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Flying Safety

U.S. AIR FORCE

50

1947 - 1997

1996 Mishap Report

FY96 SAFETY RETROSPECTIVE

As I reflect back on our safety statistics for FY96, I believe the entire Air Force community, aviators, maintainers, and support personnel alike, should be justifiably proud of their outstanding record. There was a downward trend in almost every category that we track here at the Air Force Safety Center (AFSC), some more dramatic than others. But before I get into the actual numbers, let me reiterate that our goal still is and will always be ZERO mishaps…our people and material resources are just too precious to be satisfied with anything less! While our overall numbers showed marked improvement from last year's statistics, Air Force aviation mishaps claimed 52 lives and ground mishaps another 72 lives, figures that should remind us daily that we are involved in a dangerous business.

Now back to the good news. In the flight safety arena, the Air Force experienced 27 Class A mishaps and 20 destroyed aircraft, the lowest number ever in our history. The Class A mishap rate, based on 100,000 flying hours, stood at 1.25, our second best rate behind the 1.11 rate in FY91 during DESERT SHIELD/DESERT STORM. We incurred 16 fighter-attack Class A's for a mishap rate of 2.16, a significant reduction from our FY95 rate of 2.56. Nearly every MAJCOM contributed to our improved numbers, with all but one either reducing or staying abreast with their FY95 Class A record. My hat's off to AFSPC, AFMC, AFRES, and AFSOC for their mishap-free performance in FY96—a truly outstanding accomplishment!

It was also a banner year in the ground safety realm. While, as I mentioned above, a single fatality is one too many, we did make significant progress in almost every category of ground mishaps. Overall, the Air Force suffered our all-time low of 72 fatalities, as compared to 92 in FY95—a 22 percent reduction.

Brigadier General Orin L. Godsey
Air Force Chief of Safety

As always, our No. 1 killer continued to be motor vehicle mishaps, both four-wheeled and two-wheeled. In FY96, we lost 42 people in privately owned vehicles (POV) and 9 people in motorcycle accidents, both greatly reduced from our FY95 figures of 64 and 15, respectively. While this is certainly a favorable trend, the tragic part is that these fatalities could have been reduced even further had some of our personnel worn their seat belts in POVs and worn protective helmets while riding motorcycles. This is an area that we, as safety professionals and supervisors at every level, must continue to emphasize until we achieve 100 percent compliance. The one category of ground mishaps that showed an adverse trend was in the area of on-duty fatalities, which jumped from 6 in FY95 to 12 in FY96. Obviously, this is another area where we must focus our attention in the coming year.

The Weapons Safety arena was yet another success story; zero space Class A's, zero explosives Class A's, one air-launched missile Class A, and two remotely piloted vehicle (RPV) mishaps. This represented a 50 percent reduction from FY95's record—a remarkable achievement.

Now, having said all this, can we afford to sit back and rest on our laurels? Absolutely not! We must continue to be ever vigilant in our efforts to seek out and identify those telltale signs that are often forerunners to a tragic mishap. Resources will continue to be tight and the pace of operations high…the ideal conditions that breed a "let's cut corners" mentality that increases risks in all Air Force operations. We must not allow that to happen.

As we head into FY97, you will be hearing more and more about Operational Risk Management (ORM) which is a program that will help identify and mitigate or eliminate risks inherent in our everyday operations. We have already begun training classes for MAJCOM personnel and will continue to do so throughout FY97. The beauty of this program is that while the basic principles of ORM remain constant, each MAJCOM, wing, or individual workshop for that matter, can tailor the program to meet their specific mission needs. It can even be used in your off-duty life, such as planning a family vacation! The bottom line is that ORM provides another tool that will help us sustain our forward momentum and drive our mishap rates down even lower. The old adage that "complacency kills" is as true today as ever…we must stay on guard and remain focused.

As we complete our fiftieth year as a separate service, what greater gift could we ask for than the knowledge that our efforts were somehow responsible for saving the life of a fellow airman. ✈

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CONTRIBUTIONS

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

B-1/B-2/B-52

LT COL DAN STANTON
HQ AFSC/SEF

In keeping with a recently implemented Air Force Safety Center tradition, I will be one of many authors writing their first *Flying Safety* article. While our tenure at the center may be short, our enthusiasm and desire to provide quality "safety" services is not. This article will capture the "safety" highlights of the B-1, B-2, and B-52 for FY96 and present a short think-piece concerning OPTEMPO.

I'll begin by saying that "I have some good news and some great news." First, the good news! Despite logging 10 percent more flying hours in FY96 than FY95, the total number of Class A, B, and C bomber (B-1, B-2, and B-52) mishaps dropped significantly (almost 54 percent) from last year. NOTE: All percentages are approximate—I totaled them myself. The great news is the absence of Class A mishaps and only one Class B on the records. Details to follow.

B-1

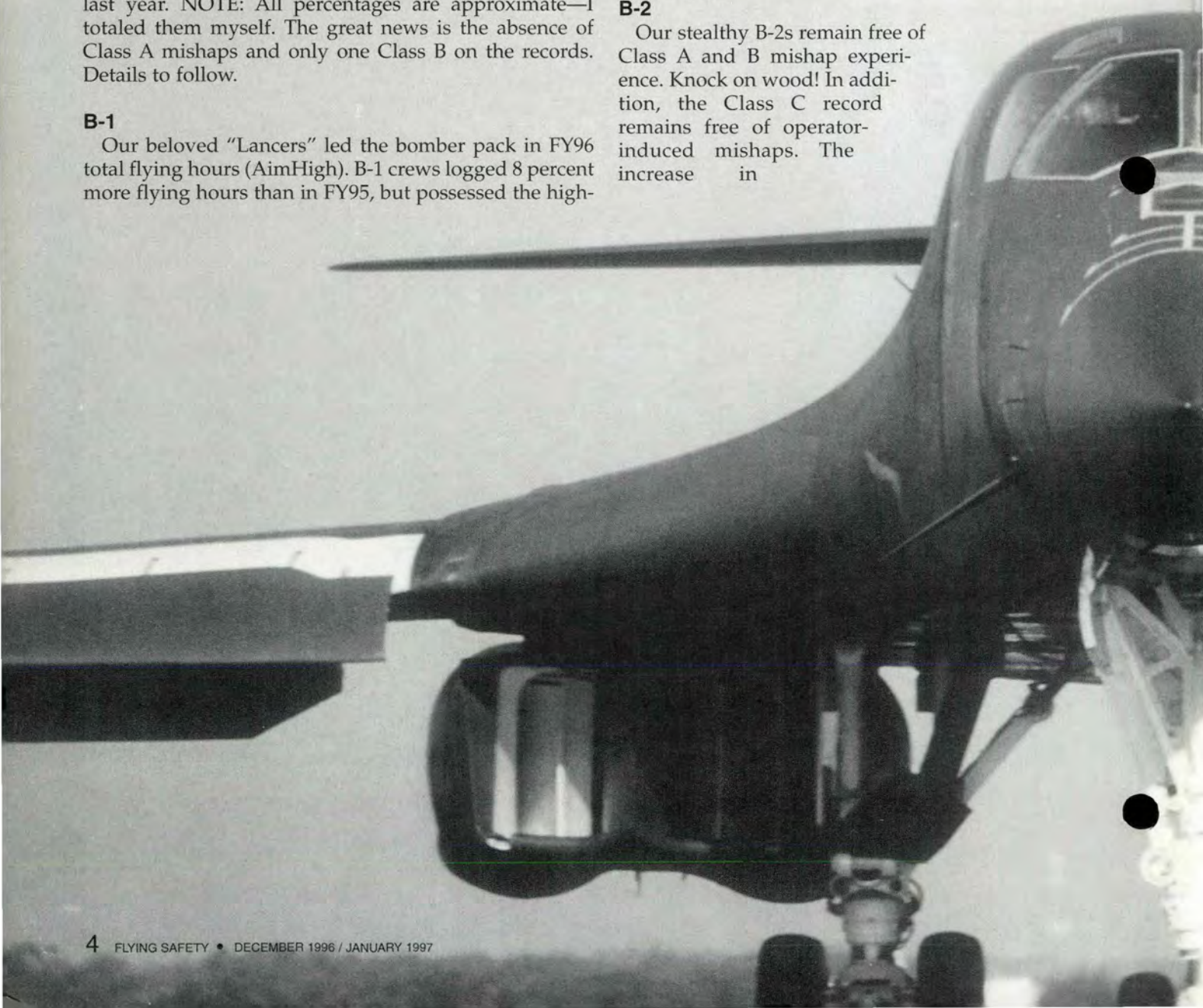
Our beloved "Lancers" led the bomber pack in FY96 total flying hours (AimHigh). B-1 crews logged 8 percent more flying hours than in FY95, but possessed the highest Class B and C rates despite reducing the total number of mishaps by two-thirds. The number of Class B's dropped from 3 to 1, and Class C's fell from 20 to 8.

The single Class B mishap occurred on a training sortie with unqualified student pilots. Airframe vibrations, later attributed to an engine bleed air failure, prompted the crew to abort a low-level training mission and divert to the closest emergency airfield available.

Prior to descent, the crew conducted a controllability check, initiated emergency fuel dumping procedures, addressed several additional caution lights (later associated with the bleed air problem), and began sweeping the wings in anticipation of landing. Approaching the field, the crew extended the landing gear and almost immediately became engaged in arresting an abrupt pitchup of the aircraft. Regaining aircraft control, they executed a wide, arcing turn to final, landed and egressed without incident. Kudos to the crew on a job well done! This flight could easily become the scenario for the "Mother of all B-1 emergency procedures simulators."

B-2

Our stealthy B-2s remain free of Class A and B mishap experience. Knock on wood! In addition, the Class C record remains free of operator-induced mishaps. The increase in



Class C's, four in FY95 and six in FY96, can be partially attributed to the B-2's approximately 50 percent jump in flying hours from last year. The increased air time meant increased exposure to "Mother Nature," the culprit in all six Class C mishaps—four bird strikes and two encounters with lightning.

Target (bird/aircraft) acquisition and avoidance are proving to be a real challenge for the crews and our feathered friends. The first three bird strikes occurred in the vicinity of home station. Maintenance discovered evidence of the first reported bird strike during a postflight inspection. The second bird strike occurred during a touch-and-go after the crew was committed to continuing the takeoff, and the third on a downwind just prior to turning base. The final reported bird strike was experienced 10 minutes after entering a low-level route to conduct terrain-following training. Fortunately, all four mishaps concluded with uneventful landings.

The first reported FY96 Class C lightning strike occurred as the aircraft climbed through 10,000 feet for FL350. The aircrew monitored aircraft systems for abnormal operations and returned to home field. During the postflight inspection, numerous damaged areas were noted near the wingtip area. The second lightning strike occurred in IMC at altitude following a radar malfunction. The crew was attempting to obtain VMC with ATC assistance at the time of the incident. Surface areas in the vicinity of the left and right wingtips received slight to minor damage. Mother Nature—6, B-2—0!

A lot of statistics that add up to a very good B-2 safety card for FY96! As a note, the B-2 "fleet" logged (in FY96) flight time equal to 82 percent of the total accumulated in the previous 6 years. AimHigh!

B-52

It's been "All Quiet on the BUFF Front." The senior citizen of the bomber family reported four Class C (two less than FY95) and no Class B mishaps in FY96. The Class C's included two bird strikes, a practice bomb-airframe strike, and the failure and departure of a turbine blade.

Maintenance discovered evidence of the first bird strike during the postflight inspection after the completion of a normal mission profile. The second strike occurred just after completing a descent as part of terrain avoidance training. The crew observed visible damage to the No. 3 engine and shut it down as a precaution en route to home station. In July, a B-52 received bomb bay and wheel well damage when the crew dropped four BDU-38/B practice bombs during a scheduled low-level bombing run. The turbine failure was discovered during postflight after the crew had shut down the No. 5 engine for excessive throttle vibrations and erratic oil pressure

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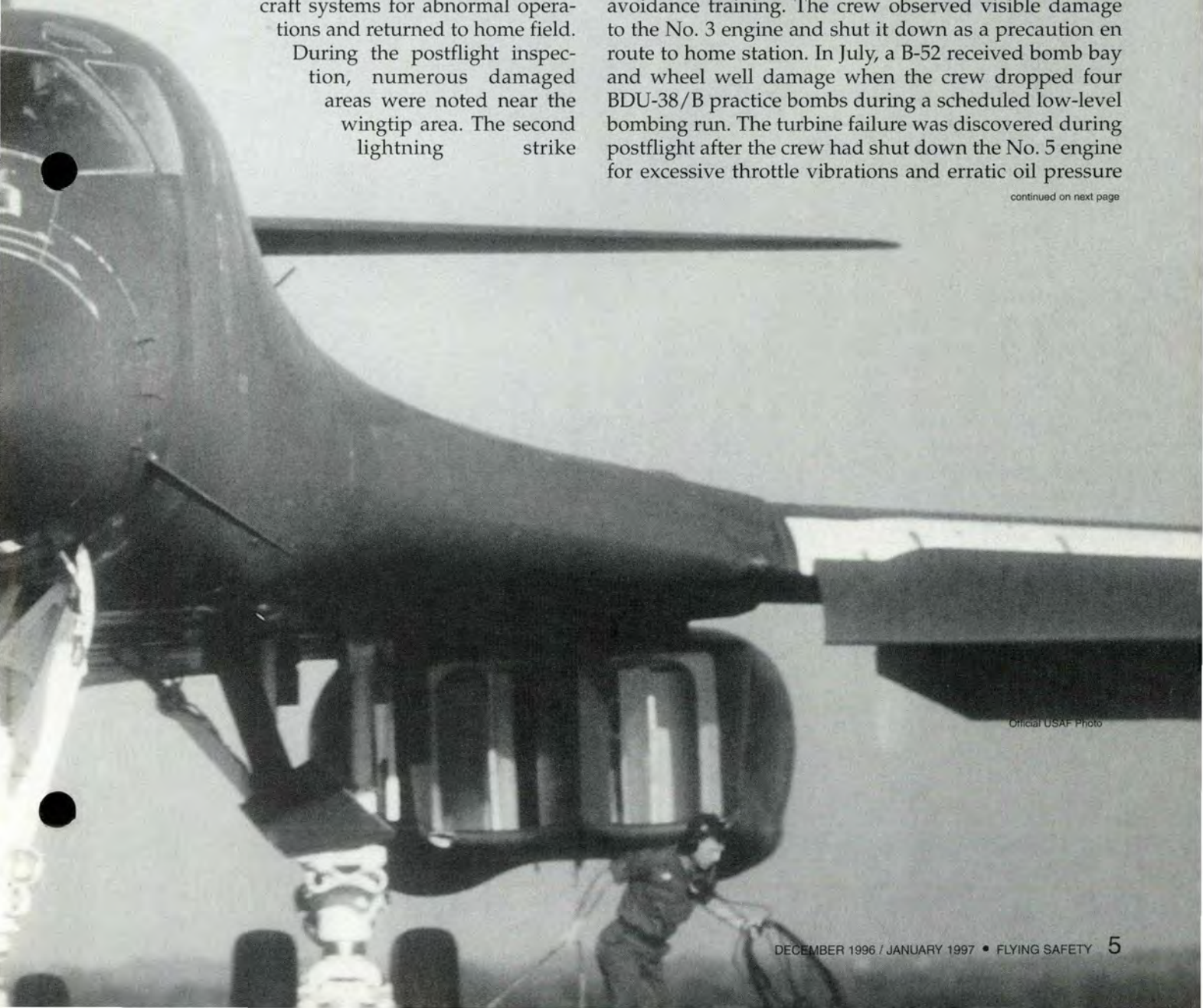

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indications. All in all, a good year for the Stratofortress. It's getting older and getting better!

Overall

A great year to be flying the B-1, B-2, or B-52! The Class A lifetime rate for the "Lancers" dropped from 4.49 in FY95 to 3.94 in FY96. The Class B mishap rate decreased from 4.94 to 4.73. As discussed earlier, the B-2 lifetime Class A or Class B mishap rates are holding steady at "zero." The lifetime Class A and B mishap rates for the BUFF continue to hover at 1.31 and 2.21 respectively. The trends are definitely headed in the appropriate direction. Congratulations! Fly safe and keep up the good work!

OPTEMPO/PERSTEMPO

As food for thought, I would like to take this opportunity to discuss a topic of escalating interest to the U.S. Air Force, especially the Safety Center—OPTEMPO! According to the experts on the Air Staff in Washington, D.C., OPTEMPO (or operations tempo) is defined as a rate of activity and is normally defined as hours per crew per month or sortie rates. It is not to be confused with PERSTEMPO (personnel tempo) which is measured in number of TDY days.

Why am I rambling on about these two issues? Because OPTEMPO and PERSTEMPO are insidious—very much like hypoxia, and they could easily start impacting flight safety in a big way. Current studies show no direct correlation between OPTEMPO/PERSTEMPO and flight mishaps. Not yet!

Today's Air Force is 36 percent smaller than 10 years ago, there are 40 percent less available pilots, but we're busier than ever. The number of Air Force personnel deployed to humanitarian or peacekeeping operations has, at times, more than quadrupled. There's a good chance something is going to give. Fliers aren't the only personnel at risk. Sorties can't be generated without support personnel. One too many 12-hour shifts or one too many 6- or 7-day weeks are forms of OPTEMPO. I like to use the term "grind" to describe the effects of OPTEMPO and PERSTEMPO. They can grind our personnel down until they lose their alertness—their edge. To quote my U.S. Army brethren, "Look for the glazed, 1,000-meter stares."

The encouraging news is senior Air Force leadership and the Joint Staff are working this issue. Air Force personnel should be getting an opportunity to contribute their observations regarding OPTEMPO and PERSTEMPO in the near future — via survey. Be looking for it! Participate in it. It could save your life.

Once again, if you're not looking for the effects of OPTEMPO and PERSTEMPO, you could get bit — REAL BAD! Be alert, be ready, be proactive to the maximum extent possible — especially our commanders and supervisors. And remember General Fogleman's "Knock it off" message. If you need a reminder, check the back cover of the September 1995 issue of *Flying Safety*. Something to think about. ✈

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USAF TRANSPORTS

USAF Photo by SrA Jeffrey Allen

MAJ ED CREECH
HQ AFSC/SEFF

This year we experienced two Class A mishaps in the transport world, one which, unfortunately, resulted in eight fatalities.

Transport aircraft took a hit to bird activity last year. The C-9, C-21, C-130, and C-141 experienced bird strikes with a total cost of $1,049,683. Bird strikes occurred day or night, around runways or in the low-level tactical environment.

C-5

The Galaxy had no Class A or B mishaps in FY96. One incident occurred which shows there is some confusion in the field concerning thrust reverser malfunctions. The aircraft was on final approach to terminate a local night AR training sortie. At about 4 miles from landing with gear down and flaps set for landing, the flight engineer reported the illumination of the No. 3 and No. 4 engine TH-REV-N-LKD (Thrust Reverser Not Locked) light. The pilot flying the aircraft on the instrument approach called for the immediate shutdown on the No. 4 engine in accordance with the Dash One. After the engine was shut down, the crew observed that the No. 4 engine low oil pressure light did not line up with the TH-REV-N-LKD light, meaning they *shut down the wrong engine.* The crew had misidentified the engine because of a recent modification of the engine caution panel and because of inadequate cockpit lighting. Lights were turned up slightly after the night's AR training, but pilot's floods and center panel floods were inoperative. The crew immediately restarted the No. 4 engine and retarded the No. 3 engine (with the thrust reverser indication) to idle for the landing. The aircraft was recovered safely.

In another incident, a C-5 on the final leg of a lengthy mission at FL 340 experienced a BLEED DUCT HOT light. The crew isolated the wing with the appropriate checklist, but the light did not extinguish. With the left AC pack shut down, the aircraft cabin altitude

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USAF Photo by SSgt Andrew N. Dunaway, II

With the emphasis now on crew resource management, we should all have an appreciation for the job each of us does. To leave someone out of the loop when you feel uncomfortable about a situation could be fatal.

rose from 8,000 feet to about 12,000 feet. Only about 40 percent of the cabin oxygen masks deployed. The crew decided to descend to FL 190 and then to FL 250 to conserve fuel. Unfortunately, a malfunction in the oxygen supply system caused the oxygen to deplete. The pilot descended to 10,000 feet for the rest of the leg and landed safely with an uncomfortably low amount of fuel.

C-9A

The Nightingale had another excellent year with only two Class C's to report—a shut-down engine for low oil pressure and FOD damage to a nose cowling.

C-17

The Globemaster 3 continued to provide excellent airlift support in the world hotspots. There were four incidents reported in FY96—some involving ice injection. The first C-17 Class A mishap occurred during a night Joint Airborne/Air Transportability Train-ing Exercise (JA/ATT) when crewmembers were unable to sever an extraction line connected to a hung 10,000-pound load. When the load finally broke loose, it imbedded itself into the aft ramp and doors, doing $1.9 million in damage in the process. Luckily, the aircraft was large enough to handle the CG shift, and there were no injuries.

There was one Class B mishap. The aircraft was in precontact behind a KC-135 in heavy weather and icing conditions when thick smoke poured from the electrical system control panel. The crew donned oxygen masks and goggles and diverted. After touchdown, some spoilers were inoperative, and landing distance was increased. The crew taxied clear of the runway and egressed safely.

C-21

The Learjet made it through the year without a Class A or Class B mishap. However, 13 Class C's in 1996 almost doubled 1995's total of 7. Like last year, approximately half (six) of the C-21s Class C's were engine problems with bird strikes accounting for three.

C-130

The Herc had another tragic Class A mishap this year. It seems a new chapter in *Ways That Can Bring Down a Herc* book gets written each year. Speaking of "new" problems—the only Class B occurred when a Herc was landed in 17.3 degrees of left bank and, not surprisingly, suffered wing and propeller damage. Despite 30 years of Air Force flying, it looks like another C-130 safety supplement will be published to ensure

pilots don't go over the max bank angle when landing.

Of the remaining 36 Class C's and HAPs, eight involved engine shutdowns or flameouts without any notable trend. There were six bird strikes, one lightning strike, and one aircraft had hail damage. Two aircraft were damaged when they departed the runway, and one aircraft blew a tire. Interestingly, there were no FOD damage reports compared to 3 in FY95, 15 in FY94, and 16 in FY93. And by the way, for the first time in 4 years, there was no deer strike.

C-141

The Starlifter fleet exceeded 10 million hours in FY96, and the aircraft provided the bulk of airlift operations support worldwide. No Class A or B mishaps occurred. There were eight reported incidents of bird strikes, doing $258,112 in damage. Most bird strikes occurred during Airland operations during takeoff and landing. Approximately 40 percent happened during airdrop/low level operations. Bird strikes were evenly split between day and night.

Two aerial refueling (AR) incidents occurred which emphasizes the fact that complacency and lack of attention can be hazardous. A C-141 was refueling behind a KC-135 on a local training sortie when the IP allowed his aircraft to move forward and low in the envelope. The boom operator called for a breakaway. In the process, the boom became bound in the Universal Aerial Refueling Receptacle Slipway Installation (UARRSI) and an inadvertent brute force disconnect occurred causing structural damage to the receptacle housing. During the second AR incident, personnel not in seat belts were injured when they were required to break away from the tanker.

Final Words

Most preventable mishaps which occurred in FY96 were due to lack of communication or coordination between crew positions in the aircraft. With the emphasis now on crew resource management, we should all have an appreciation for the job each of us does. To leave someone out of the loop when you feel uncomfortable about a situation could be fatal. Pilots need to remember that in a transport aircraft, there is seldom an emergency situation that requires immediate action. Step back, get another person to help. That's why fighters fly in flights and we have a crew. Support each other to accomplish the mission safely. ✈

Most preventable mishaps which occurred in FY96 were due to lack of communication or coordination between crew positions in the aircraft.

USAF Photo by SSgt Andrew N. Dunaway, II

KC-135 / KC-10

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MAJ LEE ALEXANDER
HQ AFSC/SEFF

KC-135

Before we get started here, how about a little historical perspective? The KC-135, since its inception in 1957, has flown 11,125,768 hours—give or take a few thousand. *Eleven million* flight hours! That's a mind-boggling figure. In that time, the -135 has experienced a total of 77 Class A mishaps and 116 Class B mishaps. That yields a lifetime Class A rate of 0.69 mishaps per 100,000 hours. Not bad! That, however, is not the whole story.

In the first 10 years of operational use, the KC-135 averaged 3.4 Class A mishaps per year. In 1968 alone, there were six Class A's! We've been doing a lot better lately, though. Compared to a lifetime rate of 0.69, the Class A rate for the past 10 years has been 0.36, and the rate for the last 5 years is 0.16. So the trend is good. Long live the trend!

Getting back to current events, the KC-135 experienced no Class A mishaps in FY96. There were 35 reportable mishaps that break down into 16 Class C's, 8 HAPs (High Accident Potential), and 11 other mishaps. Of the Class C and HAP mishaps, there were 9 ops related, 11 logistics related, and 4 other undetermined. A quick scan of the past 2 years' mishaps shows some similarities but not necessarily trends. There were several bird strikes, damaged acoustical panels, and pilots who are still occasionally dragging engine pods on the runway during crosswind landings. What I did notice was the majority of the ops-related mishaps occurred during refueling. Here's the short version of a couple of the more noteworthy mishaps.

Midair. The mishap sortie was a night mission with a large number of fighter-type receivers. At several times during the mission, the tanker pilot had to direct the receivers on the wing to move out a little bit. Several receivers flew a straight line from the precontact position to the wing position without dropping back first.

One particular two-ship finished their training and asked for a couple of contacts for the IP in the backseat of the lead aircraft. Once this was completed, he was cleared to the left wing with his wingman. The mishap aircraft attempted to rejoin between his wingman and the wingtip of the tanker. The wingtip vortices of the tanker drew the mishap aircraft toward the tanker. When the receiver pilot realized he was too close to the tanker, he abruptly rolled away. The side of his fuselage struck the wingtip of the tanker, and when he rolled, his wing tank tore through the trailing edge of the 135's

wing. Both jets landed safely with a surprisingly small amount of damage. But let's face it—this was a *very* close call.

Third Time's a Charm. This mishap occurred during drogue refueling. The last receiver of a large package had a student pilot at the controls with an IP in the backseat. This student was on his initial refueling sortie and had never seen a tanker before. He was unable to get a contact on his first two tries, but he made up for it on his third attempt. He approached the drogue with excessive closure and achieved a contact. The aircraft traveled from full hose length to half hose length in less than 2 seconds before the receiver IP intervened. Idle, boards, and dive at the ground. That's some intervention! The hose and drogue assembly were torn off and left dangling by the wire webbing. This all happened too fast for any calls to be made. Needless to say, the drogue sustained a bit more damage on landing.

"Back Four..." The mishap aircraft's crew consisted of an instructor pilot, and evaluator pilot, and an unqualified copilot getting a check ride. The receiver crew consisted of an instructor pilot, a mission-qualified pilot, and an unqualified pilot who was in a re-qual program. The instructor and unqualified pilot were in the seat of the receiver aircraft. Everything was going fine until the first contact.

The closure to contact was smooth and controlled, but the receiver continued to slide forward in the envelope. The boom operator called "back three" on AR primary, but got no reply. The receiver pilot had made a power reduction by now, but his aircraft continued to slide forward. The receiver IP told the mishap pilot "approaching inner limit" at about the same time the boom operator said "back four...back five...breakaway!" The receiver never heard any calls from the boomer except breakaway and had already initiated their own breakaway at this point. The situation was exacerbated by the tanker's autopilot disconnecting with an associated pitch-down followed by a violent pitch-up during the breakaway. The receiver crushed the ice shield on the boom, causing significant damage. Both aircraft landed safely.

When I looked back 2 years, I saw a lot of mishaps similar to those described above. Most of the air refueling mishaps involved training, either for the tanker crew or the receiver, and several of these mishaps occurred at night. There were very few air refueling mishaps during operations missions. This surprised me because there is a lot of operational refueling going on under some pretty austere conditions. So maybe I'm belaboring the obvious, but refueling is an inherently risky portion of the mission. If you have a student tanker pilot, a student boomer, and a student receiver pilot and it's at night or at the end of a long duty day, you have a *high risk situation.* Now, we can't stop training, but we can manage how we do it. At the very least, the aircraft commanders should be aware of the risk factors involved and when mission changes cause them to multiply.

KC-10

Since its introduction in 1981, the KC-10 has flown approximately 588,000 hours and experienced four Class A mishaps and five Class B mishaps. This gives an overall Class A rate of 0.68 and Class B rate of 0.85. That's the good news. The bad news is two of the four total Class A mishaps for the KC-10 occurred in FY96. This gives us a Class A rate of about 3.65 for the year. There were no KC-10 Class B mishaps in FY96. This definitely represents a spike in KC-10 mishaps, but the overall numbers for the aircraft remain good. For example, there have been no fatalities or destroyed aircraft in the history of the KC-10 fleet. Most of the Class A and B mishaps involved engines and met or exceeded the dollar cost requiring a formal report. FY96 was no exception.

No. 2 Engine FOD. The first Class A of the year involved an aircraft that was parked overnight during a severe snowstorm. The aircraft was placed in a hangar, but due to the height of the tail, the aft portion of the fuselage was exposed to the elements. The engine inlet covers were in place, but during the storm, precipitation was blown in the aft portion of the No. 2 engine, through the fan section, where it melted and refroze in the intake. The next morning, the crew and ground personnel were careful to de-ice the aft section of the aircraft prior to flight, but since the aircraft had been in the hangar with engine inlet covers in place, the No. 2 engine intake was not thoroughly inspected.

The large block of ice that was at the bottom of the No. 2 intake managed to stay in place until takeoff power was applied. At this point, the crew felt vibrations through the entire aircraft, saw the No. 2 thrust reverser unlock light, and No. 2 RPM at zero. The crew initiated a low-speed abort, shut down the engine, and egressed the aircraft. When the engine ingested this block of ice, it caused a catastrophic failure of the No. 2 engine fan disk, and liberated fan blades caused significant additional structural damage to the aircraft.

No. 2 Engine Fire. This next mishap took a little longer to develop. The mishap aircraft was scheduled for several long overwater flights supporting a fighter deployment/redeployment. On both of the first two legs of this mission, the oil quantity of the No. 2 engine dropped excessively on takeoff and climbout. Each time the oil quantity recovered to normal when the power was reduced after level off. The crew wrote it up in the 781 each time, and maintenance personnel said this was normal engine "gulping." This is a situation where the engine oil pump can't keep up with demand during high power settings which results in a low quantity indication that recovers during level off and power reduction. After the second leg, the oil quantity transmitter and cannon plug were replaced. Oil consumption was normal for both flights.

On the third leg of this misadventure, the No. 2 oil quantity dropped to zero on climbout. After level off, the quantity began to rise but did not fully recover. Oil

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temperature was slightly higher and pressure lower than the other two engines. Eventually, the oil pressure began to fluctuate, and when it fell below 15 psi, the crew elected to shut down the engine and divert to a nearby Air Force base.

After landing, a ground crewmember opened the fan cowl doors from the "patio area" and looked for leaks. He couldn't find any leaks, but the oil tank was empty. The thrust reverser and core cowl doors were not opened because they could not be reached from the patio area.

After consulting with home base, it was decided to change the lube and scavenge pump on the No. 2 engine and perform an oil consumption run. A specialist was sent to change the pump. After installation, he serviced the aircraft with 23 quarts of oil. An engine run at idle showed proper pump operation with no leaks. After the engine run, another 3 quarts of oil were added. The specialist didn't accomplish an oil consumption run because he'd been told to change only the pump. At this time, no one had opened the engine core cowling to find where all that oil had gone.

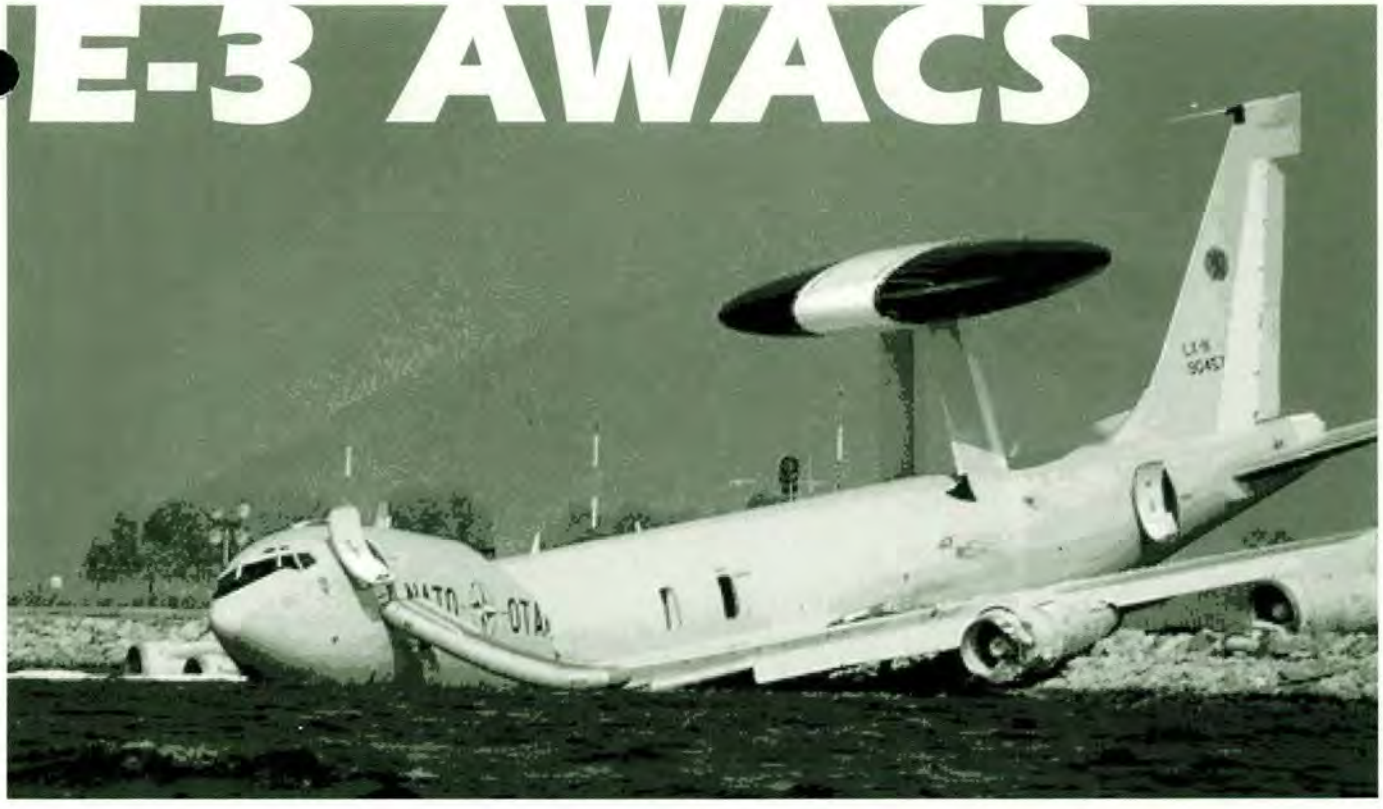
USAF Photo by SSgt Greg Sukay

Now we're on the fourth sortie, and the engine's decided it's given all the clues it's going to give and now it's time to really hit 'em over the head with a two-by-four. Oil quantity on climbout dropped to zero for the third time, and pressure began to decrease. The crew decided to shut down the No. 2 engine. While shutting down the engine, the fire light illuminated. The crew performed the correct procedures for engine fire, discharged both bottles, and diverted back to the departure base. Postflight inspection revealed no oil in the No. 2 tank—evidence of external oil leaks. And upon opening the thrust reverser and core cowl doors, large amounts of leaking oil and massive fire damage was noted.

The short story on the root cause was an overtorqued 4R vent air seal retainer nut inside the No. 2 engine sump. This retainer nut became progressively loose over several flights. This allowed high pressure, high temperature compressor air into the sump, forcing oil away from the scavenge line and out the air/oil seals in the back of the sump. This oil eventually drained into the lower thrust reverser cowl area. When the nut finally backed all the way off, a rotating air seal contacted a stationary part of the oil sump, and the friction was sufficient to ignite the oil vapors in the sump. This fire burned through the oil sump and into the engine bay area, causing the fire indications.

After reviewing these two mishaps and the other seven Class A and B mishaps in the KC-10 history, a few things kind of jump out at me. Of these nine mishaps, seven involved the No. 2 engine. Five of these involved FOD from one source or another, and three, possibly four, could have been prevented by a more complete maintenance inspection of the engine. Granted, the KC-10 is the only aircraft I know that requires helicopter support for scheduled maintenance, and finding a high lift device at some small base in a foreign country may be difficult or impossible, but if you are a KC-10 operator or maintainer, it seems to me you have to ask yourself one question: Am I giving adequate scrutiny and attention to detail to No. 2? There's only one right answer. ✈

E-3 AWACS



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HQ AFSC/SEFF

The E-3 fleet experienced no Class A or B mishaps in FY96 and only a handful of Class C mishaps. Okay, so why am I writing this? Because the USAF E-3 community did experience a rather traumatic Class A mishap at the end of FY95 that was not addressed in last year's article, and a non-USAF AWACS had a Class A mishap this year that was at least partially, and probably directly, related to the USAF mishap. So when a weapon system that has been in operation since 1977, and is currently being flown by four nations plus a NATO component, experiences its first and second Class A mishaps in a period of less than 12 months, I think it merits a bit of discussion. But first let's cover the AWACS mishap history.

The USAF E-3 has been flying since 1977. (These numbers are for USAF E-3s only.) They have accumulated a total of approximately 473,000 flying hours. This seems like a small figure, but remember we're talking about a fleet of 34 aircraft (now down to 33). In this time, the AWACS has experienced one Class A and two Class B mishaps for an overall rate of 0.21 and 0.42 respectively. The single Class A mishap resulted in a destroyed aircraft and 24 fatalities. Let's talk about this particular mishap in a little more detail.

U.S. E-3B Class A Mishap

The mishap aircraft was scheduled for an early morning (near sunrise) training mission. During the takeoff roll at rotate speed, two crewmembers commented on "all the birds" as a flock of approximately 100 Canada geese flew across the runway. As the mishap aircraft rotated, it struck several of the geese, damaging the Nos. 1 and 2 engines. The No. 1 engine lost 50 to 70 percent of takeoff thrust, and the No. 2 engine had a catastrophic uncontained fan failure with total power loss. At this point, in the opinion of the AFI 51-503 (legal) board president (and a lot of other people), the aircraft was unrecoverable.

The crew displayed excellent airmanship and CRM throughout the mishap sequence. The engineer told the crew they had lost two engines and began dumping fuel. The aircraft commander called for the rudder to override, and the navigator, seeing both pilots were rather busy, put the rudder in override. The pilot was trying as hard as he could to fly an unflyable jet. It didn't help that they were flying into rising terrain. With full right rudder and aileron, the mishap aircraft was in a slow left turn and impacted the ground left wing low, flipped inverted, and broke apart. There were no survivors. The AFI 51-503 investigation centered around not what brought the plane down (that was pretty obvious!) but how so many birds got near the runway without someone taking action.

This base had a large population of migratory Canada geese that had been growing over the years. Experts estimated the base had a population of 2,700 geese in 1995. Several witnesses who were visiting this base stated they had never been on a base with so many birds. On the day prior to the mishap, nearly 900 geese were feed-

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ing in fields immediately adjacent to the runways. Some of these birds had begun roosting on the runway infield. AFR 127-15, Bird Aircraft Strike Hazard Reduction Program, describes this condition as "an immediate safety hazard." A systematic failure of the BASH program allowed these birds to remain on the airfield.

The first problem was, in spite of a large migratory bird population, the only recorded incident at this base involving a bird strike with Canada geese was in 1993. People became accustomed to large numbers of geese on and around the airfield.

The second problem was the wing had a good BASH plan on paper, but it wasn't being aggressively implemented. The Bird Hazard Working Group did not have a specific plan to deal with the annual migration problem. Airfield management had made efforts to disperse the geese several times in the 2 weeks prior to the mishap, but the occasional dispersal did not deter them from roosting on the infield. It is also well documented that these birds will leave their roost near sunrise and return around sunset, making these times particularly hazardous. If the geese could not be dispersed, then 127-15 makes it pretty clear that large flocks of birds on the infield warrants a Severe Bird Condition. If Airfield Management, the SOF, or Wing Safety had made this call, then flying operations would have been restricted.

Official USAF Photo

Finally, a C-130 took off about 2 minutes before the E-3 and scared up a large flock of geese. Fortunately, these birds turned away from the runway, not toward it. The tower controller saw these birds flush behind the C-130 and did not inform the E-3 crew.

Non-U.S. E-3 in Europe

The mishap aircraft was deployed to a forward operating base flying operational surveillance missions. During takeoff roll, the aircraft encountered more than one flock of birds. When the last flock of birds crossed in front of the mishap aircraft, the aircraft commander decided he'd had enough and called for an abort. Unfortunately, the mishap aircraft was well past V1 (decision speed) and near rotate speed. This particular runway also had a very short overrun followed by a rock jetty extending into the Mediterranean Sea. The aircraft slid approximately 500 feet down the jetty, sheared off the gear, ripped open the center wing fuel tank, broke the fuselage aft of the flight deck, and came to rest partially in the water. The crew egressed safely with only one minor injury.

These people were *very* lucky. The crash crews began rolling before the aircraft departed the runway. The jet was loaded with 140,000 pounds of fuel, and when the center tank was breached, fuel was spilled all over the jetty and the water. Several small fires broke out after the plane came to rest, but the jetty was too narrow for the fire trucks, and the jet was too far away for hoses or the truck-mounted water cannon to reach. Several firemen grabbed hand-held extinguishers, ran down the jetty, and put out the fires before the crew had even egressed. The aircraft was totaled, but let's face it, it could have been a lot worse.

These two mishaps seem very similar. Both were early morning launches, and both occurred in areas with known bird problems. The biggest difference was the second aircraft had four good engines when it aborted. The first mishap was highly publicized in the AWACS community, and it was emphasized that the crew could not have saved the aircraft. We can't know how much the first mishap influenced the second pilot's decision to abort well above refusal speed, but I bet it was on his mind.

Birds and airplanes have been bumping heads since the Wright brothers started flying. The Air Force has spent lots of time and money to study methods of reducing the risk of bird strikes. It is *not normal* to have a lot of birds around a runway. If you notice an increase in bird activity on or around your airfield, *tell someone!* We have regulations, experts, and BASH plans at every flying unit, but none of this works if it isn't used. If you have some questions about your BASH plan or how best to implement it, we have experts here at the Safety Center who can help. ✈

HELICOPTER MISHAPS

LT COL JAMES C. JOHNSON
HQ AFSC/SEFF

The end of the year again, and for the third straight year, a new helicopter safety officer is at the controls. Lt Col Doug Tracy left for Holloman AFB, New Mexico (can't get the guy out of NM) and tag, I'm it. I'm here to be your advocate for flight safety, and I consider all of you my "first customer of the day."

The helicopter world had a good year safety-wise in FY96. Good—meaning we didn't have any fatalities. We did, however, suffer two Class A mishaps. Although it's said any landing you can walk away from is a good one, one H-1 and one MH-53 were destroyed when they contacted the ground a bit too hard. Both mishaps happened during clear and a million, day VFR conditions which again should stress to all that takeoff and landing are still the most dangerous phases of flight. I keep stressing the day VFR because we do fly so much at night on goggles that sometimes good old day VFR seems too easy, and we can become complacent.

Now for the inevitable statistics you knew were coming!

UH-1N

The Huey came into the Air Force inventory in 1959, and since that time we've had 51 Class A's which destroyed 37 helos and killed 21 crewmembers. The Huey has flown almost 1.5 million hours which figures out to an overall Class A rate of 3.42/100,000 hours.

The aforementioned H-1 Class A mishap happened during a practice autorotation with an IP at the controls. Day VFR strikes again! Everyone walked away from the mishap with only minor injuries, which is a testimonial to the toughness of the Huey. The FY96 Class A rate is 4.74 as compared to the FY95 rate of 4.55.

MH-53

The H-53 has been in the inventory since 1966, and there have been 26 Class A's, 19 destroyed aircraft, and 24 aircrew fatalities. The H-53 has flown over 388,000 hours for an overall Class A rate of 6.70/100,000 hours.

USAF Photo by SrA Jeffrey Allen

We had one Class A mishap which again occurred in day VFR conditions. The aircraft landed hard after a tactical approach to a remote site, destroying the aircraft. No one was badly injured. Helicopters are pretty tough birds! The FY96 Class A rate was 7.88 compared to 8.77 in FY95.

MH/HH-60

The H-60's did not have a Class A mishap in FY96. Congratulations to all of the operators and maintainers! We did, however, damage three FLIR balls during landings.

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The FLIR costs over $1 million, so the potential for a Class A is a reality. It is impractical to relocate the FLIR on the aircraft, so be careful when landing in remote sites. Remember, there is only about 11.5 inches between the FLIR and the **LEVEL** ground.

The ANG and AFRES both had mishap-free years. With the increase in their OPTEMPO, this is a significant accomplishment. Both ACC and PACAF have asked for increased support from the Guard and Reserves, and they have bellied up to the bar, professionally and safely. I know the MAJCOMs will again be asking for support, so keep up the safe flying in the Reserve Component (RC).

The mishap rates appear high when compared to the rest of the Air Force, but we have far fewer helicopters, flying fewer hours, and just one mishap will cause a higher rate.

Official USAF Photo

Speaking of OP and PERSTEMPO, they are on the increase. With ACC picking up the rescue commitment in Operation Provide Comfort II (OPC II) full time in FY97/3, the TDY rates will again begin to climb on both the active duty and RC sides of the house. The good news is that we're needed. The bad news is that there are so few assets that in order to meet the commitments we have to work harder.

The Air Force is working the OP/PERSTEMPO issue from the Pentagon down to the SQ/CC level, but you, the individual crewmembers, are the bottom line. Each and every person must be aware of the effects of the increased tempo and use the best judgment on each and every flight. This awareness might be as simple as calling for "knock it off" a little earlier than normal or just an old-fashioned "Why are we doing this?" type of question.

Crew coordination is even more critical as tempos increase. Remember, it doesn't crash in compartments, so keep your SA tuned up to the highest levels at all times. Don't be afraid to go to squadron supervision and let them know if the pressure is getting to the point where people are pressing safety, or anything else, to "get the job done." Set your personal limits, and stick to them.

For the RC, the increase in tempo doesn't necessarily mean an increase in proficiency for anyone. It might mean just the opposite for both the part-timers and the full-time technicians tasked with making the unit operate on a day-to-day basis. Fatigue is insidious, and people who are putting in a lot of hours might not even know they've been affected by the increase in tempo.

If you noticed the lack of the words "Operational Risk Management" (ORM), you're right. However, the whole last section was nothing but ORM if you read between the lines.

Flying is inherently dangerous, but a professional crewmember knows the regulations, the aircraft, the situation, the crew, and acts accordingly. Each and every one of you is a *risk manager* because you make the decisions affecting the safety of each flight. Don't let "day VFR" lull you into complacency. Just because you go to a certain low-level area near the home drome all the time doesn't make it any less dangerous than an unfamiliar area. Remember, prior planning prevents "you know what" performance.

By the time you're task saturated, it's a little late to wish you'd read the approach plate or had done a better job of chumming the map back in the flight planning room. The good risk management habits you build on a day-to-day basis will see you through the "there I was, out of airspeed, altitude, and ideas" pressure situation.

Remember, practice **DOESN'T** make perfect—perfect practice makes perfect. Sounds a bit preachy, doesn't it? But it just might save your life. The Air Force is developing an OP/PERSTEMPO survey which will be included in the quality of life survey. Take the time to fill it out honestly. Believe it or not, your answers to this survey will affect your quality of life.

We did have a good year. Keep up the good work, and I hope to have a real hard time coming up with this article next year because you all have had a mishap-free year. Good luck, and **"FLY SAFE."** ✈

USAF Photo by MSgt Don Wetterman

MAJ JEAN-GUY BEAUMONT, CAF
HQ AFSC/SEFF

A-10

FY96 Recap

FY96 yielded a small improvement on our FY95 safety performance. Our A-10 Class A rate for FY96 was 1.66. This represents a positive reduction against our FY95 Class A mishap rate of 1.69. Of more significance is the fact that your dedicated efforts the past 2 years have reversed our atrocious FY94 flying safety statistics (Class A mishap rate of 3.35 with a 4.19 aircraft destroyed rate). FY94 was our worst A-10 flight safety mishap year on record since FY80. In real terms, over the past 2 fiscal years, this means four more A-10 weapon systems and at least two pilots were retained in our order of battle (ORBAT). Dollar-wise, this means a minimum of $26.6 million of previously expended hard-earned U.S. taxpayer money is still at work protecting the country's national interests. Congratulations to you all for maintaining such a marked turn-around. Your noteworthy performance has impressed our AFSC's crystal ball operator, Madame Atkins, so much that she has revised her A-10 Class A forecast from four to two Class A mishaps for FY97.

Events

FY96 has been relatively quiet for the A-10 from a flight safety point of view insofar as Class A mishaps go. The good news is that we experienced only two A-10 Class A mishaps vice the four that were predicted by myself and the Air Force Safety Center. The bad news is the fact these two mishaps were operations related. Both were precipitated by a loss of situational awareness on the part of the mishap pilot with one of them paying the ultimate price for this momentary shortcoming.

On paper we look good, but many areas of our operation concern me. They are day and night live or practice ammo deliveries at unfamiliar weapons ranges, flying into thunderstorms, more nose wheel failure incidents, night low-level flying during bird season, and our unrelenting OP and PERSTEMPO are the ones I plan to address in this year's article.

My feeling is that we were very lucky during FY96 as well as FY95. Someone once said: "I'd rather be lucky than good any

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USAF Photo by SSgt Andrew N. Dunaway, II

FY96 recorded two instances where A-10 elements penetrated cumulonimbus clouds and suffered significant damage. As you are all very aware, our A-10 MK-1 weather radar eyeballs are somewhat remiss in warning us about such nasty embedded cells.

day." I believe our luck is about to run out, so we had better get good quick or we are going to be scattering a minimum of four or five Hawgs and up to three drivers into terra firma during FY97.

Risk Management Concerns

Live Air-to-Ground and Practice Munitions Deliveries. I believe most Class A and B mishaps are preceded by a minimum of two to three warning occurrences. These are supervision's last opportunity to halt the mishap chain before the Class A or B mishap occurs. Insofar as the A-10 is concerned, FY96 produced two A/G weapon delivery occurrences where airborne ordnance splashed into areas other than its intended target. Fortunately for us, no one was hurt, and material damages were minimal.

Two other similar occurrences were recorded by other airborne weapon platforms. It behooves all of us to heed these warnings and protect ourselves against the forthcoming major Class A ordnance *faux pas* coming soon to a yet-to-be-determined A-10 neighborhood.

I published an article titled "Fratricide" in the February/March 1996 issue of the USAF *Flying Safety* magazine in which I addressed this subject extensively. I suggest you dig it up, read it, and use it to validate your unit and personnel's performance in regard to safe and effective A/G deliveries.

Pilot Fatalities. My personal fear is that up to five jets could be destroyed and four pilots killed. I wrote last year: "Collision with the ground and NVG loss of SA situations will likely provide you with a 3 to 12 second 'fight or flight' ejection opportunity window. This will be a critical moment in your life, a moment that will make an eternity of difference for you and your family's future. Plan now for such a quick decision-making eventuality." The A-10 pilot who experienced our one NVG Class A mishap did. Today, he is alive to tell his story and cherish his loved ones.

The pilot involved in this year's other A-10 Class A likely had a 10- to 15-second ejection opportunity window which he failed to recognize. It cost him his life.

Thunderstorms. FY96 recorded two instances where A-10 elements penetrated cumulonimbus clouds and suffered significant damage. As you are all very aware, our A-10 MK-1 weather radar eyeballs are somewhat remiss in warning us about such nasty embedded cells. For the second year in a row, our main areas of vulnerability remained transiting the Atlantic and providing CAS into Bosnia from Aviano AB, Italy. Use every means available to obtain actual transit route weather. Ensure you leave yourself the possibility of diverting, and never let operational tasking press you into penetrating thunderstorms.

Night Low-Level Flying. This expanded A-10 operating area exposes us to a very high mishap risk. Two recent bird strikes have further highlighted our vulnerability while engaged in this type of operation. Loss of control while flying the A-10 under actual single-engine condition, midair collision, and controlled flight into the ground have cost us dearly in the past. Most were compounded by a loss of situational awareness and some form of pilot disorientation. An increase in night operations tempo will make us much more prone to all forms of disorientation and will drastically augment our risk of a Class A mishap and pilot fatality. Remember that **STAYING ALIVE** is the prime directive. Safe ejection under most of the above-mentioned conditions will likely require ejection initiation within a maximum of 2 to 5 seconds of your aircraft entering an unrecognizable or unrecoverable attitude below 2,000 feet AGL.

OP and PERSTEMPO. What are OP and PERSTEMPO? I could not locate official USAF definitions, but here are the definitions accepted by AFSC/SEFL:

- OPTEMPO—Refers to the number of missions, TDYs, and taskings assigned to an organization.
- PERSTEMPO—Refers to the level of

activity required of individual personnel.

The A-10 OPTEMPO will remain very high for FY97 with our unchanged commitments to the European and Southwest Asia theaters. Some units will be undertaking their second theater rotation which will increase family tension within all tasked squadrons as well as employers' dissatisfaction with some of our ANG/AFRES members. Affected units will find it increasingly challenging to meet their training, upgrade, and maintenance requirements. Deployed personnel are likely to become a mite bored and complacent due to the "been there, done that, and got the T-shirt!" syndrome. A-10 units remaining at home are likely to see increased air support tasking to meet FAC and U.S. Army training requirements. The level of activity of all members of the A-10 community will increase commensurate to their own individual family, their social and education commitments, and the number of secondary duties they are performing. Some sure hints of excessive OP/PERSTEMPO follow:

- Management failing to ensure all personnel assigned to a task are qualified, current, experienced, and proficient.
- Personnel scheduling criteria are routinely bent informally or amended to justify pressing to look good and accomplish the frag, sometimes referred to as "throwing bodies at the schedule."
- The unit has no formal review process, and risk assessment is commonly left up to the last line of defense, the section or element lead.
- Waivers and/or training extensions are required to meet unit and personnel training criteria.
- Your wing/squadron's daily schedule is a house of cards with no personnel and/or aircraft reserves.
- You are pulling yourself off the flying schedule often enough for your call sign to be amended to "SEAGULL," and your squadron mates say they must throw rocks at you to get you airborne.
- You rely on somebody else to do your mission planning or find it okay to skip part of a mission prebrief or debrief for whatever reason. Your debriefs are done on the way to the bar because you cannot stay in the squadron due to crew rest requirements.
- Your unit does not plan for the lowest common denominator and erroneously believes the presence of one qualified, current, experienced, and proficient individual makes a whole section experienced and qualified.
- You feel better qualified to write a point paper than a flight plan.
- You can barely remember the last time you were home in time to have supper with your family for 4 days in a row.
- You delay the start of your morning preflight brief to conclude the previous afternoon mission de-brief which you had to cut short so that your section or element members would not exceed their maximum crew day.

Maintenance Tempo.

- You come in during non-duty hours to finish up paperwork but don't have time to review the Dash One.
- Your idea of sports and exercise is situps on the couch to flip off the top of a beer can because you feel like you're too tired after work to go to the gym.

Increased requirements for the A-10 pilots (the new replacement for MCR 51-50, Fighter Training, MQT upgrade, FLUG, IPUG, NVG, to name a few) will keep the maintenance tempo very high. There will be little time to conduct training on how to do maintenance properly. Trainers will be the doers while the new 3-levels will do little hands-on technical work. More mistakes like the FY95 wing fire are likely to occur, especially during time of aircraft transfers. A seemingly minor maintenance aspect will be overlooked in an area that is not inspected regularly. The stage will then be set for a Class C or higher mishap.

My feeling is that we were very lucky during FY96 as well as FY95. Someone once said: "I'd rather be lucky than good any day." I believe our luck is about to run out, so we had better get good quick or we are going to be scattering a minimum of four or five Hawgs and up to three drivers into terra firma during FY97

Ninety days in the AOR, with only 3 days off (if the unit is lucky), on top of all their home station demands, will break the spirit of any maintenance organization. The burnout syndrome will be worse when we send these units back to the same old place for the second time. Add in theater-imposed restrictions that significantly restrict our personnel from living and behaving like Americans, and we will have successfully created some very unhappy and unmotivated wrench benders.

Engines and Parts. While failure of the HPT aft cooling plate may continue, reducing the usable life limit has been accom-

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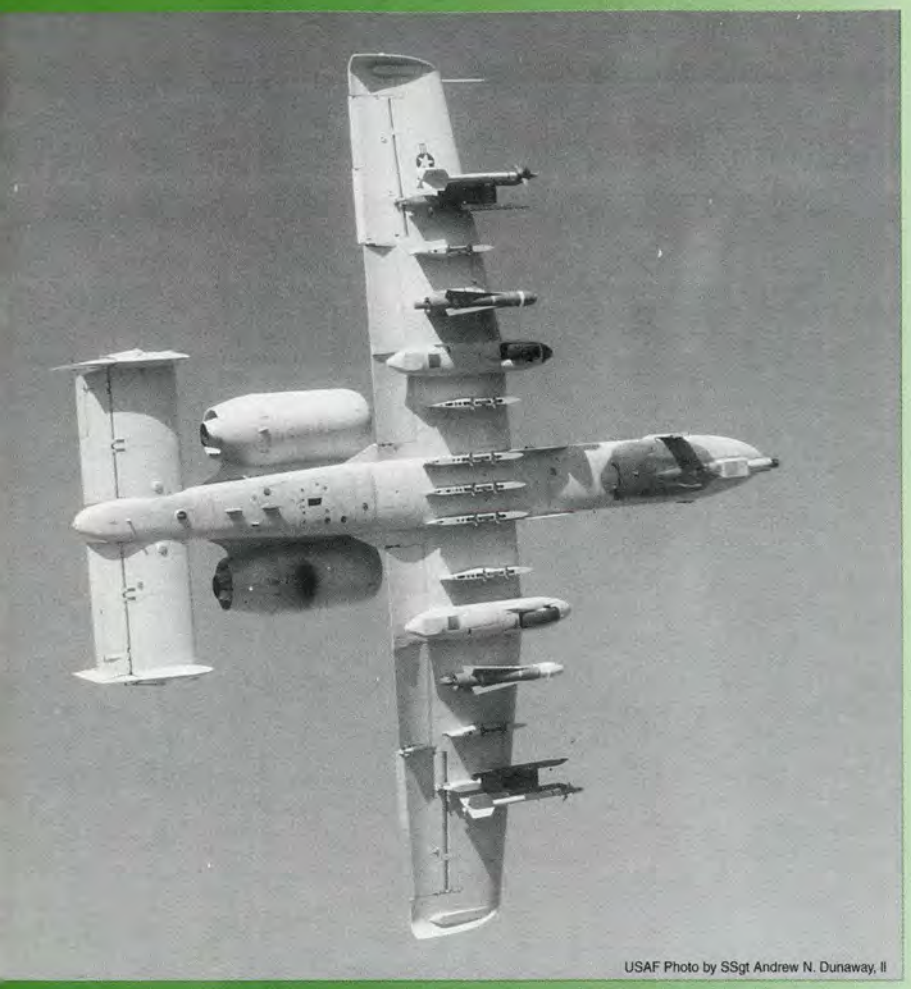

USAF Photo by SSgt Andrew N. Dunaway, II

The moves to realign the Hawg force structure have not always been ideal. Leaving technical people in place and converting them to another airframe are expeditious and cost-efficient ways for such a move. Often a squadron is not given time to set up to train and build a strong and competent unit.

plished and seems to be working. However, 30-year-old technology is bound to continue to fail, and it will become more and more difficult to maintain. New motors are the best way to go, but these will not be funded for the foreseeable future. The item managers at our ALCs are being asked to manage too many parts. The early 1990 A-10 "going away" plan is still affecting us because we have had no stability since then. Unit moves, stand-downs, stand-ups, and AOR rotations have made it unrealizable for most users to plan their needs and impossible for the engineers to catch up with the users' needs.

Manning. The moves to realign the Hawg force structure have not always been ideal. Leaving technical people in place and converting them to another airframe are expeditious and cost-efficient ways for such a move. Often a squadron is not given time to set up to train and build a strong and competent unit. Such a Hawg unit accounted for 75 percent of the waiver requests for planned, time change items and inspections during a past fiscal year. I don't see how they can continue to fly airplanes.

Squadron management and pilot manning are experiencing a significant loss of expertise. Truly experienced A-10 managers and pilots are being removed from the pointy end and not replaced at a similar rate. Most of the new majors we are getting in are "experienced" fighter pilots, fresh off staff jobs, with a background in other fighters. They are going straight into positions of leadership without understanding the culture or the way Hawgs do their missions. Some good ideas are forthcoming from this group. They, however, generate an extra burden to their assigned unit as they go through MQT and training sorties between desert rotations. They cannot be used for FLUG or IPUG.

The middle captain year groups that encompass most of the instructors will be tapped out due to the high sortie rate required for future CT sorties.

Our FY97 Class A Mishaps

#1. *Inaccurate Live/Practice Ordnance Delivery*

A fortune teller's delight and our No. 1 contender! Many indicators over the past 2 years point to the fact the "BIG BANG" theory will realize itself in FY97. We have, thus far, dutifully amended publications and fired personnel involved in such incidents. Leadership still occasionally gambles on sending A-10 pilots to various A/G ranges who are qualified and current but neither experienced nor proficient.

#2. *Controlled Flight Into Terrain*

We experienced one of these in fiscal years '93, '94, and '95. FY96 was an exception. The odds that one of our A-10 pilots will lose his SA during a turn at low-level remain extremely high. The GCAS modifications that were suggested by our last A-10 CFIT SIB are still pending. They will not be incorporated into the jet for FY97. We will continue to live and operate in a dangerous environment with the same deficient hard altitude and warning inhibitors. We will repeat this tasking maneuver countless times.

#3. *NVG Operation, SA Loss, and Spatial Disorientation*

NVG flying is, without a doubt, the A-10's riskiest flying phase. NVG flying forces you to operate in an environment where there is little room for survival if you make a mistake. During FY97, the A-10 NVG flying phase will continue to expand. We will provide basic NVG checkouts to new A-10 pilots as well as introduce more demanding advanced NVG tactical scenarios to A-10 units that previously received the basic A-10

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B-1/B-2/B-52

B-52 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY55	0	0.00	4,979
CY56	4	26.92	14,860
CY57	6	10.17	58,971
CY58	8	6.50	123,030
CY59	5	2.19	227,973
CY60	4	1.50	267,331
CY61	6	1.77	338,662
CY62	1	0.25	403,043
CY63	4	0.98	408,239
CY64	5	1.22	409,382
CY65	1	0.25	397,405
CY66	3	0.74	403,037
CY67	6	1.66	361,754
CY68	6	1.54	389,843
CY69	9	2.97	302,949
CY70	1	0.43	230,746
CY71	1	0.47	212,003
CY72	5	1.44	346,021
CY73	2	0.93	216,165
CY74	3	1.88	159,563
CY75	1	0.71	141,204
CY76	0	0.00	137,469
CY77	1	0.74	134,722
CY78	1	0.75	133,038
CY79	1	0.75	133,234
CY80	1	0.77	130,405
CY81	1	0.75	133,677
CY82	2	1.64	122,121
CY83	1	0.95	104,866
CY84	2	1.92	103,933
CY85	0	0.00	105,566
CY86	0	0.00	102,381
TY87	0	0.00	80,014
FY88	2	2.04	98,004
FY89	1	0.99	100,516
FY90	0	0.00	91,037
FY91	1	1.09	91,454
FY92	0	0.00	69,056
FY93	0	0.00	53,293
FY94	1	3.11	32,146
FY95	1	4.08	24,533
FY96	0	0.00	25,417
LIFETIME	97	1.31	7,424,042
5 YEAR AVG	0.40	0.98	40,889
10 YEAR AVG	0.60	0.90	66,547

ALL DATA AS OF 30 SEP 96
HRS FORECASTED AUG/SEP

B-1 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY84	0	0.00	195
CY85	0	0.00	543
CY86	0	0.00	2,676
TY87	1	11.96	8,359
FY88	0	0.00	19,701
FY89	2	7.66	26,100
FY90	1	3.74	26,705
FY91	2	8.56	23,355
FY92	3	11.12	26,970
FY93	1	3.31	30,179
FY94	0	0.00	29,383
FY95	0	0.00	27,781
FY96	0	0.00	29,612
LIFETIME	10	3.98	251,559
5 YEAR AVG	0.80	2.78	28,785
10 YEAR AVG	1.00	4.03	24,815

FY96 Mishap Statistics

B-2 HISTORY
CLASS A

YEAR	#	RATE	HOURS
FY90	0	0.00	60
FY91	0	0.00	225
FY92	0	0.00	378
FY93	0	0.00	455
FY94	0	0.00	976
FY95	0	0.00	2,415
FY96	0	0.00	3,653
LIFETIME	0	0.00	8,162
5 YEAR AVG	0	0.00	1,575

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C-5/C-17/C-141 C-130/C-135

C-141 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY64	0	0.00	2,469
CY65	0	0.00	35,316
CY66	1	0.53	189,246
CY67	4	0.87	461,704
CY68	0	0.00	672,627
CY69	0	0.00	642,291
CY70	1	0.16	612,518
CY71	1	0.20	487,929
CY72	0	0.00	471,440
CY73	2	0.55	362,532
CY74	2	0.70	286,377
CY75	4	1.27	314,771
CY76	3	1.07	281,622
CY77	2	0.67	299,191
CY78	1	0.35	282,594
CY79	3	1.03	291,223
CY80	1	0.36	281,411
CY81	1	0.34	290,389
CY82	1	0.35	284,675
CY83	0	0.00	294,531
CY84	1	0.35	286,443
CY85	0	0.00	293,380
CY86	1	0.35	288,339
TY87	1	0.45	220,161
FY88	0	0.00	264,201
FY89	1	0.36	276,770
FY90	0	0.00	304,106
FY91	0	0.00	442,406
FY92	0	0.00	226,312
FY93	1	0.49	203,264
FY94	0	0.00	127,938
FY95	0	0.00	157,059
FY96	0	0.00	146,979
LIFETIME	32	0.32	10,082,214
5 YEAR AVG	0.20	0.12	172,310
10 YEAR AVG	0.30	0.13	236,920

C-5 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY68	0	0.00	24
CY69	0	0.00	472
CY70	2	20.66	9,680
CY71	1	4.05	24,699
CY72	0	0.00	46,735
CY73	0	0.00	49,656
CY74	2	3.98	50,263
CY75	1	2.19	45,601
CY76	1	2.44	40,946
CY77	0	0.00	49,289
CY78	1	2.02	49,543
CY79	0	0.00	49,477
CY80	1	1.94	51,594
CY81	0	0.00	53,969
CY82	1	1.95	51,374
CY83	2	3.59	55,681
CY84	0	0.00	59,260
CY85	0	0.00	59,967
CY86	1	1.65	60,516
TY87	0	0.00	59,544
FY88	0	0.00	56,958
FY89	1	1.55	64,346
FY90	1	1.13	88,390
FY91	0	0.00	166,676
FY92	0	0.00	66,324
FY93	0	0.00	78,319
FY94	0	0.00	72,899
FY95	0	0.00	64,608
FY96	0	0.00	66,157
LIFETIME	15	0.94	1,592,967
5 YEAR AVG	0.0	0.00	69,661
10 YEAR AVG	0.20	0.26	78,422

C-17 HISTORY
CLASS A

YEAR	#	RATE	HOURS
FY91	0	0.00	8
FY92	0	0.00	539
FY93	0	0.00	1,252
FY94	0	0.00	4,454
FY95	0	0.00	12,968
FY96	1	5.72	17,468
LIFETIME	1	2.73	36,689
5 YEAR AVG	0.20	2.73	7,336

C-130 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY55	1	2,173.91	46
CY56	1	186.22	537
CY57	0	0.00	22,633
CY58	4	5.04	79,290
CY59	4	3.98	100,457
CY60	1	0.82	121,844
CY61	4	2.79	143,363
CY62	6	3.42	175,479
CY63	2	0.79	254,331
CY64	4	0.94	424,034
CY65	9	1.62	554,079
CY66	16	2.20	727,191
CY67	13	1.98	656,986
CY68	11	1.85	593,976
CY69	8	1.49	537,126
CY70	3	0.60	504,113
CY71	2	0.41	487,137
CY72	7	1.46	480,989
CY73	1	0.25	399,605
CY74	5	1.39	360,549
CY75	3	0.82	365,181
CY76	0	0.00	336,592
CY77	1	0.30	334,524
CY78	7	2.01	348,168
CY79	0	0.00	360,806
CY80	2	0.56	354,589
CY81	4	1.09	368,433
CY82	2	0.53	376,261
CY83	1	0.27	376,939
CY84	3	0.80	374,577
CY85	3	0.79	381,929
CY86	2	0.54	367,186
TY87	1	0.36	274,706
FY88	2	0.58	344,160
FY89	1	0.29	339,149
FY90	0	0.00	325,201
FY91	0	0.00	401,615
FY92	2	0.63	315,952
FY93	1	0.33	300,157
FY94	1	0.36	279,923
FY95	1	0.35	282,864
FY96	1	0.35	286,435
LIFETIME	140	0.99	14,119,112
5 YEAR AVG	1	0.41	293,066
10 YEAR AVG	1	0.32	315,016

C-135 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY57	0	0.00	4,497
CY58	3	6.94	43,204
CY59	3	2.53	118,426
CY60	3	1.94	154,579
CY61	2	0.99	201,263
CY62	5	1.78	280,695
CY63	3	0.89	336,771
CY64	1	0.26	385,681
CY65	4	1.00	400,572
CY66	2	0.44	449,445
CY67	2	0.48	419,651
CY68	6	1.19	502,467
CY69	5	1.16	431,849
CY70	1	0.27	376,930
CY71	2	0.54	372,410
CY72	4	0.91	438,029
CY73	4	1.21	329,410
CY74	2	0.67	296,320
CY75	1	0.38	266,522
CY76	2	0.77	259,785
CY77	2	0.76	262,304
CY78	0	0.00	271,819
CY79	3	1.11	269,432
CY80	1	0.39	256,761
CY81	3	1.16	259,602
CY82	2	0.77	260,007
CY83	0	0.00	258,777
CY84	0	0.00	261,112
CY85	2	0.77	260,908
CY86	1	0.39	256,743
TY87	2	1.02	196,423
FY88	0	0.00	254,973
FY89	3	1.14	263,910
FY90	1	0.37	270,624
FY91	1	0.34	298,070
FY92	1	0.39	255,073
FY93	0	0.00	245,711
FY94	0	0.00	219,206
FY95	0	0.00	219,880
FY96	0	0.00	211,492
LIFETIME	77	0.69	11,121,333
5 YEAR AVG	0.2	0.09	230,272
10 YEAR AVG	0.8	0.33	243,536

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C-10 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY81	0	0.00	2,054
CY82	0	0.00	7,018
CY83	0	0.00	12,831
CY84	0	0.00	19,534
CY85	0	0.00	24,617
CY86	0	0.00	32,572
TY87	0	0.00	29,952
FY88	0	0.00	43,558
FY89	0	0.00	47,350
FY90	0	0.00	51,490
FY91	1	1.46	68,668
FY92	1	2.31	43,253
FY93	0	0.00	54,266
FY94	0	0.00	52,289
FY95	0	0.00	43,381
FY96	2	3.94	50,700
LIFETIME	4	0.69	583,533
5 YEAR AVG	0.60	1.23	48,778
10 YEAR AVG	0.40	0.82	48,491

E-3 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY77	0	0.00	981
CY78	0	0.00	4,939
CY79	0	0.00	10,304
CY80	0	0.00	15,453
CY81	0	0.00	24,389
CY82	0	0.00	27,430
CY83	0	0.00	29,737
CY84	0	0.00	30,159
CY85	0	0.00	29,628
CY86	0	0.00	28,701
TY87	0	0.00	23,302
FY88	0	0.00	29,005
FY89	0	0.00	22,886
FY90	0	0.00	26,141
FY91	0	0.00	32,343
FY92	0	0.00	33,329
FY93	0	0.00	27,782
FY94	0	0.00	24,381
FY95	1	3.90	25,612
FY96	0	0.00	23,641
LIFETIME	1	0.21	470,143
5 YEAR AVG	0.20	0.74	26,949
10 YEAR AVG	0.10	0.37	26,842

H-1 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY71	0	0.00	15,900
CY72	3	14.22	21,097
CY73	0	0.00	20,026
CY74	1	5.18	19,315
CY75	0	0.00	22,197
CY76	0	0.00	12,896
CY77	0	0.00	19,729
CY78	1	4.19	23,838
CY79	0	0.00	24,703
CY80	1	4.34	23,041
CY81	0	0.00	24,385
CY82	0	0.00	24,547
CY83	0	0.00	24,978
CY84	1	4.02	24,846
CY85	0	0.00	46,977
CY86	1	2.17	46,101
TY87	0	0.00	32,895
FY88	0	0.00	30,774
FY89	0	0.00	31,253
FY90	0	0.00	30,704
FY91	1	3.32	30,087
FY92	2	7.21	27,729
FY93	0	0.00	25,945
FY94	1	4.15	24,099
FY95	1	4.35	22,964
FY96	1	4.89	20,464
LIFETIME	14	2.08	671,490
5 YEAR AVG	1	4.13	24,240
10 YEAR AVG	1	2.17	27,691

F-117 HISTORY
CLASS A

YEAR	#	RATE	HOURS
FY91	0	0.00	1,787
FY92	1	8.71	11,481
FY93	0	0.00	12,538
FY94	0	0.00	122,136
FY95	2	15.62	12,804
FY96	0	0.00	13,303
LIFETIME	3	1.72	174,049
5 YEAR AVG	0.60	1.74	34,452

C-10/E-3
H-1/H-53/H-60
F-16/F-117

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H-53 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY66	0	0.00	22
CY67	0	0.00	1,517
CY68	0	0.00	5,272
CY69	2	21.66	9,232
CY70	0	0.00	13,922
CY71	1	4.87	20,528
CY72	0	0.00	23,299
CY73	2	10.94	18,279
CY74	0	0.00	16,439
CY75	3	18.81	15,947
CY76	1	7.01	14,261
CY77	2	13.08	15,292
CY78	0	0.00	14,942
CY79	1	8.05	12,429
CY80	2	15.90	12,578
CY81	2	14.38	13,912
CY82	1	7.43	13,452
CY83	0	0.00	13,805
CY84	2	14.53	13,762
CY85	1	8.56	11,687
CY86	2	16.39	12,205
TY87	1	11.20	8,925
FY88	0	0.00	10,804
FY89	1	9.57	10,453
FY90	0	0.00	12,223
FY91	0	0.00	11,594
FY92	0	0.00	12,238
FY93	0	0.00	12,019
FY94	0	0.00	12,106
FY95	1	8.43	11,857
FY96	1	7.82	12,795
LIFETIME	26	6.70	387,796
5 YEAR AVG	0.40	3.28	12,203
10 YEAR AVG	0.40	3.48	11,501

H-60 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY82	0	0.00	112
CY83	0	0.00	3,147
CY84	0	0.00	4,132
CY85	0	0.00	2,992
CY86	0	0.00	3,955
TY87	1	44.42	2,251
FY88	0	0.00	4,216
FY89	0	0.00	5,591
FY90	0	0.00	7,849
FY91	1	6.85	14,594
FY92	1	5.15	19,401
FY93	1	4.37	22,871
FY94	2	8.25	24,229
FY95	1	3.75	26,666
FY96	0	0.00	27,552
LIFETIME	7	4.13	169,558
5 YEAR AVG	1.0	4.14	24,144
10 YEAR AVG	0.7	4.51	15,522

F-16 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY75	1	621.12	161
CY76	1	442.48	226
CY77	0	0.00	856
CY78	0	0.00	1,402
CY79	2	30.64	6,527
CY80	5	18.65	26,803
CY81	5	8.86	56,423
CY82	17	15.83	107,389
CY83	11	7.30	150,728
CY84	10	5.01	199,761
CY85	10	4.55	219,647
CY86	11	4.32	254,491
TY87	8	3.43	233,560
FY88	23	6.80	338,039
FY89	14	3.63	385,179
FY90	13	3.19	408,078
FY91	21	4.55	461,451
FY92	18	4.04	445,201
FY93	18	4.15	433,960
FY94	17	4.24	400,484
FY95	9	2.33	386,445
FY96	8	2.15	372,816
LIFETIME	222	4.54	4,889,627
5 YEAR AVG	14.0	3.43	407,781
10 YEAR AVG	14.9	3.85	386,521

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A-10
F-15/F-111
U-2

F-111 HISTORY
CLASS A

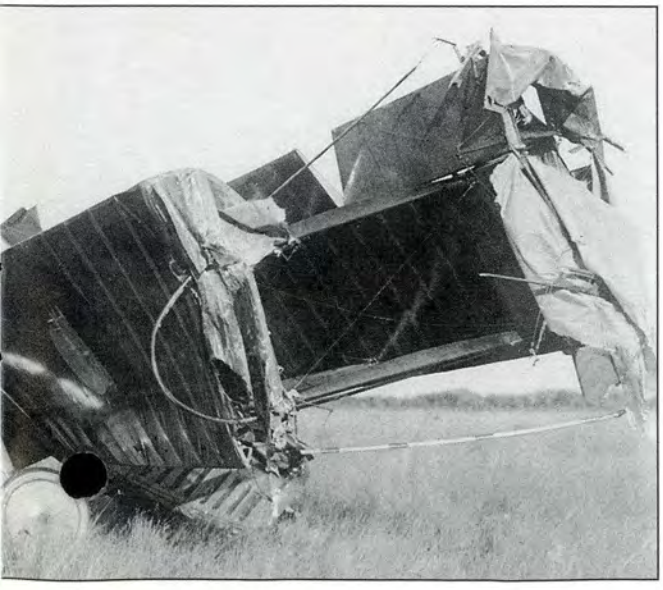
YEAR	#	RATE	HOURS
CY65	0	0.00	272
CY66	0	0.00	1,342
CY67	2	53.60	3,731
CY68	5	36.14	13,837
CY69	8	25.97	30,806
CY70	0	0.00	10,933
CY71	2	4.03	49,673
CY72	5	6.68	74,797
CY73	10	11.39	87,774
CY74	3	3.57	83,957
CY75	7	8.82	79,393
CY76	8	12.75	62,750
CY77	7	9.51	73,628
CY78	3	4.72	63,537
CY79	13	17.11	75,989
CY80	4	5.45	73,431
CY81	3	3.86	77,648
CY82	10	12.68	78,890
CY83	3	3.76	79,755
CY84	3	3.80	78,973
CY85	0	0.00	80,870
CY86	0	0.00	83,921
TY87	3	4.66	64,344
FY88	3	3.58	83,686
FY89	2	2.32	86,262
FY90	5	5.86	85,357
FY91	1	1.13	88,710
FY92	2	2.82	71,029
FY93	1	2.18	45,924
FY94	0	0.00	30,180
FY95	1	3.33	30,016
FY96	1	6.90	14,493
LIFETIME	115	6.16	1,865,908
5 YEAR AVG	1.00	2.61	38,328
10 YEAR AVG	1.90	3.17	60,000

F-15 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY72	0	0.00	25
CY73	0	0.00	826
CY74	0	0.00	2,110
CY75	1	22.02	4,541
CY76	0	0.00	17,803
CY77	6	14.16	42,369
CY78	8	11.59	69,023
CY79	5	5.16	96,959
CY80	5	4.57	109,309
CY81	5	3.78	132,291
CY82	3	1.96	153,369
CY83	4	2.36	169,438
CY84	3	1.71	175,515
CY85	5	2.70	185,324
CY86	7	3.53	198,095
TY87	3	1.94	154,821
FY88	1	0.50	201,099
FY89	5	2.33	214,592
FY90	7	3.08	227,617
FY91	3	1.09	276,393
FY92	5	2.26	220,866
FY93	3	1.38	217,547
FY94	4	1.90	210,241
FY95	4	1.94	206,649
FY96	4	2.02	198,220
LIFETIME	91	2.61	3,485,042
5 YEAR AVG	4.0	1.90	210,705
10 YEAR AVG	3.9	1.83	212,805

A-10 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY72	0	0.00	32
CY73	0	0.00	124
CY74	0	0.00	403
CY75	0	0.00	936
CY76	0	0.00	3,678
CY77	2	11.96	16,722
CY78	7	15.72	44,538
CY79	8	9.24	86,544
CY80	5	3.84	130,159
CY81	5	2.86	174,924
CY82	4	1.82	219,349
CY83	7	3.10	226,129
CY84	6	2.68	224,058
CY85	4	1.78	224,133
CY86	3	1.37	219,334
TY87	5	2.92	171,089
FY88	3	1.37	218,289
FY89	7	3.03	230,655
FY90	3	1.35	222,399
FY91	2	0.88	228,273
FY92	3	1.79	167,648
FY93	2	1.74	115,064
FY94	4	3.35	119,329
FY95	2	1.69	118,602
FY96	2	1.66	120,830
LIFETIME	84	2.56	3,283,241
5 YEAR AV	2.6	2.03	128,295
10 YEAR AVG	3.3	1.93	171,218



U-2 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY63	1	0.00	0
CY64	0	0.00	0
CY65	0	0.00	0
CY66	1	0.00	0
CY67	1	0.00	0
CY68	1	0.00	0
CY69	0	0.00	0
CY70	0	0.00	4,413
CY71	1	23.58	4,241
CY72	1	12.93	7,732
CY73	1	9.33	10,718
CY74	0	0.00	11,425
CY75	2	18.53	10,791
CY76	0	0.00	8,717
CY77	1	10.64	9,395
CY78	0	0.00	8,934
CY79	0	0.00	10,128
CY80	3	29.76	10,080
CY81	0	0.00	10,211
CY82	0	0.00	10,131
CY83	0	0.00	12,555
CY84	3	22.63	13,257
CY85	0	0.00	11,788
CY86	0	0.00	13,954
TY87	0	0.00	16,786
FY88	0	0.00	16,730
FY89	0	0.00	17,620
FY90	1	5.56	18,001
FY91	0	0.00	19,820
FY92	1	6.03	16,597
FY93	1	5.53	18,085
FY94	1	6.39	15,643
FY95	1	5.64	17,726
FY96	2	14.53	13,762
LIFETIME	23	6.78	339,240
5 YEAR AVG	1.20	7.33	16,363
10 YEAR AVG	0.70	4.10	17,077

Those who cannot remember the past are condemned to repeat it.

George Santayana (1863-1952)

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T-37/T-38/T-1/T-3

T-38 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY60	0	0.00	974
CY61	0	0.00	5,386
CY62	3	7.15	41,945
CY63	5	4.63	108,106
CY64	6	2.87	209,285
CY65	10	3.83	260,961
CY66	13	3.63	358,001
CY67	13	2.91	447,443
CY68	10	1.98	504,977
CY69	9	1.55	579,768
CY70	17	2.81	605,430
CY71	7	1.22	571,569
CY72	9	1.68	535,538
CY73	7	1.49	468,761
CY74	9	2.24	402,336
CY75	1	0.26	378,955
CY76	8	2.52	317,300
CY77	8	2.37	337,071
CY78	7	2.25	310,702
CY79	5	1.51	330,325
CY80	4	1.19	335,813
CY81	6	1.77	338,986
CY82	3	0.83	362,514
CY83	5	1.36	367,891
CY84	3	0.80	373,825
CY85	2	0.55	362,845
CY86	4	1.14	349,457
TY87	2	0.75	267,009
FY88	2	0.57	351,132
FY89	2	0.54	370,026
FY90	2	0.55	361,878
FY91	1	0.30	337,134
FY92	1	0.38	265,369
FY93	3	1.33	225,105
FY94	0	0.00	194,161
FY95	1	0.65	154,971
FY96	1	0.74	135,145
LIFETIME	189	1.58	11,928,094
5 YEAR AVG	1.20	0.62	194,950
10 YEAR AVG	1.50	0.56	266,193

T-37 HISTORY
CLASS A

YEAR	#	RATE	HOURS
CY56	1	149.25	670
CY57	1	14.90	6,713
CY58	5	8.79	56,908
CY59	14	9.23	151,713
CY60	8	3.17	252,361
CY61	9	4.08	220,362
CY62	14	4.70	297,765
CY63	5	1.53	326,348
CY64	8	2.11	378,410
CY65	7	1.99	351,848
CY66	2	0.53	376,716
CY67	4	0.99	405,880
CY68	4	0.92	433,597
CY69	9	1.79	502,492
CY70	5	0.99	503,447
CY71	2	0.43	463,844
CY72	4	0.91	439,929
CY73	3	0.71	422,721
CY74	1	0.33	305,106
CY75	1	0.33	301,353
CY76	2	0.70	284,548
CY77	1	0.38	263,718
CY78	3	1.16	257,599
CY79	1	0.34	295,890
CY80	4	1.42	282,066
CY81	2	0.68	295,614
CY82	2	0.63	318,348
CY83	1	0.30	328,836
CY84	1	0.31	320,175
CY85	1	0.32	312,805
CY86	1	0.32	312,587
TY87	0	0.00	240,762
FY88	1	0.31	318,268
FY89	1	0.32	314,105
FY90	0	0.00	306,885
FY91	0	0.00	279,593
FY92	2	0.85	234,830
FY93	1	0.56	179,933
FY94	0	0.00	151,651
FY95	1	0.74	134,425
FY96	0	0.00	146,839
LIFETIME	132	1.12	11,777,660
5 YEAR AVG	0.80	0.47	169,536
10 YEAR AVG	0.60	0.26	230,729

T-1 HISTORY
CLASS A

YEAR	#	RATE	HOURS
FY92	0	0.00	1
FY93	0	0.00	18,063
FY94	0	0.00	32,304
FY95	0	0.00	41,055
FY96	0	0.00	48,275
LIFETIME	0	0.00	139,698
5 YEAR AVG	0	0.00	27,940

T-3 HISTORY
CLASS A

YEAR	#	RATE	HOURS
FY94	0	0.00	2,663
FY95	1	4.34	23,062
FY96	1	3.57	28,032
LIFETIME	2	3.72	53,757
3 YEAR AVG	1	3.72	17,919

USAF Photo by SSgt Raymond T. Conway

NVG checkout. To protect yourself and prevent this type of mishap from revisiting us in FY97, I suggest you familiarize yourselves thoroughly with the interior cockpit lighting requirements for both modded and non-modded NVIS A-10s. Also, have a plan for inadvertent IMC penetration. Last, but not least, devise ahead of time a personal course of action to follow should you ever have the misfortune to find yourself spatially disoriented with no SA while operating an A-10 under NVG at low level. Your survival depends on it.

#4. *Midair Collision*

The last A-10 midair collision we experienced was in FY94. This type of mishap has historically hit us every 2 to 3 years. Midair collisions are deadly. On average, they claim the lives of at least 50 percent of the occupants. Our FY94 A-10 midair diverged from the norm and saw the survival of both pilots. It is most unlikely our next A-10 midair will be that indulgent.

Our publications and flying training tell us what to expect from a lead, a wingman, the Red Baron, and enemy defenses. As the lead, you must control your flying environment. Any flying scenario denying you full control of all of your formation participants is one that must be abandoned and modified prior to stepping. Never accept the lead of a formation where you are not fully aware of the intentions of all participants. Remember that nobody has ever successfully and consistently been able to stay ahead of or lead turn the unknown.

Make Your Day! Look at my above predictions as highlighted hazards with a significant probability of causing adverse effects to you, your unit, and your mission. As the underdog, work long and hard to better yourself and your team so no risk is ever undertaken without having first been duly considered by the appropriate leadership level. Remember that the only valid reason to accept a risk is the likely prospect of a far greater gain. If whatever you are planning or doing does not meet this criterion, abandon it immediately. Live and abide by this rule so you may always effectively accomplish your missions and live to tell your grandchildren about it.

Do not over-rely on operational risk management (ORM) to protect you for the immediate future. ORM takes time and training to fully implement. ORM is more than a general paper or computer risk matrix for your organization. It is a complex program requiring the full dedication and participation of wing personnel to implement. Eventually, all other unit members must be involved in the process.

I Need More Inputs—Your Inputs! In closing, let me reiterate that I welcome and need your comments and concerns. Keep our communication channels open and your information flowing to me. My coordinates are as follows: AFSC/SEFF, 9700 G Avenue, S.E., Kirtland AFB NM 87117-5670; phone (commercial) (505) 846-0737, DSN 246-0737; FAX DSN 246-0684; e-mail: beaumonj@smtps.saia.af.mil ✈

Remember that the only valid reason to accept a risk is the likely prospect of a far greater gain. If what ever you are planning or doing does not meet this criterion, abandon it immediately.

EAGLE REVIEW: '96

USAF Photo by SSgt Andrew N. Dunaway, II

LT COL KEN BURKE
HQ AFSC/SEFF

Greetings, Eagle Drivers!

Ready? Here we go.

The Nums

"We" chalked up four Class A mishaps again last year with 198,220 flying hours, for a 2.02 rate (mishaps per 100,000 hours). This reflects a marginal increase over the previous year's 1.94 rate, and right on average with the last 10 years' look-back. The FY96 fighter/attack Class A rate was down significantly to 2.20, compared to FY95's 2.56 and FY94's 3.36.

In the end, there were two F-15 Class B's for a 1.01 rate. That's a significant improvement over FY95 with five for a 2.42 rate. The Air Force-wide Class B rate was .56 for FY96.

Class A Mishaps

A brief "sanitized" look at last year's mishaps follows. See your local Flight Safety Officer if you need more of the specifics from the Boards' final reports.

• During a BFM engagement, the two pilots found themselves nose high with energy low and decreasing (really!). When the mishap pilot (MP) attempted his recovery, the aircraft's nose dropped through the vertical, and the jet hung up inverted. The aircraft was not responding to the MP's flight control inputs as he was rapidly approaching the top of the ocean. The MP safely ejected and was rescued.

• During BFM on the "back" part of an out-and-back, the MP noted engine problems. With a confirmed fire in the aft section of the engine, he beat a hasty retreat back to the "out" base. In trying to get the jet on the ground quickly, the MP did not sufficiently reduce the airspeed. Landing hot, the airspeed could not be significantly dissipated prior to the departure end of the runway. Without a cable available, and still with lots of knots, the MP ejected before running off the runway.

• On an afterburner formation takeoff, the wingman determined he had an afterburner anomaly. In attempting to correct for what he thought was the problem, he reduced

power on the "good" engine. Too late to abort, and with the aircraft not sustaining suitable airspeed, the MP ejected. The MP was seriously injured.

• During an engagement, the mishap pilot quickly became aware of an engine problem. Bad turned to incredible when the problem propagated to the other engine. With a face full of fire lights and other confirming indications, and unable to maintain altitude, the MP ejected successfully.

There are some lessons to be learned, or relearned, in almost every mishap. Sometimes a mishap appears to be the result of gross failure on the part of the pilot. A closer look usually reveals a few contributing factors that influenced the outcome.

I strongly encourage you to sit down with a copy of the above mishap final reports, including the Memorandum of Final Evaluation (MOFE). When/if you do, don't dwell on who was the "CAUSE." Better to spend your time looking at the contributing factors. See if any of them have been part of your environment. If so, are there changes YOU can influence in your unit? Review the recommendations. They may save your life. However, the SIBs do not have exclusive rights to make recommendations. If you have a good idea, get it out. You could "CAUSE" improvement.

No Eagle Driver fatalities this year! Great job! I sincerely hope you can do as well in FY97.

The Class B's

• The mishap crew was holding off-range to burn fuel prior to landing. During a turn reversal, the mishap aircraft entered an autoroll. A high negative-G pitchover during the autoroll recovery resulted in structural damage to the aircraft which was undetected until after the crew landed. The problem was that there was limited understanding of F-15E departure potential while maneuvering in certain regions even below 30 units AOA.

• Shortly after advancing power to mil for takeoff, the MP heard engine "bangs" and checked his instruments. The No. 1 engine nozzle showed 80 percent open. The left engine fire warning light illuminated, and the audible fire warning sounded. The MP accomplished engine fire on takeoff, abort, and emergency ground egress procedures, stopping approximately 1,600 feet down the runway. The fire department responded rapidly and extinguished the fire. A third-stage fan disk lug had failed, liberating the associated fan blade.

Class C's

There were 103 Class C's submitted to the Safety Center. Again this year, engine and engine-related problems accounted for over half of the problems, while departures from controlled flight contributed about 20 percent of the total. Within the engine category, no one problem stands out. The departures appear to be equally divided between operator-induced and mechanical problems. We had 11 reported missing/dropped Eagle parts last year. The most frequent reason was delamination due to water intrusion.

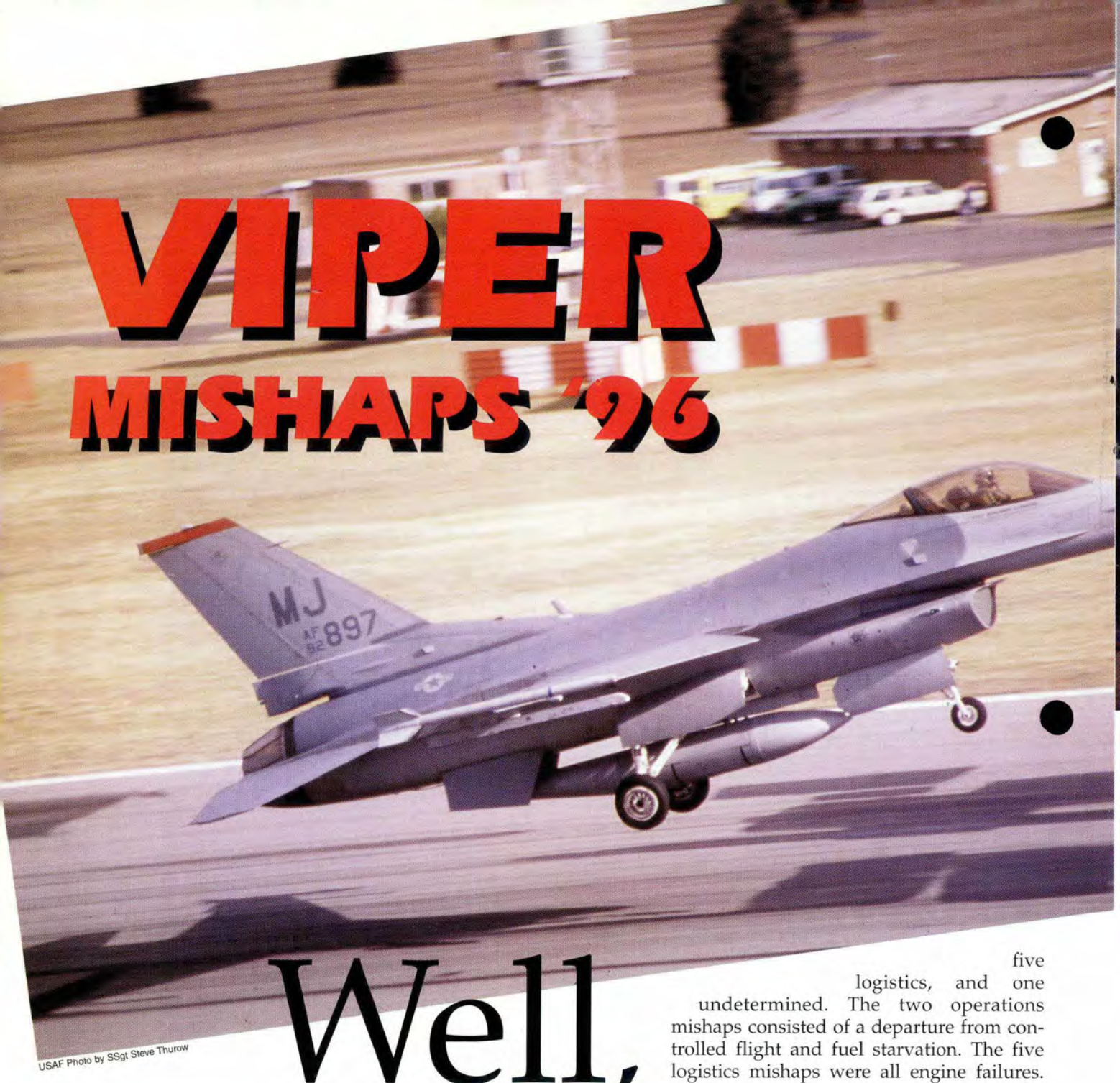
Otherwise

We have several new folks on the flight safety staff this year which is very good for us. Please take a few minutes to read the other end-of-year articles in this issue. I know you will find interesting points in every one (even Jean Guy's). Maj Dave Wood wrote another excellent article again this year on our engine problems.

Have a good year! ✈

USAF Photo by SSgt Steve Thurow

VIPER MISHAPS '96



USAF Photo by SSgt Steve Thurow

MAJ KENT DUKES
HQ AFSC/SEFF

Well, another year has passed us by. A 3-year look-back shows some interesting numbers. In FY95, we had a relatively "banner" year with a little more than half the number of aircraft lost compared to FY94. I'm pleased to report we're there again—in FY96 we experienced eight Class A's, *less than half* the FY94 losses.

Statistics

The numbers this go-round look a lot like last year's. This year's eight Class A mishaps break down into two operations, five logistics, and one undetermined. The two operations mishaps consisted of a departure from controlled flight and fuel starvation. The five logistics mishaps were all engine failures. On the plus side, we experienced zero Viper Driver fatalities this year. As it should be…

If we take a look at the Class A breakdown by MAJCOM, we have ACC with four, AETC with one, and ANG with three. PACAF, USAFE, and AFRES had zero Class A mishaps. Good on ya!

Now, let's look at ejections. Eight more Viper Drivers have earned their ACES II "wings" and returned safely to *terra firma*. One lucky individual experienced his *second* seat ride! Most of the injuries came from two ejections on or *very near* the ground. Also, one of the eight had twisted risers. A num-

ber of these "successful" ejections were below minimum recommended ejection altitude—there seems to be a dangerous trend here. Once again, let's not forget to offer a friendly "pat on the back" to those Life Support and Egress folks who've brought back our buds.

There were five Class B's this year for a rate of 1.34: two operations, three logistics. The two operations mishaps were a nose gear-up landing and an early landing gear retraction. The three logistics mishaps break down as follows: a radar avionics fire, a hydraulic failure with loss of brakes, and an engine failure that landed successfully.

There were 62 Class C's. Notably: 19 engine; 10 departure from controlled flight; 6 bird strikes; 4 weather damage, 4 electrical/wire chafing; 3 brake-related mishaps; 2 hard landings/wake turbulence; 2 ALQ pods damaged by cables ($$); and 1 midair.

Class A's

• Two F-16s were doing that BFM thing when the defender attempted an over-the-top maneuver. He ran out of knots shortly after passing through the vertical. After an unsuccessful attempt to "rock" the jet out of an inverted deep stall, the pilot bailed at 3,300 feet AGL.

• En route to the tanker, this aircraft developed severe vibrations and decreasing RPM and FTIT. It then issued a yellow flame and trailing smoke. The ensuing airstart attempts were unsuccessful, and the well-shaken (not stirred) flier hit the silk around 750 to 950 feet AGL.

• Sometime after air refueling on a ferry flight, the AFT FUEL LOW light illuminated. If you don't know it already, any fuel in external tanks when this light comes on is *not usable!* The pilot attempted to divert to an AFB about 90 miles away and only made it halfway before the engine flamed out. Several minutes later, ejection was initiated at low altitude, and he sustained major injuries.

Pop quiz question: Do you get the HUD TRAPPED FUEL warning with the fuel quantity select knob out of NORM? Also, the easiest way to notice that the external tanks have stopped feeding is to check the internal wing tanks indicating less than 500 pounds.

• During a range orientation sortie for an upcoming ORI, one of the engine bearings failed, causing catastrophic engine failure. The pilot subsequently bailed out and experienced twisted risers—yes, it really happens!—another good reason not to eject below the minimum recommended altitude.

• This Viper's engine had FOD damage prior to takeoff which resulted in the loss of a fan blade and significant damage to the compressor section. The blade let go on departure, and the aircraft was not in a position to make a suitable landing runway. The pilot successfully ejected at 1,500 feet AGL.

• About 1 hour into a cross-country sortie, a fan blade failed from a FOD nick and damaged the compressor section. The engine rolled back below idle RPM. The pilot attempted to land at the nearest divert field. He elected to stay with the aircraft well below minimum ejection altitude in an attempt to avoid a densely populated area. The pilot ejected at 200 feet AGL and luckily landed in a tree, minimizing his injuries.

• On takeoff roll, the pilot couldn't get the jet to rotate and aborted at high speed. With no cable available, he ejected as the aircraft departed the runway surface. The pilot sustained major spinal injuries.

• While on climbout at medium altitude, the pilot heard numerous loud "pops" accompanied by smoke in the cockpit. He turned toward the nearest field but was not close enough to complete a flameout landing. The pilot successfully ejected.

Class B's

• This Viper got airborne with an improperly installed nose gear torque link pin. The result was the nose gear jammed inside the

continued on next page

On takeoff roll, the pilot couldn't get the jet to rotate and aborted at high speed. With no cable available, he ejected as the aircraft departed the runway surface. The pilot sustained major spinal injuries.

Engines. Engines. Engines. Any questions? Fan blades, turbine blades, bearings, etc. If I ran the zoo, I'd make darn sure my maintainers/jet engine mechanics were afforded every opportunity to succeed.

wheel well and would not extend. The aircraft safely landed and suffered significant damage to the centerline ECM pod and fuselage hardpoint stores.

• A Viper was taxiing to park when the crew chief noticed smoke coming from the radome. He directed the pilot to shut down. It turns out radar coolant was ignited by a faulty cannon plug.

• You want to talk unlucky? This poor guy got a HYD/OIL PRESS light and system B failure. Upon landing, he discovered he had no brakes due to an unrelated malfunction and then missed the departure end cable through no fault of his own! Turns out the brakes had failed after takeoff, the system B had a leak, and the cable (a US Navy variant) was mounted on top of a steel plate, the lip of which caused the hook to skip over the cable.

• During a touch-and-go, the pilot raised the landing gear (*and the flaps!*) very shortly after becoming airborne. Naturally, the jet lost lift and settled back down to the runway—*sans* landing gear. Afterburner taxi was disapproved. I know what you're all saying: "This couldn't happen to *me!*" Yeah, right....

• Here's one that could very well have been a Class A. Early on during the departure, the pilot felt and heard a loud "bang" followed by severe vibrations. He turned back to the nearest field and jettisoned his external stores. He successfully completed a flameout approach and landing.

USAF Photo by SSgt Andrew N. Dunaway, II

Concerns

Two areas are of great import to those of us who fly and maintain the world's best single-engine fighter: operator fatality and engine reliability.

Throughout the history of the Fighting Falcon, we've lost a big share of our "buds" to GLOC, spatial disorientation, and controlled flight into terrain. There is a fix in the works—Ground Collision Avoidance System (GCAS). It's already saved the life of a long-time friend of mine (test pilot type). Unfortunately, it will be a handful of years before a *manual* version makes it into the airplane. Until then, we still need to hammer home that the Pk of the ground is still 1.0 for those missions where it applies—ACBT, LOWAT, SA, SAT, LANTIRN—pretty much sounds like all of them!

Engines. Engines. Engines. Any questions? Fan blades, turbine blades, bearings, etc. If I ran the zoo, I'd make darn sure my maintainers/jet engine mechanics were afforded every opportunity to succeed. I challenge any of my brethren pilots out there to spend 16 minutes crammed in an intake carefully looking over 32 fan blades—when the outside air temperature is 110° and the jet just landed from the first go! Bring lots of water!

Well, that's all I've got. In closing, a quote from my long-time mentor, Foghorn Leghorn, that applies to flying and fixing the F-16:

"This is dangerous, son. Ya gotta know how to handle it. One wrong move and you're done for. Pay attention, son—this is for your own good. Ya gotta understand the scientific principle behind it. There's a right way and a wrong way!"

Craniums Up! Seeeee ya! ✈

•F-111

Official USAF Photo

LT COL (SEL) STEVE PRETESKA
HQ AFSC/SEFF

Alas, for all of us who thought that the reemergence of '70s' chic hip-hugger pants, thick-soled shoes, disco music, etc., would cast a new light on our favorite supersonic swing-wing star of the '70s and delay her retirement, we were obviously smoking (but not inhaling) something.

Introduced when the Monkees were hot and polyester was cool, the remaining portion of the bomb-dropping F-111 fleet was proudly retired this year, leaving the Ravens to do the jammin' job with capabilities unrivaled by any other aircraft (despite what the Navy says).

The 27th Fighter Wing, 53d Wing, and the 79th Test and Evaluation Group turned in an exceptional year—no fatalities, no Class B's, and only one Class A. Truly remarkable in light of the retirement and the deployment schedule. The one Class A ended with the loss of the aircraft and an eminently successful recovery of the crew, thanks mostly to the crew's handling of the EP.

Our mishap crew was on a night low-level training sortie. They noted light reflecting off the ground beneath the aircraft and were in the process of analyzing "what's wrong with this picture" when the right engine fire light illuminated. Trading airspeed for altitude, they were around 10,000 MSL when aircraft response became sluggish to flight control inputs. As control continued to rapidly degrade, the EWO responded to the A/C's direction and punched the crew out. There were no cockpit indications, other than the fire light, of any problems with the jet prior to when the A/C first noted the ground glow that turned out to be the jet doing its own version of "torching"! The capsule rolled upside down upon landing, and egress was hampered by the inability to open one canopy and a partial obstruction to the other side. Recovery of the crew was swift due to superb SAR efforts.

This emergency was handled well by all involved. Unfortunately, there is little more that maintenance or ops could have done to mitigate this mishap given what went wrong with the aircraft. As the Raven continues to support our national goals with its unique and vital qualities, it is important for those who maintain and fly the jet to take full advantage of the wisdom and knowledge that comes with hard-won experience. Stay in the books, watch out for one another, and don't leave the lava lamps in the cockpit. ✈

F-117A

LT COL TOM DYER
HQ AFSC/SEFM

As I sit down to write this article, a contingent of F-117A Stealth fighters has deployed to Kuwait to help keep Saddam Hussein in check. The aircraft flew from Holloman AFB to Kuwait during a 17-hour mission. The 49th Fighter Wing once again proves the value of constant training and preparation. They made the deployment look easy. Keep up the great work!

The F-117A had an excellent year during FY96. There were no Class A's, only one Class B, and four Class C mishaps. This is an impressive record. The Class B resulted from a failed power takeoff (PTO) shaft. The pilot did an excellent job of determining the proper emergency procedures to follow and recovered a valuable national resource. A job well done! The Class C mishaps involved a misrouted cross-bleed detector loop, failed oil pressure transducer, damage to a UHF antenna which occurred during air refueling, and failure of the right main landing gear upper scissor link. As can be seen, these are relatively minor mishaps, but it must always be remembered that a Class C mishap can be a precursor to a more serious and tragic Class A or Class B mishap. All who supervise, fly, or maintain aircraft must constantly be aware of the potential for a mishap even when there is little damage.

Official USAF Photo

From a historical perspective, there have been three Class A and three Class B mishaps in the F-117 world. This total includes only those mishaps since the aircraft officially came into the Air Force inventory. The Class A's include a bleed air leak which eventually caused the pilot to eject, an engine fire due to an engine manifold leak, and failure to recover from an unusual attitude. The Class B's include a brake failure on landing roll which caused damage upon barrier engagement, a lost canopy during flight, and the failed PTO shaft mentioned above.

The F-117A this year also experienced four foreign object damage (FOD) mishaps. Of note, two of the mishaps occurred when a scribe tool and a roll of tape were ingested during engine maintenance runs. Since the Safety Center has been keeping records (June 1992) for the F-117, there have been 16 FOD mishaps out of a total of 78 mishaps. Most of these mishaps occurred when the engine ingested a screw or bolt.

With the engines inside the fuselage, an extra effort must be made to inspect for loose objects or missing hardware before any engine run is attempted. This is not news to all those personnel who regularly work on or around this aircraft. However, the message must always be repeated and repeated. Very preventable mishaps can be avoided so that the Air Force, and ultimately the tax paying citizens, can save money.

In summary, FY96 was a good year for the Stealth fighter. Keep up the great work, and FLY SAFE! ✈

U-2

Official USAF Photo

LT COL TOM DYER
HQ AFSC/SEFM

During the early years of the U-2 program, the aircraft had mishaps. All of these mishaps were investigated, but the reports were limited in number. None were released to the general Air Force community nor were they put into the Safety Center's data base. Also, the flight hours accumulated per year were a closely guarded secret, so the ability to get an accurate mishap rate was very difficult.

However, since the U-2 program has been largely declassified, this information is now available. The information provided in the chart located in the statistical portion of this issue is accurate, but the early years should be viewed with a wary eye. This chart represents all of the mishaps the Air Force Safety Center is aware of and all of the flying time flown by the U-2 since 1963.

Note: For the years FY63 to FY69, there is no accurate information on flying hours for the U-2 aircraft.

It must be remembered the U-2 aircraft was designed and fielded during the height of the Cold War, and this aircraft was one of our most secret weapons. Also, the U-2 was designed over 40 years ago when there wasn't any computer-aided design, system safety was just a dream, and the technology was on the outer limits of the aircraft industry.

However, the U-2 has performed outstandingly against all these odds and has been called upon when the nation needed valuable information on various hot spots in the world. So the mishap rate may be higher compared to newer aircraft (F-15 and F-16) or against aircraft of the same era (B-52 or C-130). But these aircraft have gone through many, many changes during the years of their operation.

More recently (the last 5 years), the mishap rates have been relatively high. However, there is no one main reason for the increase in the mishap rate. This fact makes the management of the U-2 program difficult at best. The aircraft is being upgraded with a new engine and other components, but as the Chief of Staff has indicated, this weapon system is in the sunset of its career.

So where does this leave those in the wing, staff, and us here at the Safety Center with the responsibility of flying the aircraft, planning for the future, or monitoring the trends in mishaps? We all must redouble the effort in trying to make the aircraft as safe as possible. This could be a very tall order, but from the vantage point of the Sandia Mountains here in the "Land of Enchantment," I don't think this is an insurmountable task.

I know this is like preaching to the choir, but other aircraft in similar situations as the U-2 (B-52, KC-135, C-141) may be able to take a lesson from the mishap rate and spend some time reassessing all the many factors which make up their respective missions. If one mishap can be prevented by changing the mishap sequence of events, and this happened due to lessons learned from another aircraft's misfortune, then mishap prevention is served. Some may think of this as a morbid thought process, but it is one where everyone must be involved. An F-15 mishap generally does not have an impact on other aircraft (especially those nonfighter types), but this is no reason not to be aware of all the lessons learned and try to apply them to your specific aircraft. The U-2 has had its share of mishaps where the lessons learned can be applied to various aircraft.

I guess my bottom line is don't stick your head in the ground and think that other aircraft mishaps are not a concern of yours. It's your concern just from the standpoint the pilot/crew could be your friends and a valuable Air Force resource has been lost. But more important—**YOU** could be next! This is **NOT** what anyone wants.

So learn about all the mishaps whether they are your aircraft or not. Then, in the future, if you find yourself in a similar situation, the lessons from the past hopefully will help prevent a future tragedy. Fly Safe, and watch out for those around you. ✈

FY96 ENGINE-RELATED MISHAP SUMMARIES

MAJ DAVE WOOD
MR. BILL BRADFORD
HQ AFSC/SEFE

Introduction

Those of you who recall our engine article from last year will remember it was an unusual year for engines. Engine failures were involved in 38 percent of our Class A and 35 percent of our Class B mishaps in FY95. You may also recall us asking if this was just a statistical aberration or an indication of an emerging trend. While there were fewer engine-related mishaps this year, engines were still a major contributor to the Class A and B mishap rate (see figures 1 and 2).

Looking at the data more closely (see figure 3, page 40), we see more than half of our fighter/attack Class A mishaps were from engine failures. As expected, the F-16 led the way with five Class A's and one Class B. All five F-16 Class A's were destroyed aircraft. Although not good news, it was a better year than most for the F-16 from an engine standpoint. The F-15 came in second with three engine-related Class A's and one Class B. On non-fighter/ attack aircraft, tankers stand out with two KC-10 Class A's and one KC-135 Class B.

Peeling the onion back one more layer reveals some disturbing trends. Engine parts fail for one of three reasons: (1) the design is deficient, (2) the design is okay, but the part doesn't meet the design intent, or (3) the part wasn't properly maintained. Most engine part failures result in Class C mishaps. Those which lead to Class A or B mishaps do so because of the nature of the failure or because operator error was involved. Figure 4 (page 40) shows how many times each of these factors contributed to a Class A or B mishap. Note that each mishap may involve more than one factor. For example, a design deficiency may have existed that required a periodic inspection to keep it in check.

As was the case last year, design problems continue to be a major contributing factor. The sad fact is most of these were already recognized design deficiencies for which design solutions existed. Unfortunately, tight budgets have prevented or delayed incorporation of these fixes. So instead of designing out the problem, we're relying on field inspections to keep the fleet safe.

This leads to the second major factor in FY96—maintenance errors. These included factors such as missed inspections, inadequate troubleshooting, and failure to follow tech data. But before you start beating up on the maintenance community, understand their diligence has saved many more aircraft. One study on F100 and F110 engines estimates field inspections (borescope, ultrasonic, eddy current, etc.) have saved 503 aircraft! That's a pretty good batting average. However, it's come at a high price in maintenance man-hours. Figure 5 (page 40) shows the price in man-hours ACC paid to perform safety-related inspections on the F100 and F110 in calendar year '95. The projected reductions are based upon getting

some of the long-awaited design fixes incorporated. If not, high maintenance workloads will remain a fact of life, as will the occasional human error.

The following sections provide a summary of all the engine-related Class A and B mishaps this past year. The information provided here was extracted from either Part I of the Safety Investigation Report or from the AFI 51-503 Accident Investigation Report.

Do you have a concern about engine safety? We'd love to hear from you.

Maj Dave Wood	DSN 246-0991
Mr. Bill Bradford, GS-14	DSN 246-5657
Mr. Bob Bloomfield (GE)	DSN 246-0704
Mr. Rich Greenwood (P&W)	DSN 246-0739

F-16 Summary

Table 1 shows how we fared this year compared to FY95. Overall, we did better this year, due in part to the conversion of most F100-PW-200s to F100-PW-220Es. A similar upgrade has been proposed for the GE family of engines. The F110-GE-129 Digital Electronic Control (DEC) would be retrofit onto the F110-GE-100, eliminating most of the control system anomalies. Although a great idea, the DEC would not have prevented the three F110-GE-100 Class A mishaps this year. A summary of the Class A and B mishaps is provided for each engine model.

F100-PW-200 Engine

The oldest of the F-16 motors behaved itself this year. There were no Class A or B mishaps!

F100-PW-220/220E Engine

There was one Class A and one Class B mishap in FY96. The Class A occurred when a fourth-stage turbine blade liberated due to a fatigue crack in the attachment area. The aircraft lost power, and the pilot ejected successfully. This is one of those known design problems which we're trying to control via inspection. A robust blade and disk retrofit should start in mid 1997. In the meantime, improved inspection methods and procedures are being pursued.

The Class B mishap resulted in a dead-stick landing. If not for the skill of the pilot and the fact the engine failed within gliding distance of an airport, this would have been a Class A. While still under investigation, the failure appears to have originated in the third-stage turbine blade area. As a result of this and other third-stage turbine blade failures this year, the borescope inspection interval and tip shroud curl reject limits have been tightened. The final corrective action will be a redesigned third-stage turbine blade scheduled for production availability by mid 1997, along with the robust fourth-stage turbine blade and disk.

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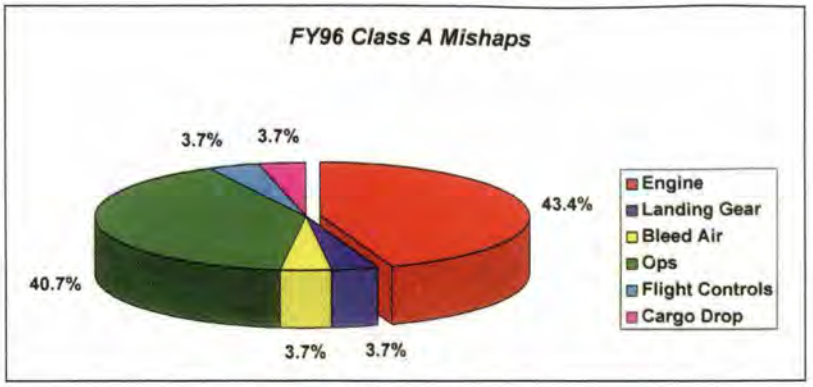

Figure 1

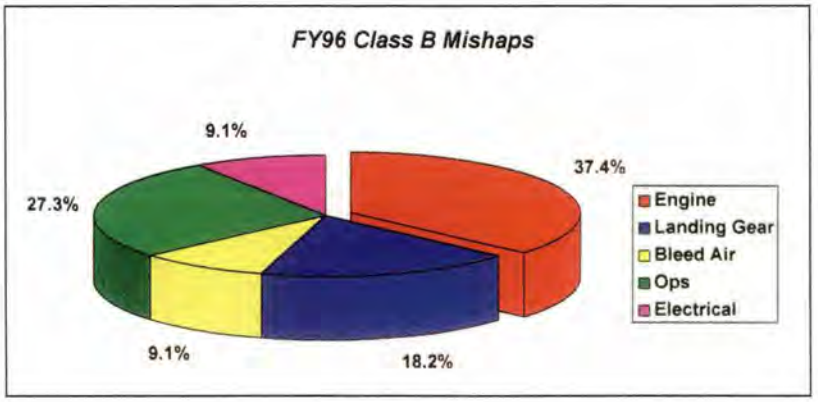

Figure 2

F-16 Engine Related Class A Mishap Statistics

Engine	FY 1995 Class A Mishaps	FY95 Rate	6 Qtr Rate End FY95	FY 1996 Class A Mishaps	FY96 Rate	6 Qtr Rate End FY96
F100-200	1	1.81	0.99	0	0	1.60
F100-220	2	1.81	1.24	1	0.87	1.72
F100-229	0	*	*	0	*	*
F110-100	2	1.30	1.41	3	2.12	1.73
F110-129	2	*	*	1	*	*
All Engines	7	1.86	—	5	1.46	—

*Insufficient flight hours on these engine models to compute a meaningful mishap rate.

Table 1

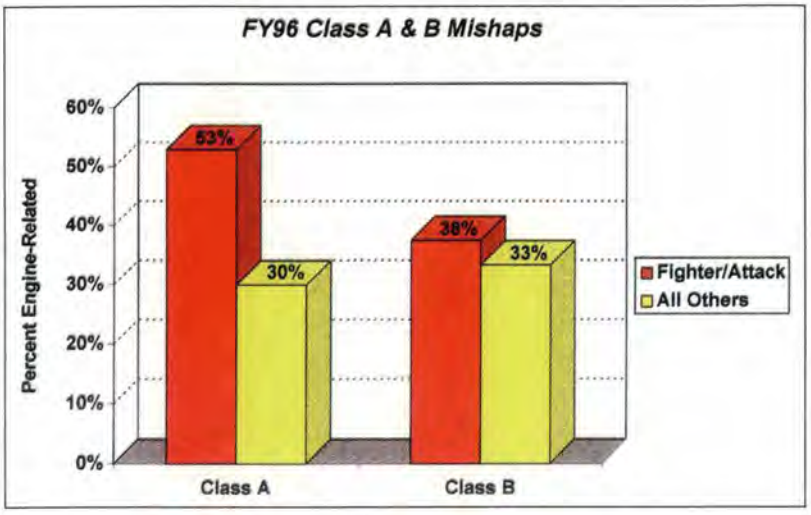

Figure 3

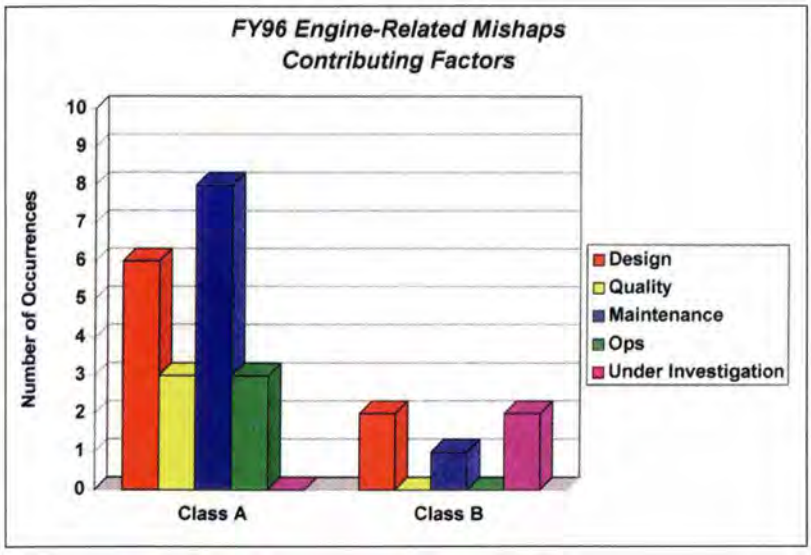

Figure 4

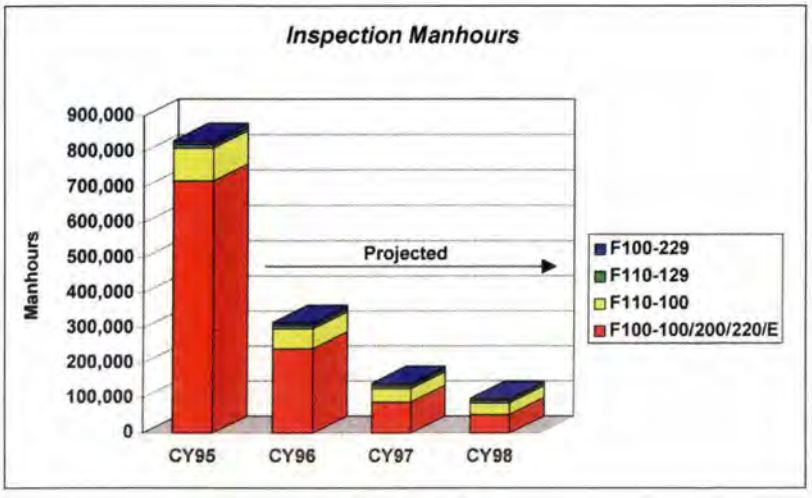

Figure 5

F100-PW-229 Engine

The -229 is still Class A-free. That's not to say there aren't problems, but aggressive action being taken by the Propulsion SPO and Pratt & Whitney, like the Falcon 229 Program, and a lot of hard work put in by our maintainers have kept the -229 fleet safe.

F110-GE-100 Engine

There were three Class A and no Class B mishaps in FY96. The first occurred when the No. 1 bearing failed. Unable to obtain usable thrust, the pilot ejected. A misalignment between the bearing housing and fan rotor shaft introduced a wobble in the rollers, eventually leading to failure of the cage and the rest of the bearing. A post-assembly run-out check was added to the T.O.s to catch any gross misalignment before returning any engine to service.

The second Class A was a catastrophic engine failure, this time due to a first-stage fan blade failure. Again, the pilot ejected safely. Investigation revealed a fatigue crack in one fan blade coming from an area which was previously blended. A one-time inspection of the fleet was performed. Blade blending procedures are being revised, as well as blend training programs. Additionally, increased emphasis is being placed on how inlet inspections are conducted. You flightline troops need to take a flashlight and mirror with you and make sure both the convex and concave sides of the fan blades are thoroughly inspected.

The third Class A was another catastrophic failure, occurring on takeoff. The pilot ejected safely, and the aircraft crashed on the departure end of the runway. The high pressure turbine (HPT) aft blade retainer liberated. Investigation revealed a defect in the HPT disk which allowed the retainer to creep and eventually fail in stress rupture. Other suspect disks have been removed from the inventory.

F110-GE-129 Engine

There was one F110-129 Class A and no Class B mishaps in FY96. A first-stage fan blade failed, forcing the pilot to divert to a commercial airport. He was unable to make the field and ejected at low altitude over a populated area. This is the fourth Class A mishap caused by a first-stage fan blade failure. The blade is being redesigned to be more FOD-tolerant. Incorporation is planned for the first 3000 TAC depot visit. In the meantime, maintainers need to carefully inspect for FOD.

F-15 Summary

F100-PW-100 Engine

Eagles with -100s experienced two Class A's and one Class B involving engine failures. The first Class A resulted from another familiar problem—No. 5 bearing bore fires. Fearing the fire would spread, the pilot rushed his landing. He landed fast and was forced to eject before running off the departure end of the runway. TCTO incorporation of the redesigned No. 5 bearing tubes and fittings continues. Further clarification on "black oil" inspection procedures were also added to the T.O.s

The second Class A began on a formation A/B takeoff. One of the engine's afterburners experienced a no- light, followed immediately by a hard light and stall. By the time the pilot realized the aircraft did not have sufficient power to lift off, it was too late. He ejected, and the aircraft crashed off the departure end of the runway. A leaky fuel control initiated the failure sequence. Revised flight manual procedures on A/B takeoff throttle technique and improved A/B anomaly troubleshooting procedures are being pursued. ACC is also revisiting whether the -100s should be upgraded to -220Es.

An F-15 ground aborted on takeoff after a third-stage fan disk lug failed, resulting in an uncontained third-stage fan blade liberation and a Class B mishap. The liberated blade caused a fire which was extinguished by the fire department. This is another known problem which is being controlled, although not always successfully, via inspection. Repetitive ultrasonic inspections of the disk lug is the No. 1 maintenance man-hour driver in the F100. Zero-time disks are being incorporated as fast as possible. This will buy about 1,800 cycles of inspection-free time. By then, we hope the redesigned disk and blade will be ready for depot incorporation.

F100-PW-220/220E Engine

An F-15 suffered a Class A mishap when the No. 5 bearing (here we go again!) in the No. 2 engine failed. The subsequent rotor eccentricity caused the third-stage turbine disk to fail. A portion of the disk penetrated the No. 1 engine, causing it to fail. By then, the pilot had run out of engines and had to eject. This is the first instance of a No. 5 bearing failure causing an uncontained disk failure. TCTO incorporation of the redesigned bearing continues at an accelerated pace. The T.O.s are being revised relative to oil consumption, and maintenance awareness briefings are being conducted on No. 5 bearing compartment maintenance and inspections.

F100-PW-229 Engine

As was the case on the F-16, the -229 did not cause any Class A or B mishaps in FY96.

F-111 Summary

An EF-111 caught fire, forcing the crew to eject. A secondary fuel manifold had developed a fatigue crack. The leaking fuel created a blowtorch, burned through the engine case into the nacelle, allowing the fire to spread to other systems. Unfortunately, the crew was unaware of the fire until it was too late. Years ago, the primary fuel manifolds were modified as a result of several mishaps. A similar modification is now being considered for the secondary manifolds. Changes to the nacelle fire detection system are also being contemplated.

USAF Photo by SSgt Steve Thurow

F-117 Summary

Shortly after takeoff, an F-117 developed problems. As he turned back to base, the left engine fire light illuminated. The pilot landed successfully and ground egressed. The PTO shaft between the F404-GE-F1D2 engine's accessory gearbox and the aircraft mounted accessory drive failed. New high-speed balancing procedures are being developed to ensure there's no imbalance in the system after assembly.

U-2 Summary

A U-2S, powered by an F118-GE-101, lost

continued on next page

One study on F100 and F110 engines estimates field inspections (borescope, ultrasonic, eddy current, etc.) have saved 503 aircraft! That's a pretty good batting average.

USAF Photo by MSgt Perry J. Heimer

power shortly after takeoff, resulting in a Class A. An engine restart was not completed. Either a restart or manual transfer to secondary control mode would likely have cleared the fault and restored normal power. As a result, the flight manual emergency procedures are being revised. Unlike its F110 cousin, the F118 will not automatically transfer to secondary when the engine goes sub-idle. A risk assessment is being conducted to determine the cost effectiveness of retrofitting the F118 with a digital engine control.

Austere defense budgets have forced the Air Force to make some tough choices. Force modernization programs, such as the F-22, B-2, and C-17, are being funded in lieu of fixing problems on our older weapon systems. The Air Force has tried to cope with this increased risk by relying on the maintenance community to "inspect in-safety" via more frequent engine inspections.

KC-10 Summary

The KC-10 community experienced two engine-related Class A mishaps in FY96. The first incident was a catastrophic uncontained failure of the No. 2 engine when it ingested a very large slab of ice during takeoff roll. The crew performed a successful abort and ground egressed. So where did this slab of ice come from? You guessed it! It was the No. 2 inlet. Inlet ice inspection procedures are being clarified for both maintainers and flight crews.

The second Class A was an in-flight oil fire in another No. 2 engine. The crew was unable to extinguish the fire, declared an IFE, landed uneventfully, and ground egressed. The 4R vent seal nut had been overtorqued during assembly, stretching the nut, causing it to disengage. Oil leaking into the bore ignited. The Air Force is going to accelerate incorporation of an improved material nut that will prevent a similar event. Improved T.O. guidance on oil consumption and "gulping" are also in the works to ensure maintainers and aircrews recognize lube system problems early.

USAF Photo by MSgt Perry J. Heimer

KC-135 Summary

A TF33-P-102 powered KC-135 suffered an engine fire shortly after takeoff. The fire was still burning after landing, and the crew emergency egressed. The cause of the engine fire is still under investigation.

Final Thoughts

Austere defense budgets have forced the Air Force to make some tough choices. Force modernization programs, such as the F-22, B-2, and C-17, are being funded in lieu of fixing problems on our older weapon systems. The Air Force has tried to cope with this increased risk by relying on the maintenance community to "inspect in-safety" via more frequent engine inspections. By and large, the maintainers have done an outstanding job. But we may have reached the point of diminishing returns. We may have so overtaxed the field with one inspection after another that human errors are on the rise. Some engine redesigns, most notably those on the F100 and F110, are being worked, but on an attrition basis. It will likely be several years before we see an appreciable drop in the inspection workload.

The authors wish to express their gratitude to Mr. Bob Bloomfield of General Electric and Mr. Rich Greenwood of Pratt & Whitney for their assistance in preparing this article, as well as their assistance year-round as part of the Air Force Safety Center propulsion team. ✈

TRAINERS/FY96

MAJ JEFF THOMAS
HQ AFSC/SEFF

"Eight's the rate for 58"

the April 1958 editorial in *Flying Safety* magazine proclaimed. Referring to the Air Force's goal of reducing to 8.00 Class A mishaps per 100,000 flying hours, the commentary went on to point out "Scoffers will say that a reduction of that magnitude is an impossible task. We must have 266 less major mishaps Air Force-wide [in 1958] than we did last year."

Obviously, 1958 is ancient history. Today, past mishap reduction efforts have allowed the emphasis to shift from 8.00 mishaps to 0.00 mishaps per 100,000 flying hours. Like 1958, scoffers have said reaching that goal is an impossible task. However, in the trainer community, you made significant progress towards making 0.00 Class A mishaps a reality in FY96. The T-37 and T-1 incurred no Class A mishaps in FY96, while the T-38 and T-3 communities experienced one Class A mishap each.

USAF Photo by SMSgt (Ret) Robert Wickley

T-37

As a famous watchmaker used to say, the T-37 "takes a licking and keeps on ticking." However, the end is in sight for the venerable old bird as a successor has finally been named to carry the baton into the next century. While the Tweet will finally get to enjoy a much-delayed retirement, it has soldiered on since the late 1950s to the tune of ***12 million flying hours.*** During that time period, the T-37 has been involved in 132 Class A mishaps for a lifetime rate of ***1.12 per 100,000 flying hours.***

To put 100,000 flying hours in perspective, the average SUPT wing currently flies approximately 24,000 T-37 hours per year (some higher, some lower). Given the mission of training "new to jets" students, a mishap rate of less than one Tweet Class A mishap per wing every 4 years is a real testament to the skill and professionalism of those who fly and maintain the "volks-wagonious subsonicious," as well as the aircraft's forgiving nature.

During its lifetime, the T-37 has suffered the aforementioned 132 Class A mishaps with 130 aircraft destroyed and 75 fatalities. Historically, since 1980, the rate of operator-caused Class A mishaps has exceeded logistics-caused mishaps two to one, with operator-induced loss of control as the leading cause factor. In fact, a logistics-caused T-37 Class A mishap hasn't occurred since FY92.

In FY96, the T-37 had no Class A mishaps for an overall rate of ***0.00.*** This isn't the first time the T-37 has gone a fiscal year without a Class A mishap (FYs 94, 91, 90, and 87 also come to mind) and is certainly a vast improvement over CY56's T-37 mishap rate of 149.25 (one mishap based on approximately 670 flying hours).

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While we've highlighted the increasing number of operator-caused Tweet Class A mishaps, you need to be aware the T-37 has developed some "quirks" as it approaches its "golden years" that require pilots and maintainers to be vigilant. Certain themes continue to recur in Class C mishap reports. See if this sounds familiar!

"There were 342 incidents reported...225 of these incidents involved engine flameouts/shutdowns." How about it, Tweet folks? Ring a bell? Thirty years ago, the T-37 *Aircraft Accident Summary* for 1966, published by the Directorate of Aerospace Safety, listed this as the No. 1 cause of Tweet reportables. The more things change, the more they remain the same. Of the ***83*** reported Class C mishaps in FY96, ***35*** involved engine flameouts.

USAF Photo by SSgt Andrew N. Dunaway, II

During the Talon's lifetime, there have been 189 Class A mishaps involving the T-38, resulting in 182 aircraft destroyed and 134 fatalities.

Historically, engine flameouts and the J-69 seem inseparable. Over the years, flameouts have been caused by operator techniques, material failures, and invariably, aging components. While no single cause factor has been pinpointed for the recent rash of flameouts, among the items being researched is the possibility that the introduction of JP-8 combined with cold winter temperatures may be a factor. In an attempt to isolate the problem, tests have recently been undertaken involving modifications to fuel controls in concert with the use of JP-8+100 on the same engines. Keep in mind that while maintenance folks are working hard to resolve the flameout issue, when material factors aren't involved, duplication of exact flight parameters (rate of throttle movement, pitch attitude, OAT, etc.) which existed at the time of the flameout make troubleshooting a difficult undertaking at best. Stay tuned!

No. 2 on the hit parade for the T-37 in terms of Class C mishaps was engine shutdowns. ***Twenty-eight*** shutdowns were reported in FY96, fully 50 percent of which involved oil pressure problems (fluctuating, zero, etc.).

The numerically gifted among you have by now no doubt spotted a trend in the T-37. Of the ***83*** reported Class C mishaps, ***62*** involved some type of engine problem/malfunction. Don't get me wrong — an intimate knowledge of all the aircraft systems and potential problems is important, but the situationally aware aviator would be particularly sharp when it comes to possible engine and associated system malfunctions, as well as proficient in single-engine procedures.

T-38

It's been almost 35 years since the first pilot training class (62F at Randolph AFB) earned their wings flying the T-38. In those years, a lot has transpired. Ford introduced the Mustang, disco came and went, men walked on the moon, and soft ice cream was introduced in Bermuda. The June 1959 issue of *Flying Safety* magazine attempted to forecast what would occur during the T-38's lifetime with the revelation that "chemically fueled bombers, a new generation of fighters and boost-glide vehicles are expected to go into service within the operational life span of the T-38." While not hitting the mark 100 percent, the implication that the T-38 would witness many changes was right on.

Having flown over ***11.9 million*** hours since first rolling off the assembly line, the "White Rocket" has logged an impressive overall mishap rate of ***1.58*** Class A mishaps per 100,000 flying hours. What makes this number even more impressive is that at the time of the aircraft's introduction, the Air Force estimated the T-38's loss rate would be 12 aircraft per 100,000 flying hours.

During the Talon's lifetime, there have been 189 Class A mishaps involving the T-38, resulting in 182 aircraft destroyed and 134 fatalities. Although historically operator-caused mishaps have outnumbered logistics-related mishaps almost two to one, recent experience has shown a change in the trend to reflect an increasing number of Class A mishaps due to compressor rotor

problems and bird strikes, with the last operator-caused Class A mishap occurring in FY91. To mitigate the former risk, the T-38 community is exploring the possibility, in the long term, of redesigning the disk or compressor, with an implementation date, if approved, in approximately 1998. The bird strike hazard is being reduced by acquisition of a new, more bird-resistant windscreen rated to 400 knots for a 4-pound bird as compared to the older windscreens' 210-knot, 4-pound limitation. Procurement and installation are expected to be completed fleet-wide in FY97.

One of the two Class A mishaps in the trainer community in FY96 involved a T-38, specifically an AT-38. According to the Accident Investigation Board, AFI 51-503 report, the "Smurf Jet" took off on a post-maintenance functional check flight. Upon reaching the assigned area and obtaining 350 knots at 20,000 feet, the mishap pilot (MP) began a 90-degree bank, left-hand turn using approximately 4 Gs. When the aircraft's airspeed dissipated to approximately 200 to 250 knots, the MP experienced a thumping sound toward the rear of the aircraft in conjunction with a "letting go sensation" in the aircraft. Simultaneous with these sensations, the aircraft failed to respond normally to control inputs.

After using rudder and full-stick deflection in an attempt to regain a wings-level attitude, the MP was only able to recover to 35 degrees of left bank with no less than a 5-degrees nose-high attitude. Checking his rearview mirrors, the MP noted a full nose-up stabilizer condition with no stabilizer reaction to stick inputs. Following a number of attempts to regain control of the aircraft (i.e., gear down, activation of the flaps, change of thrust, aggressively moving the stick from "stop to stop" in an attempt to break free something that might be jammed in the flight control system, etc.), the MP maneuvered the aircraft clear of populated areas and initiated a successful ejection at approximately 5,700 feet above the ground (6,000 feet MSL).

The Accident Investigation Board found the mishap was caused by the in-flight failure of a swaggered ball located on a cable end in the horizontal tail operating mechanism. This caused the horizontal tail surface to freeze (i.e., lock) in a trailing edge-up position (pitch-up) which resulted in the MP's control inputs to the surface to become ineffective. Due to the fact the ball was destroyed in the mishap, the board was unable to determine why the ball failed. Possibilities included corrosion and/or stress fracture. The board noted that failures of swaggered balls is extremely rare, with ALC personnel able to recall only one other failure in 30 years.

Like the T-37, the T-38 also has a recurring Class C mishap trend — engines. Of the 52 reported Class C events in FY96, 22 involved engine flameouts, while *16* involved engine shutdowns for various reasons. T-38 aviators know the J-85 has always been touchy when operated near the edge of the envelope, and as the engine ages and tolerances increase, will probably become more irritable. Factor the unquantified influence of recently introduced JP-8 fuel into the equation, and you can see the potential for the flameout problem to continue.

USAF Photo by SSgt Andrew N. Dunaway, II

Like the T-37, J-85 flameouts have historically been related to operator technique, material factors, and component age. And like J-69 flameout troubleshooting, when material factors aren't involved, duplication of exact flight parameters which existed at the time of the flameout make troubleshooting to find the exact cause a difficult undertaking. Operator techniques like monitoring throttle movements when near the edge of the envelope and paying attention to critical factors like OAT may help reduce the rate of unintentional single-engine operations. Like the T-37, the smart aviator would pay close attention to engines and their related systems, while maintaining proficiency, not just currency, in single-engine procedures.

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USAF Photo by MSgt Fernando Serna

FY96 was a banner year for the T-1A. With the last of 180 Jayhawks scheduled for delivery in June 1997, "in the inventory" aircraft soldiered through FY96 to the tune of approximately *44,000* flight hours without a Class A or Class B mishap. In fact, since its introduction, the T-1 has yet to incur a Class A or B mishap in approximately *134,000* flying hours for a lifetime rate of 0.00.

T-3

In FY96, the T-3 Firefly continued in its newly assigned role as the T-41 replacement workhorse of the Enhanced Flight Screening Program. Designed to improve the pilot candidate selection process by allowing the introduction of maneuvers and overhead patterns flown in SUPT, the 110-plus T-3s are flown at Hondo Airport, Texas, and the Air Force Academy. Since being introduced in FY94, the T-3 fleet has logged approximately ***52,000*** hours with two Class A's, for a lifetime rate of 3.80. The one Class A in FY96 occurred on the last day of the fiscal year at the Air Force Academy and, unfortunately, resulted in two fatalities. At the time of this article, the Safety Investigation Board was still continuing the investigation.

As in FY95, the vast majority of reportables involved uncommanded engine shutdowns on the ground pre- or post-mission. However, there were a handful of uncommanded engine shutdowns in flight at various points in the mission profile. Changes have been made in engine break-in, acceptance, setup and starting procedures, while fuel line shielding, oil cooler, and cowling modifications have been undertaken in an attempt to further mitigate the risk of engine stoppages. Despite these efforts, uncommanded engine shutdowns continue to plague the Firefly. As of the writing of this article, AETC is researching the hiring of an independent engineering firm to find the cause and provide solutions to the continuing shutdown problem believed to be associated with the integration of a bigger engine and associated systems (260 vs. 200 horsepower) installed in the Firefly.

A review of FY96 emergencies reveals several other "teething" problems with the aircraft. Brake abnormalities in the form of sponginess, excessive travel, and total loss of brake pressure are being addressed by a potential redesign of the brake system to include heavier pads, redesigned master cylinder, etc. Deficient parts were found in the master cylinder and replaced, but this didn't prove to be the solution for all the Firefly's stopping problems. As of the date of this writing, student solos have been removed from the syllabus until the brake problems are resolved.

Lastly, erroneous oil temperature and pressure indications are being addressed in the form of an engineering analysis to convert the oil temperature/pressure system to a direct reading system from the current method which has suffered an extremely low reliability rate with regards to the sending units.

In summary, the T-3 may seem an innocuous aircraft due to its slower performance and simpler systems than other Air Force aircraft. However, those who fly and maintain the Firefly need to be mindful that it has the same mishap potential as any other higher performance Air Force aircraft.

T-1

FY96 was a banner year for the T-1A. With the last of 180 Jayhawks scheduled for delivery in June 1997, "in the inventory" aircraft soldiered through FY96 to the tune of approximately ***44,000*** flight hours without a Class A or Class B mishap. In fact, since its introduction, the T-1 has yet to incur a Class A or B mishap in approximately ***134,000*** flying hours for a lifetime rate of 0.00. Like the T-3, the T-1 is stepping up to its newly

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assigned role in the trainer environment. As with any new aircraft, the Jayhawk is currently solving what minor bugs exist and can be considered a real success story in the "white jet" community.

There were only ***six*** Class C mishaps in the T-1 in FY96, three of which were engine related. Interestingly, ***two of the three engine*** problems involved operator error as the engines were inadvertently shut down. AETC is currently undertaking a study to determine if a redesigned throttle quadrant is warranted, but given the factors involved in the two operator-related engine shutdowns, this isn't likely to occur.

As was iterated in FY94's trainer review article, the T-1A is a "missionized" version of the Beechjet 400A commercial business jet modified to be used as an airlift/tanker trainer. Unlike a business jet, which cruises primarily at high altitude, the T-1 spends a great deal of time in the low altitude environment flying instrument approaches and syllabus-directed low levels. This places the aircraft in surroundings much more susceptible to bird strikes than its "nonmissionized" cousin. While the Jayhawk managed to avoid any bird strikes that resulted in reportable damage during FY96, the threat is still, and will continue to be, very high. The Air Force typically records approximately 2,500 reported bird strikes annually, and while T-1 specifications called for an aircraft capable of incurring a 4-pound bird strike at 330 knots and 500 feet without "catastrophic loss of aircraft," dual engine failure due to bird ingestion could ruin your whole day. Keep your eyes outside, your head on a swivel, and know the bird-strike potential whether in the pattern or enjoying the sights low level.

Starting in FY97, one major upgrade slated for the Jayhawk is the addition of the Global Positioning System. This will result in the highly automated T-1 becoming even more computerized. Due to the high degree of computerization present in the Jayhawk, the potential for "automation confusion" exists when you've called up a function that doesn't look familiar or with which you're not very proficient. In fact, a study undertaken by the Royal Air Force Institute of Aviation Medicine with regard to pilots' attitudes about flight deck automation found the issues of "What's it doing now?" and "How do I get this thing to work?" as often stated concerns when dealing with modern glass cockpits.

Remember, automation has not changed the fundamentals of airmanship: *Fly the aircraft first!* Don't let all cockpit crewmembers (jump seat included) be "heads down" trying to resolve some unintelligible display or trying to figure out how to program/reprogram the Flight Management System (FMS). "One pilot handles the FMS, the other handles the aircraft" needs continuing emphasis during briefings and training due to the potential for the above-highlighted automation dilemmas. ✈

USAF Photo by MSgt Fernando Serna

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If a pilot buries his head in the cockpit, sooner or later someone else will have to dispose of the rest of him.

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