0	0.00	0	0	20,205	811,556
FY00	0	0.00	0	0.00	0	0.00	0	0	20,250	831,806
LIFETIME CY68-FY00	3	0.36	2	0.24	1	0.12	3	3	831,806	
5 YR AVG	0.2	0.91	0	0.00	0	0.00	0	0	21,935.6	
10 YR AVG	0.1	0.42	0.1	0.42	0	0.00	0	0	24,094.4	

C-9

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	1	1.46	1	1.46	0	0.00	0	0	68,668	339,644
FY92	1	2.31	1	2.31	0	0.00	0	0	43,253	382,897
FY93	0	0.00	0	0.00	0	0.00	0	0	54,266	437,163
FY94	0	0.00	0	0.00	0	0.00	0	0	52,289	489,452
FY95	0	0.00	0	0.00	0	0.00	0	0	43,381	532,833
FY96	2	3.87	0	0.00	0	0.00	0	0	51,725	584,558
FY97	0	0.00	0	0.00	0	0.00	0	0	50,181	634,739
FY98	0	0.00	0	0.00	0	0.00	0	0	48,809	683,548
*FY99	1	1.88	1	1.88	0	0.00	0	0	53,286	736,834
FY00	1	1.88	0	0.00	0	0.00	0	0	53,297	790,131
LIFETIME CY81-FY00	6	0.76	6	0.76	0	0.00	0	0	790,131	
5 YR AVG	0.8	1.55	0.2	0.39	0	0.00	0	0	51,459.6	
10 YR AVG	0.6	1.16	0.3	0.58	0	0.00	0	0	51,915.5	

KC-10

YEAR	CLASS A #	RATE	CLASS B #	RATE	DESTROYED A/C	RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	34,944	279,702
FY92	0	0.00	0	0.00	0	0.00	0	0	28,893	308,595
FY93	0	0.00	0	0.00	0	0.00	0	0	27,099	335,694
FY94	0	0.00	0	0.00	0	0.00	0	0	16,500	352,194
FY95	0	0.00	0	0.00	0	0.00	0	0	21,461	373,655
FY96	0	0.00	0	0.00	0	0.00	0	0	4,740	378,395
FY97	0	0.00	0	0.00	0	0.00	0	0	4,728	383,123
FY98	0	0.00	0	0.00	0	0.00	0	0	5,666	388,789
*FY99	0	0.00	0	0.00	0	0.00	0	0	4,416	393,205
FY00	0	0.00	0	0.00	0	0.00	0	0	3,516	396,721
LIFETIME CY75-FY00	2	0.50	1	0.25	1	0.25	2	6	396,721	
5 YR AVG	0	0.00	0	0.00	0	0.00	0	0	4,613.2	
10 YR AVG	0	0.00	0	0.00	0	0.00	0	0	15,196.3	

C-12

CLASS A	CLASS B		DESTROYED		FATAL					
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	8	8
FY92	0	0.00	0	0.00	0	0.00	0	0	,539	,547
FY93	0	0.00	0	0.00	0	0.00	0	0	1,252	1,799
FY94	0	0.00	0	0.00	0	0.00	0	0	4,454	6,253
FY95	0	0.00	0	0.00	0	0.00	0	0	12,968	19,221
FY96	1	4.75	1	4.75	0	0.00	0	0	21,050	40,271
FY97	1	3.78	1	3.78	0	0.00	0	0	26,486	66,757
*FY98	1	2.35	0	0.00	0	0.00	0	0	42,623	109,380
*FY99	0	0.00	0	0.00	0	0.00	0	0	56,676	166,056
FY00	0	0.00	2	3.53	0	0.00	0	0	56,652	222,708
LIFETIME FY91-FY00	3	1.35	4	1.80	0	0.00	0	0	222,708	
5 YR AVG	0.6	1.47	0.8	1.97	0	0.00	0	0	40,697.4	
10 YR AVG	3	1.35	4	1.80	0	0.00	0	0	222,708	

C-17

YEAR	CLASS A #	RATE	CLASS B #	RATE	DESTROYED A/C	RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	8,244	45,855
FY92	0	0.00	0	0.00	0	0.00	0	0	6,994	52,849
FY93	0	0.00	0	0.00	0	0.00	0	0	6,046	58,895
FY94	0	0.00	0	0.00	0	0.00	0	0	6,617	65,512
FY95	0	0.00	0	0.00	0	0.00	0	0	6,472	71,984
FY96	0	0.00	0	0.00	0	0.00	0	0	6,403	78,387
*FY97	0	0.00	0	0.00	0	0.00	0	0	6,380	84,767
*FY98	0	0.00	0	0.00	0	0.00	0	0	6,817	91,584
*FY99	0	0.00	0	0.00	0	0.00	0	0	6,757	98,341
FY00	0	0.00	1	14.79	0	0.00	0	0	6,760	105,101
LIFETIME CY83-FY00	0	0.00	1	0.95	0	0.00	0	0	105,101	
5 YR AVG	0	0.00	0	3.02	0	0.00	0	0	6,623	
10 YR AVG	0	0.00	0	1.48	0	0.00	0	0	6,749	

C-20

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	54,923	376,453
FY92	0	0.00	0	0.00	0	0.00	0	0	47,603	424,056
FY93	0	0.00	0	0.00	0	0.00	0	0	48,421	472,477
FY94	0	0.00	0	0.00	0	0.00	0	0	47,336	519,813
FY95	1	2.13	0	0.00	1	2.13	2	7	47,020	566,833
FY96	0	0.00	0	0.00	0	0.00	0	0	46,239	613,072
FY97	0	0.00	0	0.00	0	0.00	0	0	44,743	659,815
FY98	0	0.00	0	0.00	0	0.00	0	0	45,231	705,046
FY99	0	0.00	1	2.16	0	0.00	0	0	46,234	751,280
FY00	0	0.00	0	0.00	0	0.00	0	0	46,232	797,512
LIFETIME CY84-FY00	2	0.25	1	0.00	2	0.25	4	9	797,512	
5 YR AVG	0	0.00	0.2	0.43	0	0.00	0	0	46,135.8	
10 YR AVG	0.1	0.21	0.1	0.21	0.1	0.21	0.2	0.7	47,598.2	

C-21

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	401,615	12,653,781
FY92	2	0.63	0	0.00	2	0.63	8	24	315,952	12,969,733
FY93	1	0.33	0	0.00	1	0.33	2	6	300,157	13,269,890
FY94	1	0.36	0	0.00	1	0.36	0	8	279,923	13,549,813
FY95	1	0.35	1	0.35	1	0.35	2	6	282,864	13,832,677
FY96	1	0.34	1	0.34	1	0.34	2	9	294,075	14,126,752
FY97	2	0.70	2	0.70	2	0.70	2	13	283,997	14,410,749
FY98	0	0.00	0	0.00	0	0.00	0	0	282,876	14,693,625
*FY99	0	0.00	0	0.00	0	0.00	0	0	283,542	14,977,167
FY00	1	0.35	12	4.23	0	0.00	0	3	283,556	15,260,723
LIFETIME CY55-FY00	143	0.94	155	1.02	83	0.54	134	616	15,260,723	
5 YR AVG	0.8	0.28	3	1.05	0.6	0.21	0.8	5	285,609.2	
10 YR AVG	0.9	0.30	1.7	0.57	0.8	0.27	1.6	6.9	300,855.7	

C-130

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	1	0.34	0	0.00	0	0.00	0	0	298,070	9,969,971
FY92	1	0.39	0	0.00	1	0.39	0	0	255,073	10,225,044
FY93	0	0.00	1	0.41	0	0.00	0	0	245,711	10,470,755
FY94	0	0.00	0	0.00	0	0.00	0	0	219,206	10,689,961
FY95	0	0.00	1	0.45	0	0.00	0	0	219,880	10,909,841
FY96	0	0.00	1	0.46	0	0.00	0	0	215,105	11,124,946
FY97	0	0.00	3	1.41	0	0.00	0	0	212,055	11,337,001
*FY98	1	0.47	0	0.00	0	0.00	0	0	211,206	11,548,207
*FY99	1	0.48	1	0.48	1	0.48	2	4	207,796	11,756,003
FY00	0	0.00	1	0.48	0	0.00	0	0	208,538	11,964,541
LIFETIME CY57-FY00	79	0.66	122	1.02	64	0.53	134	629	11,964,541	
5 YR AVG	0.4	0.19	1.2	0.57	0.2	0.09	0.4	0.8	210,940	
10 YR AVG	0.4	0.17	0.8	0.35	0.2	0.09	0.2	0.4	229,264	

C-135

C-141

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	442,406	9,220,662
FY92	0	0.00	0	0.00	0	0.00	0	0	226,312	9,446,974
FY93	1	0.49	0	0.00	2	0.98	4	13	203,264	9,650,238
FY94	0	0.00	0	0.00	1	0.78	0	0	127,938	9,778,176
FY95	0	0.00	0	0.00	0	0.00	0	0	157,059	9,935,235
FY96	0	0.00	0	0.00	0	0.00	0	0	146,417	10,081,652
FY97	1	0.83	1	0.83	1	0.83	2	9	121,043	10,202,695
FY98	1	0.97	0	0.00	0	0.00	0	0	102,917	10,305,612
*FY99	0	0.00	1	1.13	0	0.00	0	0	88,888	10,394,500
FY00	0	0.00	4	4.50	0	0.00	0	0	88,889	10,483,389
LIFETIME CY64-FY00	34	0.32	34	0.32	16	0.15	34	161	10,483,389	
5 YR AVG	0.4	0.36	1.2	1.09	0.2	0.18	0.4	1.8	109,630.8	
10 YR AVG	0.3	0.18	0.6	0.35	0.4	0.23	0.6	2.2	170,513.3	

E-3

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	32,343	335,398
FY92	0	0.00	0	0.00	0	0.00	0	0	33,329	368,727
FY93	0	0.00	0	0.00	0	0.00	0	0	27,782	396,509
FY94	0	0.00	0	0.00	0	0.00	0	0	24,381	420,890
FY95	1	3.90	0	0.00	1	3.90	2	22	25,612	446,502
FY96	0	0.00	0	0.00	0	0.00	0	0	25,430	471,932
FY97	0	0.00	0	0.00	0	0.00	0	0	21,752	493,684
FY98	0	0.00	0	0.00	0	0.00	0	0	20,960	514,644
*FY99	0	0.00	1	5.06	0	0.00	0	0	19,762	534,406
FY00	0	0.00	0	0.00	0	0.00	0	0	19,665	554,071
LIFETIME CY77-FY00	1	0.18	3	0.54	1	0.18	2	22	554,071	
5YR AVG	0	0.00	0.2	0.93	0	0.00	0	0	21,513.8	
10 YR AVG	0.1	0.40	0.1	0.40	0.1	0.40	0.2	2.2	25,101.6	

E-4

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	1,822	29,817
FY92	0	0.00	1	58.28	0	0.00	0	0	1,716	31,533
FY93	0	0.00	1	74.96	0	0.00	0	0	1,334	32,867
FY94	0	0.00	0	0.00	0	0.00	0	0	1,587	34,454
FY95	0	0.00	0	0.00	0	0.00	0	0	1,697	36,151
FY96	0	0.00	0	0.00	0	0.00	0	0	1,401	37,552
FY97	0	0.00	0	0.00	0	0.00	0	0	1,310	38,862
FY98	0	0.00	0	0.00	0	0.00	0	0	1,362	40,224
*FY99	0	0.00	1	78.74	0	0.00	0	0	1,270	41,494
FY00	0	0.00	0	0.00	0	0.00	0	0	1,269	42,763
LIFETIME CY75-FY00	1	2.34	3	7.02	0	0.00	0	0	42,763	
5 YR AVG	0	0.00	0.2	15.12	0	0.00	0	0	1,322.4	
10 YR AVG	0	0.00	0.3	20.31	0	0.00	0	0	1,476.8	

E-8

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	0,109	0,109
FY92	0	0.00	0	0.00	0	0.00	0	0	0,514	0,623
FY93	0	0.00	0	0.00	0	0.00	0	0	1,219	1,842
FY94	0	0.00	0	0.00	0	0.00	0	0	0,524	2,366
FY95	0	0.00	0	0.00	0	0.00	0	0	0,361	2,727
FY96	0	0.00	0	0.00	0	0.00	0	0	0,724	3,451
FY97	0	0.00	0	0.00	0	0.00	0	0	1,305	4,756
FY98	0	0.00	0	0.00	0	0.00	0	0	2,106	6,862
FY99	0	0.00	0	0.00	0	0.00	0	0	3,327	10,189
FY00	1	30.07	1	30.07	0	0.00	0	0	3,326	13,515
LIFETIME FY91-FY00	1	7.40	1	7.40	0	0.00	0	0	13,515	
5 YR AVG	0.2	9.27	0.2	9.27	0	0.00	0	0	2,157.5	
10 YR AVG	0.1	7.40	0.1	7.40	0	0.00	0	0	1,351.5	

F-15

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	3	1.09	2	0.72	3	1.09	0	0	276,393	2,431,519
FY92	5	2.26	2	0.91	5	2.26	2	3	220,866	2,652,385
FY93	3	1.38	5	2.30	3	1.38	0	0	217,547	2,869,932
FY94	4	1.90	3	1.43	4	1.90	1	1	210,241	3,080,173
FY95	4	1.95	5	2.42	3	1.45	1	2	206,649	3,286,822
FY96	4	1.99	2	1.00	3	1.49	0	0	200,766	3,487,588
*FY97	3	1.56	5	2.60	2	1.04	0	0	192,081	3,679,669
*FY98	3	1.59	5	2.66	2	1.06	0	0	188,204	3,867,873
*FY99	7	3.70	9	4.76	6	3.17	1	2	189,109	4,056,982
FY00	3	1.59	21	11.60	1	0.53	0	0	189,233	4,246,215
LIFETIME CY72-FY00	107	2.52	175	4.12	98	2.31	35	42	4,246,215	
5 YR AVG	4	2.08	8	4.38	3	1.46	0	0	191,879	
10 YR AVG	4	1.87	6	2.82	3	1.53	1	1	209,109	

F-16

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	21	4.55	2	0.43	21	1.09	5	5	461,451	2,850,721
*FY92	18	4.04	1	0.22	18	4.04	7	8	445,201	3,295,922
FY93	18	4.15	2	0.46	18	4.15	4	5	433,960	3,729,882
FY94	17	4.00	2	0.50	15	3.75	3	27	400,484	4,130,366
FY95	9	2.33	2	0.26	9	2.33	1	1	386,445	4,516,811
FY96	8	2.14	5	1.34	7	1.87	0	1	374,530	4,891,341
FY97	11	3.05	0	0.00	11	3.05	1	1	360,738	5,252,079
*FY98	14	3.89	1	0.28	12	3.33	5	6	360,245	5,612,324
*FY99	18	5.11	3	0.85	16	4.54	2	2	352,275	5,964,599
FY00	9	2.55	8	2.27	9	2.55	2	2	352,375	6,316,974
LIFETIME CY75-FY00	273	4.32	43	0.68	259	4.10	69	104	6,316,974	
5 YR AVG	12	3.33	3.4	0.94	11	3.06	2	2.4	360,032.6	
10 YR AVG	14.2	3.62	2.5	0.64	13.6	3.46	3	5.8	392,770.4	

F-117

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	17,875	17,875
FY92	1	8.71	0	0.00	1	8.71	0	0	11,481	29,356
FY93	0	0.00	2	15.95	0	0.00	0	0	12,538	41,894
FY94	0	0.00	0	0.00	0	0.00	0	0	12,136	54,030
FY95	2	15.62	0	0.00	1	7.81	1	1	12,804	66,834
FY96	0	0.00	1	7.59	0	0.00	0	0	13,171	80,005
FY97	3	23.69	0	0.00	1	7.90	0	0	12,661	92,666
FY98	0	0.00	0	0.00	0	0.00	0	0	12,470	105,136
*FY99	1	7.35	1	7.35	0	0.00	0	0	13,599	118,735
FY00	0	0.00	0	0.00	0	0.00	0	0	13,509	132,244
LIFETIME FY91-FY00	7	5.29	4	3.02	3	2.27	1	1	132,244	
5 YR AVG	0.8	6.12	0.4	3.06	0.2	1.53	0	0	13,082.0	
10 YR AVG	0.7	5.29	0.4	3.02	0.3	2.27	0.1	0.1	13,224.4	

H-1

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	1	3.32	1	3.32	1	3.32	1	2	30,087	550,289
FY92	2	7.21	0	0.00	2	7.21	3	7	27,729	578,018
FY93	0	0.00	0	0.00	0	0.00	0	0	25,945	603,963
FY94	1	4.15	1	4.15	1	4.15	0	0	24,099	628,062
FY95	1	4.60	0	0.00	1	4.60	0	0	21,761	649,823
FY96	1	4.73	0	0.00	1	4.73	0	0	21,141	670,964
FY97	0	0.00	0	0.00	0	0.00	0	0	20,716	691,680
*FY98	1	5.05	0	0.00	1	5.05	0	0	19,787	711,467
*FY99	0	0.00	0	0.00	0	0.00	0	0	19,354	730,821
FY00	1	5.17	0	0.00	1	5.17	0	0	19,357	750,178
LIFETIME CY71-FY00	16	2.13	6	0.80	15	2.00	9	24	750,178	
5 YR AVG	0.6	2.99	0	0.00	0.6	2.99	0	0	20,071	
10 YR AVG	0.8	3.48	0.2	0.87	0.8	3.48	0.4	0.9	22,997.6	

H-53

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	1	8.63	0	0.00	0	0	11,594	326,781
FY92	0	0.00	0	0.00	0	0.00	0	0	12,238	339,019
FY93	0	0.00	0	0.00	0	0.00	0	0	12,019	351,038
FY94	0	0.00	0	0.00	0	0.00	0	0	12,106	363,144
FY95	1	8.43	0	0.00	1	8.43	0	0	11,857	375,001
FY96	1	7.44	0	0.00	0	0.00	0	0	13,436	388,415
FY97	0	0.00	0	0.00	0	0.00	0	0	12,996	401,433
FY98	0	0.00	0	0.00	0	0.00	0	0	13,926	415,359
*FY99	1	7.36	1	7.36	1	7.36	0	1	13,578	428,937
FY00	1	7.37	1	7.37	0	0.00	0	0	13,569	442,506
LIFETIME CY66-FY00	28	6.33	17	3.84	20	4.52	24	81	442,506	
5 YR AVG	0.6	4.44	0.4	2.96	0.2	1.48	0	0.2	13,501	
10 YR AVG	0.4	3.14	0.3	2.36	0.2	1.57	0	0.1	12,731.9	

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY91	1	6.85	0	0.00	0	0.00	0	0	14,594	48,839
FY92	1	5.15	0	0.00	1	5.15	0	1	19,401	68,240
FY93	1	4.37	0	0.00	1	4.37	1	12	22,871	91,111
FY94	2	8.25	1	4.13	1	4.13	0	0	24,229	115,340
FY95	1	3.75	1	3.75	1	3.75	2	5	26,666	142,006
FY96	0	0.00	0	0.00	0	0.00	0	0	27,809	169,815
FY97	0	0.00	0	0.00	0	0.00	0	0	26,009	195,824
FY98	1	3.84	0	0.00	2	7.69	4	12	26,014	221,838
*FY99	0	0.00	0	0.00	0	0.00	0	0	26,384	248,222
FY00	1	4.14	0	0.00	0	0.00	0	0	24,141	272,363
LIFETIME CY82-FY00	9	3.30	2	0.73	7	2.57	9	34	272,363	
5 YR AVG	0.4	1.53	0	0.00	0.4	1.53	0.8	2.4	26,071.4	
10 YR AVG	0.8	3.36	0.2	0.84	0.6	2.52	0.7	3.0	23,811.8	

H-60

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY92	0	0.00	0	0.00	0	0.00	0	0	0,001	0,001
FY93	0	0.00	0	0.00	0	0.00	0	0	18,063	18,064
FY94	0	0.00	0	0.00	0	0.00	0	0	32,304	50,368
FY95	0	0.00	0	0.00	0	0.00	0	0	41,055	91,423
FY96	0	0.00	0	0.00	0	0.00	0	0	48,186	139,609
FY97	0	0.00	0	0.00	0	0.00	0	0	58,420	198,029
FY98	0	0.00	0	0.00	0	0.00	0	0	78,618	276,647
*FY99	0	0.00	1	0.00	0	0.00	0	0	98,994	375,641
FY00	0	0.00	0	0.00	0	0.00	0	0	98,995	474,636
LIFETIME FY92-FY00	0	0.00	1	0.21	0	0.00	0	0	474,636	
5 YR AVG	0	0.00	0.2	0.26	0	0.00	0	0	76,642.6	

T-1

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY00	1	341.30	0	0.00	1	341.30	0	0	293	293
LIFETIME FY00	1	341.30	0	0.00	1	341.30	0	0	293	

T-6

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	279,593	10,929,982
FY92	2	0.85	0	0.00	3	1.28	2	2	234,830	11,164,812
FY93	1	0.56	0	0.00	1	0.56	0	0	179,933	11,344,745
FY94	0	0.00	0	0.00	0	0.00	0	0	151,651	11,496,396
FY95	1	0.74	0	0.00	1	0.74	0	0	134,425	11,630,821
FY96	0	0.00	0	0.00	0	0.00	0	0	144,079	11,774,230
FY97	1	0.63	0	0.00	1	0.63	0	0	159,855	11,934,755
FY98	0	0.00	0	0.00	0	0.00	0	0	183,911	12,118,666
*FY99	0	0.00	0	0.00	0	0.00	0	0	201,993	12,320,659
FY00	1	0.49	0	0.00	1	0.49	0	1	202,798	12,523,457
LIFETIME CY56-FY00	134	1.07	31	0.25	132	1.05	26	75	12,523,457	
5 YR AVG	0.4	0.22	0	0.00	0.4	0.22	0	0.2	178,527.2	
10 YR AVG	0.6	0.32	0	0.00	0.7	0.37	0.2	0.3	187,306.8	

T-37

YEAR	CLASS A		CLASS B		DESTROYED		FATAL	ALL	HOURS	CUM HRS
	#	RATE	#	RATE	A/C	RATE	PILOT			
FY91	1	0.30	0	0.00	1	0.30	0	2	337,134	10,953,343
FY92	1	0.38	0	0.00	0	0.00	1	1	265,369	11,218,712
FY93	3	1.33	0	0.00	3	1.33	0	0	225,105	11,443,817
FY94	0	0.00	0	0.00	0	0.00	0	0	194,161	11,637,978
FY95	1	0.63	0	0.00	1	0.63	0	0	158,422	11,796,400
FY96	1	0.75	0	0.00	1	0.75	0	0	133,959	11,930,359
FY97	0	0.00	0	0.00	0	0.00	0	0	135,011	12,065,370
FY98	0	0.00	1	0.71	1	0.71	0	0	141,448	12,206,818
*FY99	0	0.00	0	0.00	0	0.00	0	0	141,575	12,348,393
FY00	0	0.00	2	1.41	0	0.00	0	0	141,628	12,490,021
LIFETIME CY60-FY00	189	1.51	92	0.74	183	1.47	75	134	12,490,021	
5 YR AVG	0.2	0.14	0.6	0.43	0.4	0.29	0	0	138,724.2	
10 YR AVG	0.7	0.37	0.3	0.16	0.7	0.37	0.1	0.3	187,381.2	

T-38

YEAR	CLASS A		CLASS B		DESTROYED		FATAL	ALL	HOURS	CUM HRS
	#	RATE	#	RATE	A/C	RATE	PILOT			
FY91	0	0.00	0	0.00	0	0.00	0	0	24,172	543,220
FY92	0	0.00	0	0.00	0	0.00	0	0	26,293	569,513
FY93	0	0.00	0	0.00	0	0.00	0	0	23,755	593,268
FY94	0	0.00	0	0.00	0	0.00	0	0	17,881	611,149
FY95	0	0.00	0	0.00	0	0.00	0	0	0,578	611,727
FY96	0	0.00	0	0.00	0	0.00	0	0	0,671	612,398
FY97	0	0.00	0	0.00	0	0.00	0	0	0,622	613,020
FY98	0	0.00	0	0.00	0	0.00	0	0	0,834	613,854
*FY99	0	0.00	0	0.00	0	0.00	0	0	0,780	614,634
FY00	0	0.00	0	0.00	0	0.00	0	0	0,571	615,205
LIFETIME CY64-FY00	9	1.46	5	0.81	4	0.65	1	2	615,205	
5 YR AVG	0	0.00	0	0.00	0	0.00	0	0	0,696	
10 YR AVG	0	0.00	0	0.00	0	0.00	0	0	9,616	

T-41

YEAR	CLASS A		CLASS B		DESTROYED		FATAL	ALL	HOURS	CUM HRS
	#	RATE	#	RATE	A/C	RATE	PILOT			
FY91	0	0.00	0	0.00	0	0.00	0	0	13,296	269,263
FY92	0	0.00	0	0.00	0	0.00	0	0	11,005	280,268
FY93	0	0.00	0	0.00	0	0.00	0	0	9,179	289,447
FY94	0	0.00	0	0.00	0	0.00	0	0	7,069	296,516
FY95	0	0.00	0	0.00	0	0.00	0	0	7,917	304,433
FY96	1	14.28	0	0.00	1	14.28	2	35	7,003	311,436
FY97	0	0.00	0	0.00	0	0.00	0	0	6,552	317,988
FY98	0	0.00	0	0.00	0	0.00	0	0	5,265	323,253
FY99	0	0.00	0	0.00	0	0.00	0	0	5,066	328,319
FY00	0	0.00	0	0.00	0	0.00	0	0	5,155	333,474
LIFETIME CY74-FY00	1	0.30	6	1.80	1	0.30	2	35	333,474	
5 YR AVG	0.2	3.44	0	0.00	0.2	3.44	0.4	7.0	5,808.2	
10 YR AVG	0.1	1.29	0	0.00	0.1	1.29	0.2	3.5	7,750.7	

T-43

A New Age In Deicin

Photo Courtesy of Author

As with most new things, these improved trucks will—at first—pre-sent new challenges when deicing.

MR. JAMES B. BOLIN
AF ENGINEERING AND TECHNICAL SERVICES
ELMENDORF AFB, ALASKA

Are you ready for winter? Have you reviewed your winter ops checklists? Have you reviewed T.O. 42C-1-2, *Anti-Icing, Deicing, and Defrosting of Parked Aircraft*? Are your personnel fully trained? Hopefully, all of your answers to these questions were "Affirmative!" You can bet winter preparation is something we take pretty seriously here in Alaska!

Our task of deicing aircraft has recently become more efficient and safer, thanks to acquisition of an improved deicing/anti-icing vehicle, the Global GL-1800AP. We here at the 632d Air Mobility Support Squadron (AMSS) received a vehicle for testing in the Fall of 1999, and the base currently has about 10 of the GL-1800s on hand. As I understand it, several locations Air Force-wide will receive these enhanced vehicles over the next couple of years and they'll largely replace the more prevalent "open basket-type" deicers.

As with most new things, these improved trucks will—at first—present new challenges when deicing. But with good training, some hands-on practice and—perhaps most importantly—a good attitude, I believe most of you will really appreciate how well this new vehicle does its job and provides the operator some real "creature comforts." I threw in the "attitude" part, because the transition from an open basket to an enclosed compartment isn't easy for everyone. More on that later.

These trucks are state-of-the-art equipped. Gone is the open basket, donning of tons of PPE and getting soaked with backwash while enduring the winter environment and frigid temperatures. Similar to the Landoll TM1800 written about in these pages in 1999 ("It's Cool To Be Warm When It's Cold," Oct 99, Ed.), the person doing the deicing is doing so from an enclosed compartment. I wouldn't say the compartment is luxurious, but it does come with a comfortable seat, your own personal heater (!), lights to illuminate the work area, and joystick fingertip controls that direct the nozzles (for dispensing fluids, air or a combination of both), and the boom. And it's quiet inside, too. On second thought, it really is downright luxurious compared to the open basket!

For those who have used the Hot Air Blast System (HABS) to clear away loose snow, the latest versions of Global's GL-1800AP have another improvement. It's new technology that goes by the name of "AirPlus!™" This AirPlus!™ design allows for delivery of high velocity—700-760 mph—air at low pressure, typically at 11-13 psi. This could be compared to an aerosol spray can, where the contents are under high pressure, but they're dispensed—in volume—at relatively low pressure. The air pressure is developed by a supercharger that's hydraulically driven by an auxiliary motor hydraulic pump located on the truck. This supercharger is one that's commercially available and has agricultural and marine boating uses, just another example of how off-the-shelf technology was incorporated into this vehicle. Ambient air is drawn from behind the cab and routed through an exterior aluminum duct and a swivel joint, where it exits the air nozzle about 108 degrees F above ambient temperature (a natural effect of compression by the supercharger). At approximately 32 inches from the nozzle the temperature of that heated air is back at ambient. **NOTE!** This air is intended for use—at *ambient* temperature—in removing accumulations of snow/ice while in a "frozen" state. Air that's used to remove snow accumulations should never be so warm that it melts the snow or ice. This melted snow or ice *will* re-freeze and could accumulate in an area that creates extremely hazardous—even *deadly*—flight conditions for the aircraft and crew. If the deicer operator is *melting* snow (or ice) with the air, then he's too close and needs to back away immediately. Reference T.O. 42C-1-2, para 4.2.2e. The air and fluid nozzles are ganged together, so pointing them allows application of air, deicing fluid or a combination of both for snow and ice removal.

These new GL-1800APs are designed to help reduce the amounts of fluid used and protect our environment while still doing a great job of making aircraft safe for flight. Fluid dispensing is regulated by a foot pedal located at the operator's right foot, similar to one that you'd find in your car. You can control output to a maximum of 60 gallons per minute—that's a lot of fluid! You should never have to even come close to dispensing that much. Available fluid application combinations are:

- Heated deicing fluid;
- Heated deicing fluid with an air injection; and
- Anti-icing fluid.

You also have the option of using AirPlus!™ air all by itself.

The GL-1800AP's 3.4 million BTU heater can provide deicing fluid out of the two nozzles that's nearly instantaneously hot. The heated deicing fluid can be applied from the fluid nozzle or it can be injected into the forced air system to allow for greater distance and coverage. At the touch of a switch, anti-icing fluid can then be selected and applied. This allows for a faster two-step deicing/anti-icing operation. Truck capacities are 1650 gallons of deicing fluid and 170 gallons of anti-icing fluid.

Depending upon your location and local restrictions, deicing operations might be accomplished right at aircraft parking locations or they may be done at a designated deicing pad. Deicing pads should be used to the maximum extent possible, since they facilitate fluid recovery and greatly decrease the possibility of harm to the environment. Naturally, if you're performing deicing/anti-icing at other than a designated deicing fluid recovery pad, use only as much fluid as necessary. Allow the fluids to do their job and use only the amounts needed.

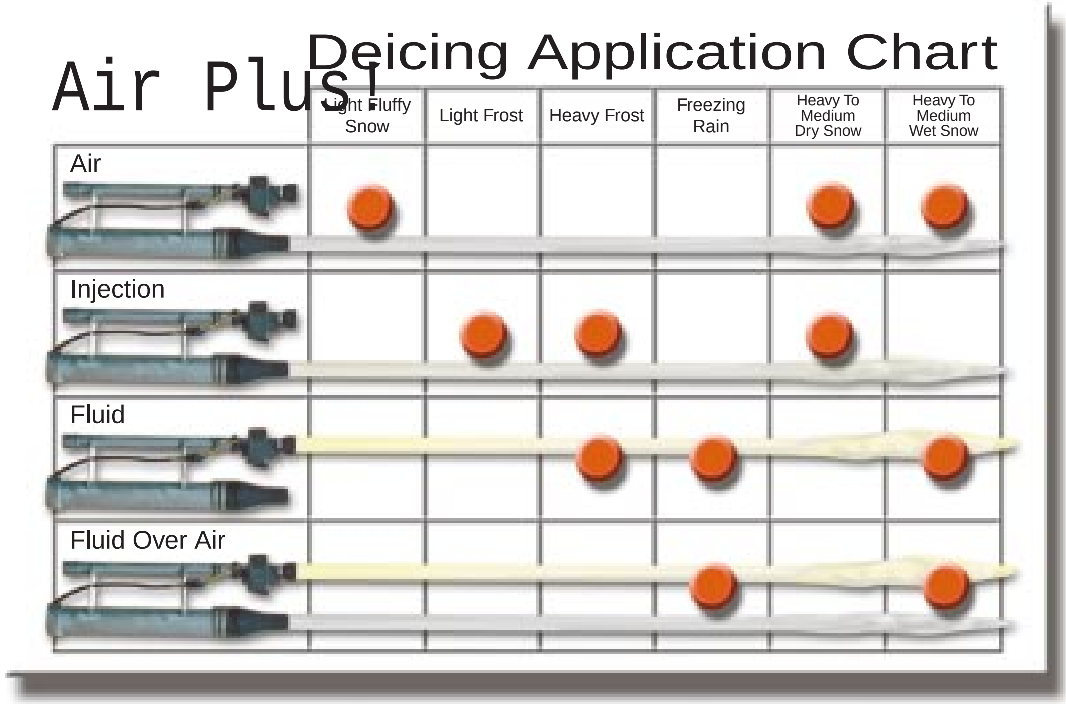
Air that's used to remove snow accumulations should never be so warm that it melts the snow or ice.

No matter how good a deicing vehicle is, it can't do everything. Preparing aircraft for flight in winter-time conditions has to follow a plan that's well-executed. Start your deicing operations early. This will give you time to use "mechanical" equipment to your advantage: Ropes, shovels, brooms, etc., to remove as much loose snow as possible. It may not be as easy as using the deicing vehicle, but here are two good reasons you shouldn't depend only on the deicer:

- You'll use less deicing fluid; and
- More importantly, manual removal of accumulations of snow means that when you do start deicing, there'll be that much *less* snow available to possibly re-freeze in areas that could endanger the crew: Flight control areas, landing gear, doors and the like.

If you're fortunate enough to be at one of the locations that received the new Global trucks, get out there and start using them. That's what we do with our training plan here at Elmendorf. Working with the different systems is the best way to take advantage of the benefits of this new deicing tech-

continued on next page



No matter how good a deicing vehicle is, it can't do everything.

nology. Experiment with air and fluid combinations. Remember my earlier comment about "attitude"? There is a learning curve that comes from working in an enclosed cab that only experience can overcome, and for some folks, it's tough to leave behind the old, familiar practices that grew from working in an open basket. Get comfortable with the boom and basket and overcome any apprehension over a reduced vision area. It's been my experience that most novice operators misjudge their distance and try to accomplish deicing from too far away, causing an increase in fluid usage, deicing time and frustration! Per the operator's manual, the surest way to optimize snow removal is to use the nozzles at an angle from 30 to 45 degrees to the surface being deiced, at a distance of from 32 inches to six feet. When you can safely and effectively operate within these parameters, you're ready to deice.

Finally, I've got to throw in a couple more pitches here. Review your T.O. 42C-1-2, *Anti-Icing, Deicing, and Defrosting of Parked Aircraft*. Ensure your troops are familiar with and understand the terms, "deicing" and "anti-icing," and that they know the procedures of "Two-Step Anti-Icing." Know which fluids and types are applicable for your aircraft. Learn the procedures for applying anti-icing fluid, which are quite different from deicing fluid application procedures. **NOTE!** Remember that application of *anti-icing* fluid is *not* approved for all types of aircraft. If your computer is set up for viewing secure "af.mil" web sites, you may view a copy of T.O. 42C-1-2 and its latest changes at: https://afpet.lackland.af.mil/sfweb/sft/techorder/tos/42C-1-2.pdf. You'll see a "Warning" on the title page that states the T.O. is incomplete without reference to the Air Force Flight Standards Agency's (AFFSA) "Holdover Tables." You may view the latest Holdover Tables for anti-icing and deicing fluids at: http://www .andrews. af.mil/tenants/affsaxo.htm. Once there, select the "Flight Standards" button, then scroll down and you'll see the button for "Aircraft Anti-Icing, Deicing and Defrosting Information."

As CMSgt Robert McDonald from HQ AMC stated in a previous article ("Aircraft Deicing/Anti-Icing Fluids and Standards: 2000 Update," Nov 00. Ed.), many of our aircraft now use commercial airfields. Many of these airfields use the new Global truck. So we in the Air Force aren't far behind our civilian counterparts. Your increased experience will enable you to provide Global service for Global Reach.

So: *Are* you ready for Winter?

(Mr. Bolin is the resident AFETS representative for AMC's 632d Air Mobility Support Squadron at Elmendorf AFB. He joined the 632 AMSS in 1991 and his background is primarily in airlift aircraft. He is a regular contributor to these pages. Ed.)

Photos Courtesy of Author

Learn the procedures for applying anti-icing fluid, which are quite different from deicing fluid application procedures.

The Strat Airlifter C-5, C-17 and C-141

TMAJ STEVEN C. PANGER
C-141, C-17 ACTION OFFICER
MAJ PAUL GALLAHER
C-5 ACTION OFFICER
HQ AFSC/SEFF

The number of reportable bird strikes is down slightly from last year. However, the cost is not.

This is my second year writing this article and I must say a whole lot has changed as far as the safety of our strat airlift force. Fiscal Year 00 was a great year for safety in the whole Air Force, as well as the airlift world. However, the numbers of the major mishaps, Class As and Class Bs, were up this year compared to prior years. The good news this year is that looking at pure Class C numbers, the numbers are way down. However, the driver behind this may be the introduction of the Class E mishap category. Class Es are a new mishap class which, in theory, are supposed to enable us at the Safety Center to keep a better track of trends. If we combine Class Cs and Class Es, these numbers are actually quite steady through the last few years with the exception of the C-5, whose numbers increased slightly this past year. Now on to the meat.

C-141 Starlifter

The C-141 is still plowing along, shouldering a major load of the nation's airlift requirements. While we are looking to phase it out, it just doesn't want to go. The flying hour trend is decreasing, though. This past fiscal year we flew 88,889 hours (estimate), one of the leanest years since the C-141 became worldwide operational and the workhorse of airlift and airdrop. The good news this year is that looking at pure Class C numbers, there were seven compared with 19 last year. However, totaling Class Cs and Es we come up with 14. Still not bad, but off compared to FY97 and FY98 (seven apiece). Class Bs are up to three this past year. This is the highest number of annual Class Bs the C-141 has had dating back over two decades. C-141 data for the last five years is depicted in chart one.

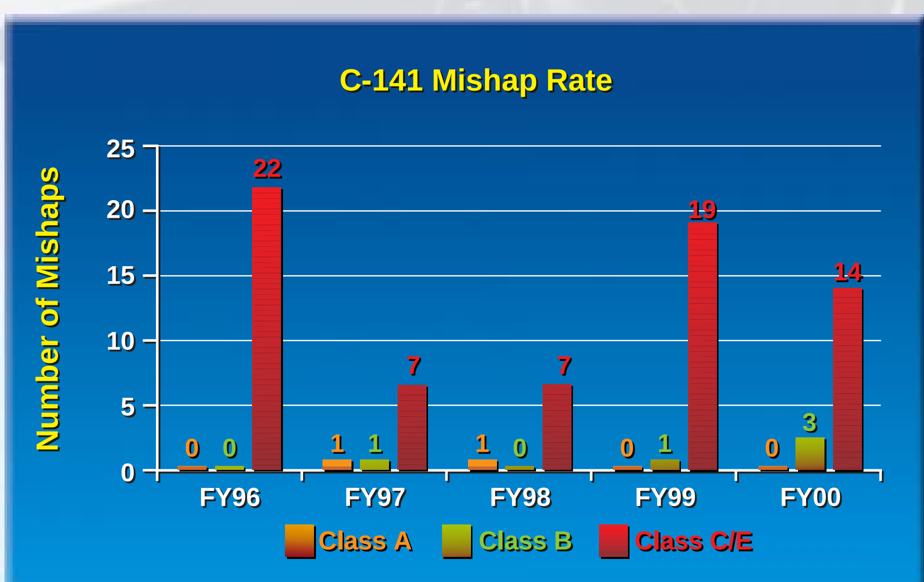


Chart 1

C-141 Trends

Bird strikes continue to be a problem in the C-141, as it is with most other aircraft. The number of reportable bird strikes is down slightly from last year (from seven to five). However, the cost is not. These five bird strikes caused over 1.6 million dollars in damage. In one incident the aircraft was in the local pattern. After rolling out on short final they struck eleven Canadian Geese. The damage was extensive including totally obstructing the view of the pilot flying in the right seat. Bird condition was low at the time. This illustrates the "bird problem" is far from being solved. Crews must still be diligent out there. Continue to be aware that bird strikes can happen any time. See the bird strike discussion at the end of the C-5 section.

This year there has been an increased number of reportable events involving flight controls. While this is most likely because of the Class E requirement, it is nonetheless a potential cause for concern. Two of the these events were uncommanded rudder deflections. One occurred on takeoff, the other while descending from altitude. Other events involved the autopilot inadvertently deflecting the flight controls. Regardless of where the event occurred, any flight control malfunction is a big cause for concern. Crews should continue to report uncommanded flight control movement IAW AFI 91-204 so that we can establish if a trend does indeed exist.

C-141 Operator-Induced Mishaps

There were two operator-caused mishaps that I need to stress. The first involved an aircraft striking a hangar while taxiing. The second incident involved a tail scrape during landing.

What are the lessons learned in the above two incidents? Attention to detail and flight discipline are each factors. Knowing the rules isn't good enough. Adherence to established rules and directives, following established procedures, knowing the right thing to do in a given situation and then actually doing it are all components of flight discipline. Attention to detail is a big component also. Knowing the small stuff can keep you out of something big. Aircrews need to exercise flight discipline at all times when operating an aircraft, whether in flight or on the ground. Bottom line: If you can't exercise a high degree of flight discipline, you have no business operating any aircraft.

C-17 Globemaster III

As the C-17 becomes more prevalent around the airlift world, the hours that it flies continues to climb. We flew 56,652 hours (estimate) this past year. Obviously, as the Air Force acquires more C-17s, they will fly more hours. This past year's totals are the most since the aircraft became operational. The C-17 mishap rate has also continued to increase in the last few years. This is most likely attributed to a combination of two factors: the increased number of operational aircraft and the maturing of the fleet. We've experienced "only" one Class A last year while the Class Bs increased sharply, up to four. As far as the Class C and E rates, the trend the last two years remains steady. One big problem in the C-17 community involves the landing gear. Eliminate these types of mishaps and the Class Bs go down and the Cs decrease by four. C-17 data for the last five years is depicted in chart two.

C-17 Trends

The number one trend in the C-17 community is the quality of the landing gear. Over the past five years there have been numerous failures of landing gear assembly. There have been at least six gear failures this year (two were ground jacking mishaps). Currently, the main problem seems to be centered around post assembly fractures on the main landing gear. These fractures have occurred on both operational and training missions. The landings ranged from normal to assault and all were within aircraft specifications and tolerances. Crews need to be aware that this problem has not been officially solved and that any landing could trigger another fracture of the post assembly. In addition, some of these failures were discovered during pre/post flight inspections. Continue to be diligent in all walkaround duties by paying close attention to the landing gear.

Under the correct conditions, the C-17 is susceptible to a lateral PIO. During the past year, a C-17 encountered a lateral PIO while attempting an assault landing. The aircraft received minor damage to the right wingtip and outboard slat as a result of ground contact. On the mishap sortie, crosswinds were approximately 15 knots. The MA was stable on final approach until approximately 20 feet above the ground when the MA rapidly rolled to 7 degrees left wing down due to an undetermined reason. The pilot attempted to recover, entered a pilot-induced oscilla-

continued on next page

One big problem in the C-17 community involves the landing gear.

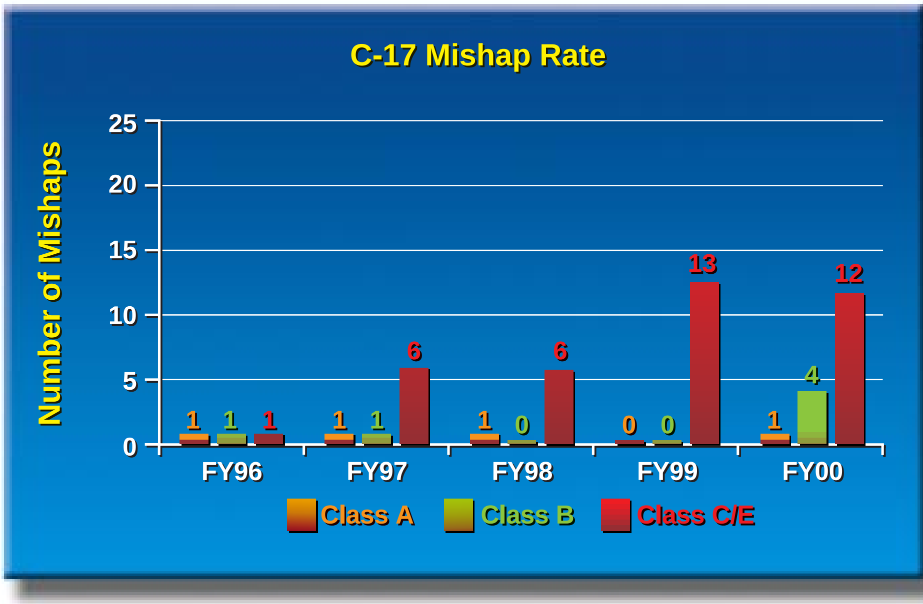


Chart 2

Knowledge of emergency landing gear procedures is essential to good decision-making.

tion, and ended up 13 degrees right wing low where the right wing contacted the runway. The crew executed a go-around. AMC has recognized this is an issue and is working on incorporating PIO procedures into various levels of training.

C-5 Galaxy

The C-5 Galaxy continues to set a good pace for safety. FY00 saw two Class B mishaps, and eight Class C mishaps. There were also seven Class E events and one reported HAP. This is up slightly from the 1999 totals of ten Class C mishaps. During this time, the C-5 flew 56,968 hours (estimate), the lowest flying hour totals since 1988. The airplane is still flying strongly and is projected to fly for decades. With the Avionics Modernization Program (AMP) gearing up to give Freddy a new "glass cockpit," reliability promises to improve. Coupled with the proposals of the Reliability Enhancement and Re-Engining Program (RERP) the C-5 should become more reliable and easier to maintain. Through RERP, a new engine, the GE CF-6-80, rated in the 50,000 lbs. thrust class, has been selected to replace the TF-39. The RERP program is still going through the approval process and will hopefully, be approved this coming spring. C-5 data for the last five years is depicted in chart three.

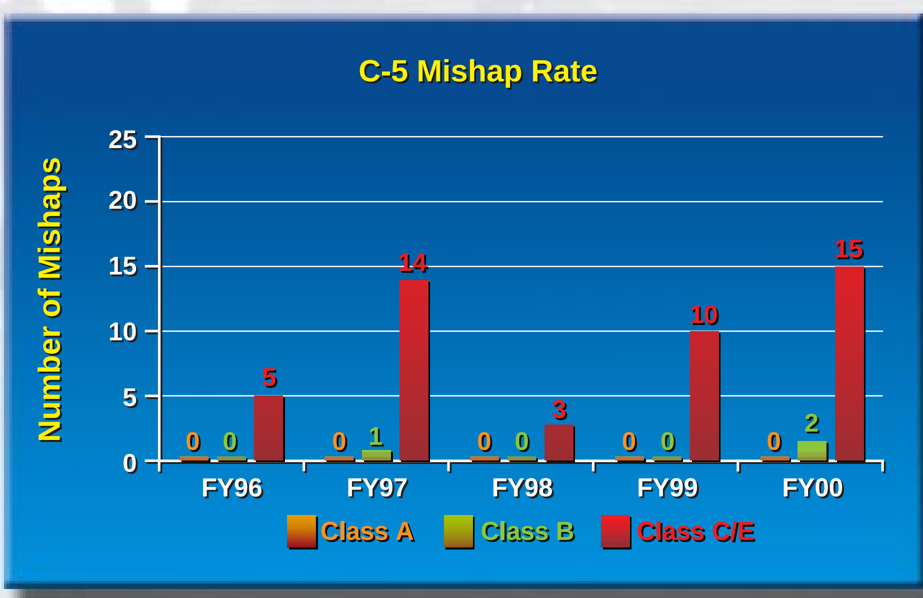


Chart 3

C-5 Class B Mishaps

(1) During a prepositioning mission, a C-5A experienced a landing gear incident where the #4 MLG showed a "red wheels" indication. The crew troubleshot the problem and landed due to low fuel and deteriorating weather. During landing sequence, some of the No. 4 MLG tires blew and the No. 4 MLG sustained damage. Knowledge of emergency landing gear procedures is essential to good decision-making. Aircrews should ensure they are familiar with these procedures and test them in the simulator when possible.

(2) During a test engine run, a screw was ingested through an engine causing substantial damage. The compressor section of the engine received significant damage to the fan blades. As always, FOD prevention is vital. Aircrew and maintenance share equal responsibility in ensuring a FOD-free environment.

(3) During a night sortie, the flight crew received MADAR indications of excessive VIBS on the No. 1 engine. The crew landed immediately and noticed catastrophic failure of several fan blades due to a bird strike. The bird strike occurred during darkness and bird condition "low" periods. For more information, refer to the bird strike section below.

C-5 Trends

One cause for concern over the last year is the area of taxi and towing mishaps. Both the C-5 and the C-141 were involved in these types of mishaps this year. These are "attention to detail" mishaps. Along with current T.O.s, AFOSH STD 91-100 gives details on taxi and towing of aircraft. All flight crews and maintainers involved in taxi and towing of aircraft should be aware of the risks inherent in moving a large aircraft in a congested area. Of particular concern is the concept of "wing growth" when turning the aircraft. This phenomenon is particularly inherent in larger, swept-wing aircraft.

Another trend area is leaking hazardous cargo. Fluids such as battery acid, paint thinner and fuel are far more dangerous once airborne, as lower cabin pressure allows fluids to evaporate more quickly, making the situation even more critical. One of these leaks could have grave consequences should it occur in a remote area or over the ocean. Explosion or breathing problems are possible scenarios with such a leak. Aircrews and Aerial Port personnel must ensure cargo is properly marked and sealed prior to flight. Once again, an ounce of prevention is worth a pound of cure.

Finally, there were three damaging bird strikes in the C-5, along with five in the C-141 and one in the C-17 over the last year. This isn't a significant increase; however, it highlights the need for vigilance. Aircrews need to be especially vigilant during spring and fall migration periods, along migratory flyways (along both the Pacific and Atlantic coasts, as well as along the Mississippi and Missouri River flyways) and during the periods of time near sunrise and sunset. Please use the tools you have available to you. The Air Force now has a Bird Avoidance Model you should access as part of your mission planning. It's available on the web at: http://bam.geoinsight.com/. It is very detailed and shows risk levels by date, time of day and location. More bird avoidance information is available through the HQ Air Force Safety Center BASH website at: http://kirtland.safety.af.mil/AFSC/Bash/home.html along with the annual *Flying Safety* magazine BASH issue (last issue: April 2000).

Conclusion

We must continue to maintain a high safety awareness. Just because we in the strat airlift world enjoy an excellent safety record doesn't mean that the next Class A isn't around the corner. Keep complacency to a minimum, maintain a high level of attention to detail and practice good flight discipline at all times. This may have been the safest year ever for the Air Force, but next year could be the worst. Let's keep up the good work and continue to fly safe. ✈

All flight crews and maintainers involved in taxi and towing of aircraft should be aware of the risks inherent in moving a large aircraft in a congested area.

F-16

MAJ PABLO "CHOLO" SANCHEZ
HQ AFSC/SEFF

With the new Millennium, the Viper community has finally managed to turn the corner on the mishap rate! After three crushing years of compounding our Class A numbers, the year 2000 turned a mishap rate of only 2.63 per 100,000 flight hours; slashing last year's rate by half. Hand-in-hand with the overall Air Force rate, we have had a pretty good year. I will note however, that as we approached the end of August, the Viper was on track to have its best year.

The Air Force experienced nine F-16 Class A mishaps in FY2000 (as opposed to eighteen for FY1999). (I'll give a brief review of the particulars for each.) The more recent mishaps do not have much releasable data since the investigations may not yet be concluded. If you want more detailed information you should visit your local wing safety office to review the privileged messages.

The flight lead's aircraft experienced dual hydraulic failure and subsequently went out of control.

The Class As

The data included here comes from the Accidental Investigation Board results and non-priviledged sortie reports.

• During a two-ship Night Vision Goggle (NVG) upgrade sortie, the wingman was performing a slow-speed visual identification (VID) intercept against his flight lead. The wingman performed a low-to-high intercept with minimal lateral turning room and initiated the conversion turn too early with too much closing velocity. The wingman experienced an extreme loss of situational awareness regarding his spatial relationship with the flight lead and didn't take evasive action until just prior to impact. His right wing impacted and severed the flight lead's left horizontal tail, significantly damaging its hydraulic system. The flight lead's aircraft experienced dual hydraulic failure and subsequently went out of control. The flight lead ejected and parachuted to safety. The wingman's aircraft sustained substantial damage but was able to return to base for a landing.

• The mishap aircraft (MA) was number four of a flight that was briefed as a four-ship formal course air combat tactics (ACT) mission. During the G-Awareness turn, the mishap pilot (MP) noted vibrations and eventually analyzed his problem as a compressor stall. The engine stagnated and the MP attempted three airstarts. After the third attempt, the MP determined he was too low for further actions and ejected from the MA. The mishap engine (ME) had stalled due to domestic object damage (DOD) when a rear compressor inlet guide vane (RCIGV) fractured and proceeded through the high pressure compressor. The engine was damaged further during attempted starts. There were two occasions in the sequence of events where this mishap could have been avoided:

° At the last scheduled depot visit, the ME was disassembled for component inspection. A crack in the RCIGV was not discovered and the ME was reassembled. Over time, the crack propagated and the blade eventually fractured, initiating the mishap.

° The MP selected secondary engine control (SEC) mode while the engine was recovering from the stall. This action overrode the digital electronic engine control (DEEC) logic, causing an over-temperature condition in the high pressure turbine section which severely damaged the engine, making recovery impossible.

• The MA was an F-16DG with two pilots on board. The sortie was planned as a two-ship air intercept NVG sortie. While executing their fifth intercept of the mission, the crew felt a "bang" and noted the engine winding down. Mishap crew called "knock-it-off" and climbed while executing restart procedures. After a second unsuccessful airstart attempt, the pilots ejected safely. One of the first stage fan blades had liberated which resulted in DOD. The fan blade had a manufacturing defect which was addressed by two separate TCTOs dictating inspection. However, due to conflicting interpretation of the TCTOs, the ME "slipped through the crack" and the defect wasn't discovered until after the mishap.

• The MP and MA were operating as part of an Air Force F-16 Demonstration Team. The mishap occurred six minutes into a scripted aerial demonstration in front of an open house/airshow audience. In the sequence leading to the mishap, the MP completed a Double Immelman, then maintained inverted flight for 21 seconds while setting up for a Split-S. The MP's attention became channelized on ground references while correcting to show line. He failed to detect or correct a 12-degree dive angle and maintained a higher-than-normal power setting which placed him in a lower-and-faster-than-normal position for starting the Split-S maneuver. MP selected full aft stick and idle power and didn't recognize his situation until approaching the vertical. MA was destroyed and the MP was fatally injured.

• The mishap flight was a three-ship air combat maneuvering (ACM) B-Course Syllabus ride. During a defensive reaction to the bandit, the MP (wingman) moved the throttle to idle. The MA then experienced a loss of thrust and decreasing RPM. The MP attempted the Critical Action Procedures for engine failure/airstart. The engine didn't restart prior to minimum ejection altitude and MP successfully ejected. MA was destroyed upon ground impact.

• The mishap flight was a surface attack tactics (SAT) sortie for a Maple Flag large force employment mission. Following a post-target, low-altitude threat reaction, the MA struck a mature American white pelican. MA parameters at the time of the occurrence were approximately 2200' AGL and 570 KTAS. The bird penetrated the MA canopy. Bird, canopy, and head-up-display (HUD) debris struck the MP, causing momentary blindness, disorientation and minor injuries. MP ejected and sustained additional injuries from the windblast and the parachute landing fall. MA impacted the ground and was destroyed.

• The mishap sortie was scheduled and flown as a 2 v 2 air-to-air mission. During the last engagement, the number one and number four aircraft collided. One MA was destroyed and the MP was able to eject successfully. The other MA returned to base with structural damage.

• The mishap sortie was scheduled to be a single-ship return flight from a depot-level maintenance center to home station. MA crashed while performing unauthorized low-altitude aerobatics in the vicinity of a relative's farm. MP was fatally injured.

• The MA was on a routine training flight in an over-water range. MP encountered engine problems and ejected successfully.

What Lessons Can We Learn From This Year's Numbers?

Looking at this year's numbers in more depth gives us some thoughts for the next sortie.

Other critters still insist on occupying the same piece of sky with us. Bird strike took out one jet this year and, thankfully, without a fatality. That was not the only strike of the year though. Birds were responsible for no less than half a dozen Class C's. Had their aim been a bit better, they could have turned those events into Class A's.

Motors are still going to fail. Maintenance and Logistics have cooperated to come up with solutions to motor problems. Testament to that fact is that we lost no augmenter sections off the back of F-16s this year! Although only three of the Class A's this year could be attributed in some way to engine material failure, many more engine faults show up as Class C's. The only thing that kept them from becoming Class A's was usually the location where the mishap happened. It's much better to have an engine anomaly on the ground than in the air!

The human is still the weakest link. This year at least seven of the nine Class A's had causes relating directly to human factors. Whether manifested in the pilot at the controls or the technician inspecting the parts, the F-16 community sustains an undue number of mishaps where the human element is found causal. Complacency, Attention Mismanagement, Inadequate Risk Management, Lapses in Discipline or Judgment; these categories leap off the page of mishap reports like bad pennies. They contain phrases which begin with "Pilot failed..." or "Maintenance neglected..." and are uncomfortable to read because they place blame directly on an individual. This is the area where we as individuals can have the greatest impact.

Food For Thought

Today it is more important than ever to be personally vigilant in every aspect of F-16 operations and training. The decline in pilot experience levels at operational units, the shortage of five-level maintenance troops and an ever-aging fleet are all potential contributors to the next mishap. Think about these things next time you crank a wrench or strap on the jet. You may be the last one who can break the chain.

Bird, canopy, and head-up-display (HUD) debris struck the MP causing momentary blindness, disorientation, and minor injuries.

Anatomy of an Aircraft Accident Investigation

MAJ KURT J. SALADANA
CANADIAN AIR FORCE
HQ AFSC/SEFF

So, what does happen after an aircraft crash?

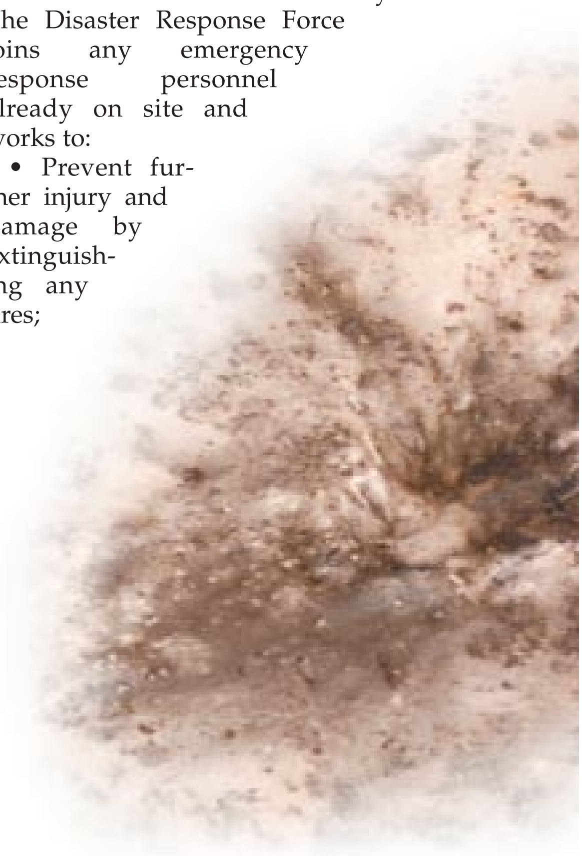
It's a Friday morning about 1000 and you're in an engine bay doing a teardown. The exterior hangar door is open to let the air circulate and take the edge off of the 110-degree ambient temperature. In the distance, you hear sirens. Curious, and ready for a break, you walk outside and look north, towards the direction the sirens seem to be heading. At first you don't see anything. Then, off to the west, you see a black cloud. Two thoughts cross your mind: "I hope nobody got hurt!" and "*Please* don't be an engine I worked on." Seconds later one of your buddies is at the hangar bay door. He confirms an aircraft is down, but doesn't know if the pilot got out or if the aircraft hit anything on the ground.

You go back to work, but it's hard to concentrate. A little while later, your buddy reappears and gives you the news you had been dreading—the pilot didn't survive. However, the aircraft did hit the ground in an uninhabited location, so no one else was injured. The current rumor—the first of many—is that the aircraft lost its engine shortly after takeoff. Your mind races as you think of every engine you worked on in the last few weeks, and you start playing the "What if" game with all of your recent actions. Then, another question forms in your mind: "What happens now?"

Initial Actions

This scenario plays itself out routinely in various iterations throughout the USAF on an annual basis. So, what *does* happen after an aircraft crash? In a case like this one, the control tower is likely the first agency to know about the crash and immediately calls the Command Post (CP), where the Disaster Response Plan would be initiated. In addition to notifying the wing/base commander, the CP notifies firefighters, emergency medical personnel and security forces. At the same time, local air traffic controllers transmit a message alerting all aircraft in the vicinity about the mishap. This not only gives notice to rescue resources who may be able to provide assistance—but also keeps "rubberneckers" out of the way. It isn't all that unusual for a police or media helicopter to be first on the scene and transport the pilot to the closest medical facility.

The Disaster Response Force joins any emergency response personnel already on site and works to:



- Prevent further injury and damage by extinguishing any fires;
- Safe the site by identifying, and removing or neutralizing, hazards like unexploded ordnance, or equipment under pressure or tension; and
- Secure the site against intrusion by media, sightseers or souvenir hunters. This prevents them from hampering the accident investigation or getting hurt.

Upon notification of the accident, units involved will gather and secure training records and aircraft maintenance/servicing records for pilot(s), maintainers and the affected aircraft. Within hours of the accident, the wing/installation commander appoints an Interim Safety Board, whose members' sole responsibility is to preserve evidence for the MAJCOM-appointed "permanent" Safety Investigation Board (SIB). This evidence preservation includes collecting training records and maintenance records, gathering witness statements and obtaining perishable fluid samples. The "fluid samples" include not only oil, hydraulic and fuel samples from the aircraft and associated support and servicing equipment, but also blood and urine samples from the aircrew and anyone who may have worked on the aircraft or its components. This is standard procedure so, as the engine mechanic in this scenario, you shouldn't be surprised if the doctor from the Interim Safety Board calls to arrange for samples.

Safety Investigation Board (SIB) Composition

Within one to three days of the accident, the SIB will arrive and take command of the investigation and crash site. SIB members include:

- A Board President (Colonel or Brigadier General pilot or navigator);
- An Investigating Officer (pilot or navigator who has completed the HQ Air Force Safety Center's [HQ AFSC] Flight Safety Officer or Aircraft Mishap Investigation Courses);
- A HQ AFSC Representative (pilot, navigator or maintenance officer whose primary duty is the investigation of aircraft mishaps);
- A Pilot Member (someone current and qualified on the type of aircraft involved in the mishap);
- A Maintenance Officer;
- A Flight Surgeon;
- A Life Support member, qualified to analyze egress systems and life support equipment; and
- A Recorder, the administrator for the SIB team.

By regulation, the SIB has thirty days to investigate the mishap, determine the cause (or causes) and formulate recommendations to prevent future, similar accidents. By the end of the allotted time, the SIB must also:

- Publish a formal report containing all of the deliberations and substantiating material that led to its conclusions;
- Compose a final message summarizing the formal report; and
- Prepare a briefing for the MAJCOM commander and his/her senior staff, explaining why the mishap occurred, how the SIB reached its conclusions and how the SIB believes the USAF can prevent the same thing from happening again.

Investigating the Accident

The SIB has no preconceptions; therefore, the investigation is thorough in determining what actually happened. In this scenario, the pilot didn't survive the crash, so there is no first-hand account of what happened. The next best source of information is the Crash Survivable Flight Data Recorder (CSFDR) (or cockpit voice recorder, flight data recorder, or similar device) which the news media often refers to as the "black box." However, not all aircraft are equipped with crash-survivable recording devices, they don't always work and, in spite of their name, they don't always survive a crash.

In addition to CSFDR data, the SIB will also obtain recorded data from various sources in the aircraft, which may contain non-volatile memory—electronic data that's kept after the loss of electrical power. Even if this information is available, it provides only certain, limited types of data. Other sources of information could include HUD or on-board radar videotapes (if they survived the crash), recorded communications between the mishap aircraft and Air Traffic Control or other aircraft, and eyewitness testimony. All of this information can help the SIB corroborate and explain what its exami-

continued on next page

A typical crash site is one with an impact point and wreckage strewn out in a "V" pattern in the direction that the aircraft was traveling.

nation of the wreckage revealed.

Even with good testimony and data, the SIB will still examine the wreckage to determine what happened and, more importantly, *why* it happened. A typical crash site is one with an impact point and wreckage strewn out in a "V" pattern in the direction that the aircraft was traveling. The width and length of the "V" depend upon the aircraft's velocity and angle of impact. Usually, unless the aircraft was out of fuel, the site will be heavily scorched and, depending on the crash site, will usually include damage from ground fires. Apart from items that fell off, were intentionally jettisoned or broke off due to a midair collision, all the pieces from the aircraft will be in, or very close to the "V." Few of these pieces will be easily recognizable. They'll be shattered, melted, scorched and in some cases, completely destroyed. That said, even the destroyed pieces will leave some residue. It isn't uncommon for maintainers to be recruited by the SIB to assist with identification of individual pieces of wreckage.

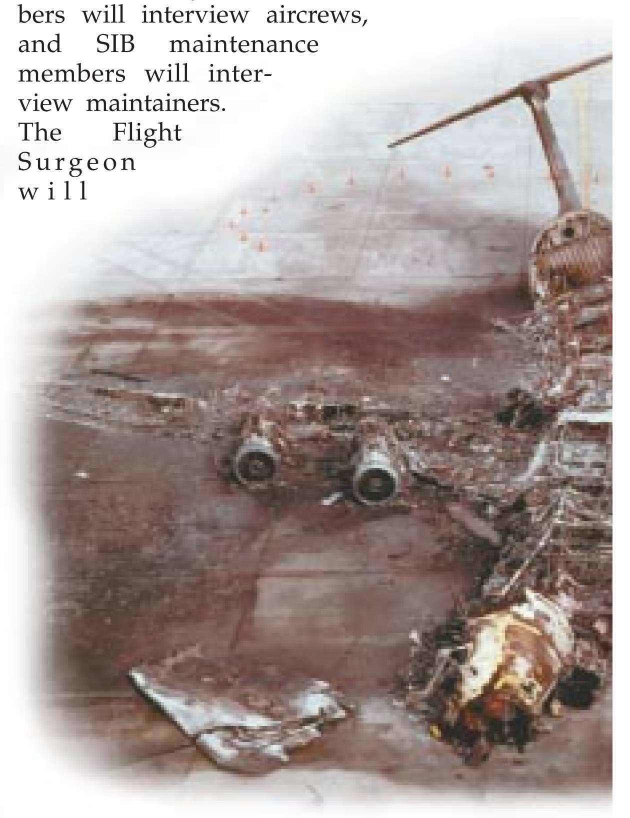
SIBs will normally only reconstruct small areas of interest rather than the entire aircraft.

The SIB will examine all the pieces that could have possibly been involved in the sequence of events that led to the crash. Although SIB members have a high degree of expertise in how the aircraft are maintained and operated, and how pilots and maintainers are trained and employed, they are, in reality, "generalists." That's why an SIB often enlists the aid of numerous specialists. Experts from both the USAF and the manufacturers examine the engine, flight controls and airframe. Egress system specialists will scrutinize the ejection seat, parachute and associated components to ensure they operated as designed. Engine mechanics and life support technicians from the mishap wing routinely assist the SIB with teardown of those components. Cockpit instruments and indicators, circuit breakers, wiring, actuators, control rods, structural members and engine pieces go to laboratories for detailed analysis.

Frequently, SIB members, assigned specialists and local technical assistance will sift the soil at the impact site in search of small springs, screws, nuts and bolts, and other potentially revealing debris. But, by the end of the first week, wreckage has usually been cleaned up and returned to the host wing where it's kept under lock and key and accessible only to the SIB, whose members and technical assistants will continue to search for evidence. Unlike airliner reconstruction, as will sometimes be done in a civil aviation mishap, SIBs will normally only reconstruct small areas of interest rather than the entire aircraft.

Witness Testimony

While waiting for test results and analyses, the SIB spends most of its time interviewing witnesses. It's during this phase that everyone who recently worked on or flew the mishap aircraft will be interviewed. Usually, SIB aircrew members will interview aircrews, and SIB maintenance members will interview maintainers. The Flight Surgeon will interview individuals from all categories, as required.



Many witnesses will be offered confidentiality which means that these statements will be privileged, i.e., these statements will only be used within DoD safety channels for safety purposes. These statements cannot be used against the witness in any disciplinary or adverse administrative action. The only time this doesn't hold true is if the SIB discovers that a witness intentionally provided *false* information (i.e., lied). "Privilege" prevents a supervisor or commander from asking you to talk about the mishap, but it also prohibits you from talking to your buddies or others about your testimony to the SIB.

Reconstructing the Accident

Once the results return from analysis, and are combined with what is known from recorded data and witness testimony, the SIB attempts to determine exactly why the mishap occurred. Frequently, the answer is still unknown and the SIB must search the wreckage in even greater detail. In most cases, specific mechanical malfunctions will either be determined or ruled out—SIBs are *rarely* unable to identify an item that failed. The SIBs most challenging task is most often determining *why* the failure occurred.

Was a part poorly designed, improperly manufactured, incorrectly installed, damaged, poorly maintained, or inadequately inspected? Was the person who inspected, installed or serviced the part properly trained and supervised? Was the pilot properly trained and proficient enough to respond to the emergency? Each SIB asks literally thousands of these questions and many more, dependent upon the circumstances.

Once the SIB has determined the "What" and is trying to discover the "Why," it's normal to have another round of interviews. In our scenario, if a problem was discovered with the engine, as the technician who worked on it, you would be interviewed extensively. Questions would include what you remember about the engine and the day that you worked on it, training, supervision, ops tempo, home life, job satisfaction, and on and on. You would be asked if you remembered anything unusual, or if there were any particular problems, and be given the opportunity to comment on any perceived problem areas with the work on the engine, your shop, the unit, etc. The SIB would also interview people who work with you, your supervisors and, if you're married, might ask to interview your spouse. The SIB realizes this can put a lot of pressure on an individual, and will emphasize that no punitive actions will be taken.

Included in the SIB's final report will be Findings, Causes and Recommendations. Findings are single events or conditions that SIB members believe, based on the weight of evidence, professional knowledge and their judgment, were essential steps in the mishap sequence. Causes are findings that identify deficiencies which, if corrected, eliminated or avoided, would likely have prevented or mitigated damage or injury. Recommendations are feasible solutions related to the causes of the damage, fatalities or injuries in the mishap sequence of events.

In most cases, specific mechanical malfunctions will either be determined or ruled out.

Determining Accident Cause

When an SIB attempts to identify "Cause," it looks for root cause. For instance, in our scenario, the SIB determined that the engine suffered a catastrophic failure, which ruptured a fuel tank and caused an explosion that incapacitated the pilot and prevented his safe ejection. The SIB would ask why the engine failed. If it failed because a fan blade had a catastrophic failure, the SIB would ask why the failure occurred. If it was because of a fatigue crack, why did the crack occur? If the crack occurred because of a poor design, why was the design deficient? If the design was deficient because of technological/computer limitations at the time, then that would be the root cause. The SIB would also ask if there was an opportunity to detect the crack during inspections and, if so, why wasn't it detected? If the reason it wasn't detected was because the inspection took place at 0300 in an inadequately lit area with improper equipment, then this is another "Cause," and it would likely be attributed to a level of supervision.

While assigning "Cause" to a "Finding," the SIB may find an *individual* was causal. When this occurs, the local or unit flight safety officer notifies that person after the final SIB mishap message is released. The individual may then read the message and will have up to 30 days to respond or make comments. In the scenario, let's say that the SIB found you, the engine mechanic, *causal* because you failed to detect the crack during

continued on next page

the inspection. However, you may believe that, under those working conditions and with the equipment provided, the crack was undetectable. In your written response you would detail the reasons why you believe the crack couldn't reasonably have been detected. This information would be forwarded to the HQ AFSC, where it would be considered and further investigated. If your information is substantiated, then the Memorandum of Final Evaluation (MOFE) that concludes all Class A and B Flight mishaps would remove "Cause" from you and likely place it at some level of supervision.

Remember: Even if you or your actions *were* found causal and you can't refute the finding, SIB findings cannot be used for punitive or career-ending actions. Normally, people that make mistakes are informed of their error and receive additional training or retraining. The SIB's ultimate goal is to make solid recommendations that will prevent the same mistake from being made again. It's all about *mishap prevention*.

The purpose of the safety investigation process is to prevent future, similar mishaps.

In addition to an individual named as causal, all recipients of the final SIB mishap message have the right to make comments for the MOFE process, all of which will be considered and, if found credible, investigated. Although SIB recommendations are acted on immediately, the MOFE isn't complete and distributed until 150 days from the date of the mishap. As well as changing "Cause," the MOFE will often add, subtract or change "Findings" and "Recommendations."

Will There Be An Accident Investigation Board (AIB)?

While the SIB conducts its investigation, a second investigation, conducted by an Accident Investigation Board (AIB)—if warranted—may also be investigating. The *accident* investigation is completely separate from the *safety* investigation and is tasked to provide a publicly releasable report of the facts and circumstances surrounding the accident and to collect and preserve evidence for various purposes.

AIB members include, as a minimum, a Board President and a Judge Advocate (an attorney). Additional personnel—whose backgrounds generally mirror those found in SIB members—may be included as AIB members. But take note of this: Nobody from the SIB will "switch hats" and become a member of the AIB. SIBs and AIBs investigating the same accident are made up of two totally different sets of personnel. This is another built-in safeguard to promote mishap prevention and ensure confidentiality. The purpose of an AIB and its formal report is to provide a statement of opinion on the cause of the accident; gather and preserve evidence for claims, litigation, disciplinary and adverse administrative actions; and for all other necessary purposes.

The AIB is given all of the factual information gathered by the SIB, including non-priv-

ileged witness interviews and a list of all witnesses. But the AIB cannot offer promises of confidentiality to witnesses, and USAF military and civilian members must appear when called and testify under oath or affirmation. Witnesses may not refuse to answer questions simply because their answers may adversely affect another person, but they may refuse to answer questions to prevent self-incrimination. AIBs usually arrive at the same conclusions as SIBs, but not always. Their deliberations may run a different course.

Preventing Future Accidents

The purpose of the safety investigation process is to prevent future, similar mishaps. In our original scenario, if the MOFE process determined that the tools and procedures for conducting the blade inspection were inadequate and added a new recommendation to develop a new inspection procedure and provide the correct tools, then a major step has been taken to preclude a similar mishap.

What remains to be done is to implement the recommendation. Neither the SIB nor those of us here at the Air Force Safety Center have the power to ensure that this happens. The decision to follow SIB/MOFE recommendations rests with the MAJCOM responsible for the aircraft/inspection. MAJCOM staffs will run a cost-risk analysis to determine if the recommendation will save lives and money, *or* if the chances of the mishap recurring are so small as to make allocating scarce resources worthwhile. In our scenario, the MAJCOM agrees that changing the inspection will be beneficial and takes the appropriate steps. So, almost a year from the date of the mishap, you see the change to Technical Orders detailing the new procedure.

Implementation of recommendations can occur rapidly if an obvious deficiency is determined at any time during an SIB. In the scenario, if the SIB had determined that the blade inspection process was inadequate, the Board President would have contacted the MAJCOM Chief of Safety, informed him/her of the problem and recommended grounding all of the aircraft affected at the mishap wing until their engines could be inspected using an adequate procedure. The Chief of Safety would inform the MAJCOM commander and the SIB's recommendation would normally be acted upon immediately. However, the commander could decide to modify the recommendation, depending upon real world aircraft taskings. The SIB would also recommend to other MAJCOMs flying the same type of aircraft that they determine if they were using the same inadequate inspection procedures, and to ground their aircraft as required.

The bottom line of the USAF aircraft mishap investigation process is to ensure that there is the maximum amount of aviation assets possible available to contribute to the nation's defense. In other words, flight safety is a force multiplier. Accidents are going to happen, but when they do, we must learn from them and make every effort to prevent their recurrence for the same reasons.

Flight safety is a force multiplier.

USAF Class A Mishaps

FY01 Flight Mishaps (Oct 00 - Nov 00)

4 Class A Mishaps
1 Fatality
4 Aircraft Destroyed

FY00 Flight Mishaps (Oct 99 - Nov 99)

3 Class A Mishaps
0 Fatalities
2 Aircraft Destroyed

04 Oct	♣✶	An RQ-1 Predator UAV crashed while on a routine test mission.
12 Oct	♣	An F-16C crashed during a routine training mission.
23 Oct	♣✶	An RQ-1 Predator UAV went into an uncommanded descent.
03 Nov		An F-15C experienced engine problems on takeoff. The pilot successfully RTB'd. Both engines sustained damage from FOD.
07 Nov	✶	Two F-15s were serviced from a contaminated oil cart. There was engine/accessories damage.
13 Nov	♣♣	There was a midair collision between two F-16CJs. Only one pilot was recovered safely.
16 Nov	♣	An F-16CG on a routine training mission was involved in a midair collision.

- 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 25 Nov 00.**

☆ U.S. GOVERNMENT PRINTING OFFICE 2001-673-404/53002

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.

TSGT ROBERT J. MAIER
TSGT MARTIN ROMERO

419th Fighter Wing Logistics Group
Hill AFB, Utah

On 11 September 1999, TSgt Robert J. Maier and TSgt Martin Romero of the 419th Fighter Wing Logistics Group Pneudraulics shop noted that the wing had experienced two hydraulic leaks in the main landing gear wheel brake assembly of the F-16C Block 30 within two days. Upon further investigation, they discovered the hydraulic leaks were both caused by a premature failure in the brake piston seal. Together, they initiated coordination required to highlight the problem to senior leadership.

It was quickly discovered that the wing had been using brake piston seals which had been previously condemned. Unfortunately, the wing was unable to ascertain with 100 percent certainty that the rest of the F-16 fleet did not have any of the faulty seals installed.

So, they were given the enormous task of inspecting and replacing every brake in the entire fleet for bad seals. Meanwhile, the fleet was grounded until the inspections were complete—the pressure was on. Overall, they inspected 36 brakes (with 6 seals per brake)—for a total of 216 seals replaced—and they completed the entire job in two days time.

Of the 36 brakes inspected, 11 were found with faulty seals. There is no question that TSgt Romero and TSgt Maier were responsible for averting a Class A mishap. Any of those 11 brakes could have failed, spilling hydraulic fluid onto a hot brake, causing a landing gear fire resulting in total aircraft destruction and possible aircrew fatalities. Their hard work, dedication and attention to detail averted what could have been a disastrous situation. Well Done!

FY 2000 was our safest year ever...

Don't rest on your Laurels!