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This Issue:

Correction: In the October issue of *Flying Safety*, the story "Silent Flight" should have had the byline listed as "Anonymous." It is not the personal experience of Major Noel Bradford, who sent us the story.

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

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MESSAGE From the Chief of Safety

FY02: A SOBERING YEAR
A SUMMARY OF USAF FLIGHT MISHAPS IN FY02

FY02 was an incredibly challenging year for the nation and our Air Force, and we should all be extremely proud of our contributions around the world. Simultaneously supporting Operations ENDURING FREEDOM, NOBLE EAGLE, NORTHERN WATCH and SOUTHERN WATCH, as well as continuing operations throughout the world, posed tremendous challenges to our expeditionary capabilities, and the men and women of the United States Air Force acquitted themselves with the skill, determination and professionalism our nation expects. Well done!

We closed FY02 having flown over 2.3 million hours, 200,000 more than we flew last year. From a safety perspective, however, FY02 proved to be a sobering year. The Air Force suffered 35 Class A aircraft flight mishaps last year—almost one every 10 days—and destroyed 19 AF aircraft, at an estimated cost of $789.3 million. This is an alarming 46 percent increase over the 24 Class A mishaps we experienced in FY01. Nine of these were helicopter mishaps, compared with zero in FY01! This equates to a Class A mishap rate (mishaps per 100,000 flying hours) of 1.52, the second highest in the last 10 years, compared with 1.16 last year. Tragically, we lost 22 invaluable members of our Air Force family in aviation mishaps, compared with nine in FY01—and we were lucky we didn't lose twice that number. Our performance in FY02 represents an unacceptable and unsustainable loss of our combat capability, and demands our attention right now!

It would be easy, and convenient, to attribute this year's safety record to the global war on terror and an increased operations tempo. That assessment, however, would miss the mark. We did experience 12 mishaps this year during combat or combat support missions, with eight of these mishaps occurring in support of Operation ENDURING FREEDOM. None of these mishaps were directly attributable to enemy action. Of our 35 mishaps, 24 were categorized as "operations" mishaps, as were all nine of the helicopter mishaps. As usual, we remain our own worst enemy. We have been the problem in the majority of our major mishaps this year—and now we must become the solution.

The past year's mishaps are littered with the old bugaboos of the past: shortcuts around Technical Order guidelines or violations of time-tested operational procedures in the name of expediency; poor decisions in the cockpit, on the flight deck or on the ramp; and just plain-old poor risk management decisions. These mishaps lead me to ask three very basic but related questions. First, is leadership an issue in our mishaps? Second, is accountability an issue? And third, do we truly understand risk management principles? As you read the year-end summaries that follow, I ask you to keep these questions in mind.

We also need to remember these basic questions as we continue our demanding operations tempo around the globe. Every warfighter, whether in a flight suit or BDUs, needs to refocus on the basics—in combat, support or training operations—to preserve our precious combat capability. Sound, practical risk management decisions will be critical to our success at every level—from mission planning to the Ops Desk to the cockpit, both in peacetime and combat. We must continue to undertake some missions even when we know the risks are high—that is the nature of our business. But these occasions should be rare. Let's not continue to be our own worst enemy and pose a higher threat to ourselves than the real enemy does. We must challenge and thoroughly evaluate mission planning and execution decisions that minimize the margin of error. We must constantly evaluate prospective operations and weigh the risks to our aircrews versus the benefit gained by flying a mission right now—even in combat. No mishap or fatality is worth pushing the envelope when there is another way, or another time.

The United States Air Force will continue to be challenged as we support our nation's objectives around the world. Whether executing our part of the global war on terror, supporting contingency operations around the world or training at home, let us work smartly to preserve our nation's treasure. Godspeed, and fly safe. H H

Major General Kenneth W. Hess, USAF Chief of Safety

F-16

Overall, this was an outstanding safety year for the mighty Viper.

LT COL RICHARD J. "MOSES" BURGESS
HQ AFSC/SEFF

The F-16 had an outstanding year from a safety perspective—arguably the best ever! There were seven F-16 Class A mishaps in FY02—the lowest number in 21 years (since 1981). In 1981, however, the F-16 was still ramping up operationally and only flew 56,000 hours. Most significant is the Viper Class A mishap rate for FY02. Based on 344,809 estimated flight hours for the F-16 in FY02 (final computations for FY02 will not be completed until a later date), the mishap rate was 2.03. This is the lowest ever for the F-16! Comparing back to 1981 when there were only five Class As, the mishap rate was a whopping 8.86. Keeping the big picture in perspective, it was a great year but unfortunately we lost two Viper brethren in fatal mishaps. Two of the seven Class A mishaps were engine-related—one a GE-110 motor and one a GE-129. So, overall, this was an outstanding safety year for the mighty Viper. Let's take a look at the specific mishaps and see what we can learn from them.

Class A Mishaps

Here's a summary of the FY02 F-16 Class A mishaps: one failed nose tire during takeoff, one main landing gear collapse on landing, one loss of control after an overshoot from a flight rejoin, two nighttime controlled flights into terrain (CFIT), each resulting in pilot fatalities, and two catastrophic engine failures.

• F-16 CG Nose wheel tire failure on takeoff. During takeoff roll for a night two-ship flight lead upgrade sortie, at 126 KIAS the nose tire of the mishap aircraft (MA) failed catastrophically and created a phenomenon known as reverse castering. The mishap pilot (MP), perceiving he had an engine malfunction, aborted the takeoff. The nosewheel steering was rendered inoperative, and with no directional control capability the MP was unable to keep the MA on the runway. As the MA neared the painted runway edge stripe at a 30-45 degree angle, the MP elected to eject. MP sustained minor injuries during the ejection. The MA departed the prepared surface, continued across an unused taxiway and came to a full stop after catching the right wingtip in soft ground and sustained major damage.

• F-16C landing gear failure after a hard landing. Following a day syllabus surface attack training mission, the mishap flight (MF) of four F-16s entered the traffic pattern for a standard overhead pattern with a right break. MP was number four in the formation and was observed to have pitched out slightly early, but corrected his position by extending his downwind leg. MP rolled out on final at 177 KIAS, slightly faster than the preceding aircraft. MP appeared to have maintained required minimum separation from the preceding aircraft and crossed the threshold at 20 feet AGL and 148 KIAS. At approximately 10 feet AGL, the MA's right wing suddenly dropped. MP attempted to level the wings but the wings dropped a second time and the MA aircraft touched down asymmetrically, right wheel first. Upon impact, the right main landing gear shock strut piston failed, followed by bulkhead pivot joints. Subsequently the right main gear folded outwards and under the right wing tank. The MA settled to the right and slid down the runway for approximately 6500 feet before departing the right side of the runway. The MP safely ejected as the MA departed the runway. The MA came to rest approximately 375 feet from runway centerline and sustained major damage. The Accident Investigation Board (AIB) determined that the MA encountered wake turbulence. The MP attempted to level the wings of the MA and flare, but the wake turbulence produced a roll and downward vector he was unable to overcome.

USAF Photo

• F-16C departure from controlled flight. Following the completion of a day Basic Surface Attack training mission, the MP, number two in the three-ship formation, was attempting to rejoin to visual formation. During the rejoin, the MP used AB while rapidly climbing in a nose-high position. The MP realized he had excessive overtake with the lead aircraft and aggressively applied additional G forces to control the overtake. Unable to control the closure with G, the MP executed an overshoot procedure. MP failed to follow normal overshoot procedures IAW AFTTP 3-3V5. As the MP attempted to relax G forces on the aircraft during the overshoot, he inadvertently applied too much forward stick pressure, resulting in a negative G flight situation. After approximately five seconds of unsuccessfully attempting to regain positive G flight, the MA's nose began to drop and roll slowly to the left. The MP, realizing he was below the minimum uncontrolled ejection altitude and perceiving the aircraft was not responding to control stick inputs, ejected at 4500 feet AGL and 425 KIAS and sustained minor injuries.

• F-16CJ controlled flight into terrain (CFIT). The MP was number three of a four-ship formation conducting a night (non-NVG) tactical intercept training mission. Following several uneventful intercepts, MP reached BINGO fuel before other flight members and departed the training airspace single-ship to

Wake turbulence produced a roll and downward vector he was unable to overcome.

The pilot experienced a violent thump and severe airframe vibrations which threw him laterally in the cockpit.

RTB. MP proceeded to the IAF and was cleared for the ILS approach. MP contacted GCA and was asked by the radar approach controller if he could accept a PAR for training purposes. The MP answered in the affirmative. The weather provided to the pilot during arrival was an inaccurate PIREP for an aircraft breaking out at 3000 feet AGL with two miles visibility. The weather on final approach at the time of the mishap was a 500-foot AGL ceiling, visibility four miles with light rain. MP contacted the Radar Final Controller (a trainee under supervision) and confirmed two-way radio communication. The MP drifted right of course on a heading of 232 degrees slightly less than four miles from touchdown, and the Final Controller trainee instructed the MP to turn left to a heading of 236 degrees. The MP turned to a heading of 236 degrees, which was a right turn, putting him further right of course. At three miles from touchdown the Final Controller directed a left turn back toward course centerline. Immediately afterward, the controller notified the MP that he was too far right of course and that if the runway approach lights were not in sight to execute local climbout. MP acknowledged this radio call with his callsign. Data collected from the Crash Survivable Flight Data Recorder (CSFDR) indicate that the MP increased his dive angle with a .7 G pushover, descending from 1100 feet AGL to 900 feet AGL and simultaneously used 19 degrees of bank to turn left toward centerline and then slightly reduced power. MP increased his flight path angle to 11 degrees (PAR glide path angle of descent was three degrees) and achieved descent rates between 3800 and 4700 feet per minute. MP began to pull the nose up from a maximum of 14 degrees and MA impacted the ground two seconds later, 1.9 NM short of the runway, right of centerline. MA was destroyed and the MP was fatally injured with no apparent attempt to eject.

• F-16CJ Engine Failure (GE-129). The mishap occurred during a day MQT BFM upgrade sortie for the MP. Following an uneventful takeoff, departure, area entry and G-awareness exercise, the MF was maneuvering in the area to set up for a simulated missile and gun employment exercise. Approximately two-thirds of the way through a turn, MP experienced a violent thump and severe airframe vibrations which threw him laterally in the cockpit. MP also heard grinding metal sounds emanating from the engine area. MP turned the MA toward land, emergency jettisoned his centerline tank and informed his FL of his situation. MP attempted four engine restarts, all unsuccessful. Nearing the shoreline MP noticed several homes and cultural buildups, so he decided to turn and parallel the shoreline. MP successfully ejected at approximately 2000 feet AGL and 180 KIAS. The MA impacted the water and was destroyed, and a local fishing vessel safely recovered the MP. MP experienced mild hypothermia due to water leaks in his anti-exposure suit. The AIB said the engine experienced a fatigue crack in one high pressure turbine blade which subsequently liberated, causing catastrophic high and low pressure turbine blade failure.

• F-16C Engine Flameout (GE-110). This mishap is still under investigation at the time of printing. The mishap sortie was a day two-ship Basic Surface Attack mission to the range. During a climbing safe escape maneuver after a HADB pass, MA experienced engine flameout. MP attempted a flameout approach and landing to the nearest airfield and was unable to reach the runway. MP safely ejected, sustaining minor injuries, and the MA was destroyed upon ground impact.

• F-16C flight into terrain. This mishap is still under investigation at the time of printing. MP was number three of a three-ship night Red Air (non-NVG) support mission for a 4V3 NVG syllabus upgrade sortie. MA impacted the ground. MA was destroyed and MP was fatally injured.

Class B Mishaps

The F-16 experienced 12 total Class B mishaps ($200,000 to $1 million) in FY 02, but I will only comment on the three that were Flight or Flight Related.

• F-16C main landing gear tire failure. Following a three-ship opposed Surface Attack mission, the MP landed the MA. During the landing, both main gear tires failed and the aircraft began to fishtail. The main gear tires were stripped clear of the rims as the MA slid down the length of the runway on seized rims. A small fire in the gear area ignited as a result of leaking hydraulic fluid and sparks. The MA engaged the BAK-13 departure end cable and came to a stop on the runway. The fire was extinguished by fire response personnel and the MP egressed without incident.

• F-16CG engine overheat (PW-220). Following a HADB pass during a Surface Attack mission, the MP selected AB and began a threat reaction maneuver. MP then began a descent for a follow-on attack when the cockpit engine overheat light illuminated. MP reduced the throttle setting and began a climb toward the emergency airfield. Enroute to the emergency airfield, the overheat light illuminated several times and then extinguished each time. MP jettisoned his ordnance and proceeded to a straight-in flameout approach to the auxiliary airfield. MP flew the straight-in approach with the throttle at a minimum setting and the light extinguished for the final time at two NM on final. MA touched down 3500 feet down the runway, engaged the departure end cable at 112 KIAS and came to a stop prior to the end of the runway. Emergency response teams arrived, and the MP shut down the aircraft and egressed uneventfully.

• F-16CJ engine malfunction (GE-100). After initial takeoff for a local training sortie, MP retarded the throttle from AB to MIL. The mishap engine #1 bearing failed shortly thereafter due to oil starvation. MP felt vibrations and thumping, and the engine automatically transferred to SEC. The engine experienced a compressor stall, accompanied by a significant loss of thrust. MP zoomed the MA, initiated a turn back toward the field and jettisoned the external stores, which landed in a field and were destroyed. MP climbed, flew to a base key position, lowered the gear normally and landed the MA via a simulated flameout pattern with the engine still operating. MP engaged the departure end cable with 2500 feet remaining, shut down the MA and egressed without incident.

Lessons Learned

There are a couple of lessons I think we in the Viper community can take away from these mishaps. First, a sober reminder about the inherent risks of flying at night. Three of this year's F-16 Class As happened during night training sorties. Two of these resulted in pilot fatalities. Lesson learned? Night can kill you! Stay with the basics, with heavy emphasis on relying on a thorough instrument crosscheck. Use every system available to keep SA in the cockpit. Even though you've done several PARs in the weather or night air-to-air abort maneuvers in the simulator or in the air, each one demands full attention due to limited visual cues.

The second lesson learned is the mishap potential—with little decision time available—during takeoff or landing phase. This year we had one nose wheel fail during takeoff and one main landing gear fail during landing—both resulting in destroyed aircraft, and fortunately no lives lost. We all need to have an immediate game plan in mind every time we take off or land. Prior to taking the runway for takeoff we should do one last review of our "what if" game plan—aborts, no-brain ejection situations, and decisions to continue. The landing phase also needs added attention for potential gear or brake problems, slick runways or nosewheel steering problems. I also encourage SOFs and supervisors to stay on top of Base Ops to do additional runway FOD checks at night—maybe twice as frequently as during the day.

The third lesson learned from this year's mishaps is the importance of having an immediate gameplan in mind for an airborne engine failure situation. This year Viper pilots and flight members made some outstanding decisions handling critical engine malfunctions—my hat's off to them and those who trained them. This is another situation we can train for over and over again in the UTD or simulator. Low altitude, high altitude, within gliding distance of the runway, right on the edge of one-to-one, restart attempts, use of our wingmen for SA and checklist items, and finally—ejection decisions.

Congratulations for a great year in the Viper, and let's continue to ensure the enemy doesn't get much sleep in FY03.

Use every system available to keep SA in the cockpit.

A-10

USAF Photo

LT COL RICHARD J. "MOSES" BURGESS
HQ AFSC/SEFF

From a safety perspective, FY02 was both a good and bad year for the mighty Warthog. The positive side was that mishap rates were better than historical averages, but the negative side is that we lost two Hog brethren in fatal mishaps. Over the 30 years the A-10 has been in the inventory, 96 Hogs have been destroyed in non-combat mishaps. This is an average of 3.2 mishaps per year over the life of the Hog, or a lifetime rate of 2.40 mishaps per 100,000 flying hours. In the last 10 years the numbers are slightly better. Since 1992 we've had 25 A-10 Class A mishaps or 2.5 per year, and a mishap rate of 1.86 Class As for every 100,000 hours flown. The two Class As in FY02 are below historical averages and the FY02 mishap rate of 1.72 is lower than both the 10- and 30-year averages. The two fatalities in the A-10 in FY02 were double the average—one pilot fatality per year—over the last 10 years. The Hog also experienced seven Class B mishaps in FY02. Let's take a look at some of these mishaps and see what we can learn from them.

Both fatalities this year involved fully functioning A-10s running into something.

Class A Mishaps

The two A-10 Class A mishaps in FY02 resulted in two pilot fatalities—one from a midair collision between fighter and FAC-A during a CAS training mission over the Arizona ranges, and one a flight into terrain mishap during a multi-national composite force interdiction training sortie.

• A-10 (fighter) midair with A-10 (FAC-A). The mishap sortie was the third sortie of a planned hot-pit surge for the mishap pilots. Upon arrival in the training airspace for the close air support training mission, and throughout the tactical portion of the mishap sortie, the A-10 FAC-A (single ship) established deconfliction measures consisting of vertical (altitude), lateral (geographic), or both with the A-10 fighter aircraft (two ship). The first two close air support attacks were uneventful. Prior to the fighters' third attack the fighter flight lead and the FAC-A had a midair collision. Both aircraft were rendered unflyable. The FAC-A successfully ejected and was recovered by search and rescue assets, and the mishap flight lead was fatally injured. Both aircraft were destroyed upon ground impact.

• A-10 flight into terrain. The A-10 flight lead (mishap pilot) and A-10 wingman were part of a multi-national composite force interdiction mission and were tasked against a target in the French Polygone airspace, an electronic combat range. The mishap flight planned a low altitude ingress at 500 feet AGL with a fly-up 7 NM from the target for a 30-degree dive bomb delivery. During the planned attack the mishap aircraft (flight lead) impacted the ground. The pilot was fatally injured and the aircraft was destroyed.

Class B Mishaps

The A-10 experienced seven total Class B mishaps ($200,000 to $1 million) in FY02. This is the fourth highest number of Class Bs in the Hog's 30-year history.

• A-10 compressor stall, overtemp. During a BFM MQT sortie, the mishap aircraft was flown into a slow speed, high AOA flight regime. The MA experienced a compressor stall with high ITT indications. The MP shut down the mishap engine and flew an uneventful single engine approach and landing.

• A-10 engine damage. During routine post-flight maintenance, inspection revealed Turbine Engine Monitoring System (TEMS) reporting. Further inspection revealed damage to high and low pressure turbine blades and was determined to be non-FOD related.

• A-10 ammo (30 mm TP) exploded in the gun during strafe pass. The mishap sortie was a 2-ship Air Strike control upgrade sortie. The mishap flight made several attacks on targets while awaiting the arrival of dedicated fighter assets. Following BDU-33 bombing deliveries, the MP set up for a two-target high-angle strafe pass. The first burst was uneventful. During the second strafe burst, a 30 mm TP round exploded in the gun housing, causing the Gun Unsafe light to illuminate. Following a knock-it-off call, the mishap wingman rejoined and found extensive damage to the aircraft. MP landed the aircraft uneventfully.

• A-10 engine damage. During an A-10 BFM engagement, the mishap engine experienced an unrecoverable stall. MP shut down the engine and diverted to an emergency airfield and executed an uneventful single-engine approach and landing.

• A-10 engine damage. Following an uneventful Basic Surface Attack mission, the MP landed the MA. MP exited the runway and at an undetermined time the MA experienced an engine malfunction causing high ITT. MP followed the boldface for engine fire on the ground, shutting down the mishap engine, then shut down the other engine normally. MP ground egressed without further incident.

• A-10 engine damage. Mishap aircraft experienced #1 engine fire and overtemp indications. No further information available.

• A-10 engine damage, compressor stall. During a day weapons pass, MA experienced a #2 engine compressor stall. MP shut down the engine and recovered uneventfully at an auxiliary airfield via a single-engine approach and landing.

Lessons Learned

Here are a couple of things we can take away from mishaps over the last year. First, from this year's Class A mishaps we are reminded of the importance of airspace deconfliction and visual lookout in the front quadrant of the jet. Whether it's during medium altitude CAS or a tree-top interdiction ingress, we've got to keep SA on what's in front of us, or about to be in front of us in the next few seconds. Both fatalities this year involved fully functioning A-10s running into something: one running into another A-10 during medium altitude CAS and one running into the ground during a low level attack.

Second, pilots and their wingmen are doing outstanding jobs handling engine-related emergencies. Six of the seven Class Bs involved serious engine damage, and all six jets were recovered uneventfully. We need to continue to focus emergency procedure training on these types of mishaps and have a solid gameplan in mind every time we fly.

A single-engine approach and landing are not "normal" by any stretch, so table top, 1-G discussions about yaw rates, flight parameters and cockpit indications are invaluable. Time and gas should also be allocated for training for these contingencies whenever possible. Congratulations to Hog drivers all over the world for another year of successfully instilling fear into the hearts and minds of enemy tank drivers and ground forces. Fly safe and have a great year!

Six of the seven Class Bs involved serious engine damage.

C-135/KC-

The C-135 community did not experience any Class A Flight mishaps.

MAJOR JOEL HARVEAUX
HQ AFSC/SEFF

FY02 was another busy year in the C-135 and KC-10 communities. As fortune and hard work would have it, we continued a positive trend with no loss of life or lost airframes! This year had its share of challenges with Operation ENDURING FREEDOM being in full swing. A lot has been happening, and there is a lot to learn from the events of this past year. Due to safety privileged information it's often difficult, if not impossible, to discuss details and causes for many mishaps, particularly in a public forum like this. I encourage you to visit your local Flight Safety Office and take a look at the mishap messages related to the following accounts.

As you go about your busier than usual life with all the new deployments, keep yourself sharp and alert. Invest yourself fully in your training sorties and simulators when you can get them. Do everything you can to hedge your bets when it comes to the safe operation of your airframe. You never know when you could become intimately familiar with an incident similar to one of these that your peers had to deal with.

C-135

The C-135 community did not experience any Class A Flight mishaps, but did experience four Class B mishaps, 15 Class C mishaps, 23 Class E events (four of them physiological) and six HAPs.

All four Class Bs involved engines.

—On an FCF flight at the end of PDM, the mishap crew (MC) experienced a fire in the No. 2 engine strut. The MC shut down the engine, but the fire continued. The MC also noticed loss of the left hydraulic system. They were met by the fire department upon landing. The MC egressed the aircraft while the fire department extinguished the fire.

—During air refueling (AR) a vibration/shudder was felt throughout the aircraft. Safe separation was obtained from the receiver, and the MC noticed No. 1 engine instruments rolling back. They shut the engine down and diverted. The engine had suffered a No. 4 bearing failure.

—On a Coronet East mission, the MC noticed the No. 1 engine roll back with an accompanying loss of thrust. The MC shut down the engine and recovered to their destination base uneventfully. Maintenance discovered damage to the sixth, seventh and eighth stage compressor blades.

-10

USAF Photo

—Significant FOD damage to the No. 2 engine was discovered on the post-flight inspection following a local mission.

Of the 15 Class C mishaps, four involved AR, four were abort-related, three involved landing with the boom/WARP-hose (Wing Air Refueling Pod) in trail, and four were due to miscellaneous reasons.

—During night AR, an F-117 got too close to the tanker. The mishap boom operator (MBO) triggered a disconnect and retracted the boom. Upon landing, damage was found to the boom ice shield.

—An erratic heavy receiver reached his inner and lower limit simultaneously. The MBO triggered a disconnect and called for a breakaway. As the tanker accelerated and the receiver slipped aft, boom separation could not be affected and a brute force disconnect occurred.

—Following a breakaway during a C-17 AR, a brute force disconnect was sustained.

—During a night C-17 refueling, the receiver contacted and damaged the ice shield.

—There were four significant high-speed aborts resulting in aircraft damage. All involved multiple fuse plugs blowing and deflating tires due to hot brakes. One occurred following an engine overtemp, one following a birdstrike, one following multiple warning lights on the bleed air panel, and one for a warning horn sounding (undetermined reason) during a touch-and-go. In one instance, an unrelated crew entry door malfunction necessitated use of an alternate egress route by the crew and passengers.

—Following an AR, the MBO and mishap instructor boom operator were unable to latch the boom in the stowed position. The MC ran the applicable checklists, and then tried several alternate techniques. Nothing succeeded in latching the boom, and they landed with the boom in trail.

—During WARP AR, the MBO noticed a momentary "Ram Air Turbine Overspeed" light followed by a continuous "Pod Failed" light. The MC consulted with Boeing and tried multiple attempts to rewind the WARP hose without success. Ultimately they landed with the hose in trail.

—During contact, a receiver got forward in the envelope. The receiver continued forward and down to where the boom hoist cable was fully extended. The cable failed under the load.

—Following a disconnect, a receiver notified the MC there were flames, heavy smoke, and fluid coming from the boom ice shield. The severity seemed to increase as the boom was retracted, although flames were no longer seen. A depletion of the right hydraulic system was also noted. The MC landed with the boom in trail.

—One crew experienced a scraped No. 3 engine pod during a night landing.

—One crew noticed a climbing oil temp that eventually exceeded limits and required the engine to be shut down. In the course of the shutdown, the engine fire light and thrust reverser light illuminated, and smoke trailed the engine briefly. The fire light went out and the MC recovered uneventfully. A fuel leak caused by other factors resulted in this incident.

—One APU ingested a starter nozzle a couple of weeks after undergoing its isochronal inspection.

Two significant trends were evident when looking at the C-135 Class Es, and HAPs in FY02—flight control related events (six), and smoke/fume events (19).

—One mishap aircraft (MA) didn't

One crew experienced a scraped No. 3 engine pod during a night landing.

rotate smoothly during initial takeoff and the controls felt mushy and sluggish. The autopilot had difficulty with the pitch trim as well. The MA was grounded and maintenance discovered a misassembled pitch control quadrant.

—Following level-off, the autopilot was engaged and immediately ran the trim nose-down for about five seconds to the trim stop and then disconnected. This crew completed the mission with the autopilot off. Investigation revealed a stuck relay in the autopilot processor.

—During preflight, one crew noticed the manual trim wheel felt heavy. When either pilot engaged the right half (motor side) of their trim switch, the stab trim moved nose-down regardless of the direction of switch movement. The movement stopped when the switch was released. Investigation revealed chaffing/arcing on the copilot's control column wiring.

—Following level off, one crew noticed an abnormal jerking of the control column both with and without the autopilot engaged. Maintenance discovered a corroded autopilot pitch motor.

—During takeoff roll, a boom operator noticed and called trim wheel movement. During the abort, the trim moved from two units nose-up to five units nose-up. Local maintenance and a depot team investigated the occurrence extensively, but were unable to determine the cause.

—One crew experienced rudder hunting caused by low rudder accumulator pressure inducing a FCAS (flight control augmentation system) fault. They recovered without incident.

—Of the 19 reported smoke/fume events, five were due to failed/dirty ACM water separator socks, five were due to various ACM mechanical malfunctions, and four were due to cooling fan failures (2 personnel fans/2 equipment fans). The remaining smoke/fume events were from an overheating battery, over-serviced engine oil, a failed radar beacon pressure pump, a failed bleed air check valve, and a malfunctioning temperature limiting switch.

The KC-10 community experienced one Class A Flight mishap, four Class Bs, 13 Class Cs, one Class E, and one HAP.

KC-10

On the KC-10 side of the house, the community experienced one Class A Flight mishap, four Class Bs, 13 Class Cs, one Class E, and one HAP.

We can't discuss the single KC-10 mishap openly in this forum. Please visit your local Flight Safety office for any details about the Class A.

The four Class Bs were split between engines, a centerline drogue incident, and a No. 2 hydraulic system failure.

—During takeoff roll, an EGT caution light illuminated, and later in flight the engine failed a coupon check. Still later, the MC experienced a compressor stall. They experienced another stall several minutes after clearing the first, after which the engine was left at idle. A failed compressor blade was found to have damaged the high-pressure compressor.

USAF Photo

—Accelerating for cruise flight, the mishap engine (ME) hung up and two loud thumps were heard/felt throughout the airframe. The MC cleared the compressor stall, only to get another several minutes later, after which the engine was left at idle. Damage was found to the 11th stage compressor.

—During a centerline drogue AR, the hose was extended partially when it stopped; the hose began to unravel and jumped off the hose drum. The MC couldn't retract the hose and landed with it in trail.

—During AR, the receiver reported a fluid leak from the boom, and the MBO noticed sluggish boom controls. Various hydraulic system caution lights associated with the No. 2 hydraulic system illuminated and the quantity went to zero. Extensive damage to the No. 2 system was found after landing.

One significant trend was evident when looking at the KC-10 Class Cs in FY02—nine of the 13 mishaps were centerline drogue or WARP-related.

—The receiver on the left noted heavy fuel leakage from the WARP itself (not the hose). The MBO noted both a "Fuel Press Hi/Low" light. Refueling was continued on the right wing. Once refueling was done, the leak was contained. The MC was unable to retract the hose and jettisoned it.

—When getting ready to refuel, the right WARP had both "Fuel Press Hi/Low" lights flashing, and "Fail" in the WARP fuel counter. The MC was unable to retract the hose and landed with it in trail.

—Following a refueling, the MBO attempted to rewind the centerline drogue. There was a loud thump and a large sine wave oscillation, and fuel then began spraying from the drogue stowage tube. All attempts to control the leak and stow the hose were unsuccessful, so they attempted to jettison the hose. This too was unsuccessful. The MC landed with the hose in trail while continuing to leak fuel.

—During an in-flight check of the centerline drogue, the drogue indicator switched from "Trail" to barber pole. The hose wouldn't retract and the "Cntr Drogue Control" circuit breaker was found open. The MBO reset the circuit breaker, but it popped again. The MC was unable to retract the hose and landed with it in trail.

—While rewinding the centerline hose a loud bang was heard and the hose unreeled rapidly and separated from the aircraft.

—Shortly after the offload started, a sine wave in the centerline drogue hose occurred resulting in failure of the hose approximately seven feet from the drogue. The hose unraveled and beat against the receiver's canopy, shattering it. The receiver recovered successfully, wearing the drogue and trailing the hose retention wire.

—During a night centerline drogue refueling, the drogue refueling basket separated from the hose assembly following an erratic contact. The receiver returned from whence he came with his probe wearing a new hat.

—Approximately four seconds after a contact with a normal rate of closure to the centerline drogue, a sine wave developed in the hose and separated the drogue from the hose. Again, the receiver went home wearing the drogue.

—Yet another receiver closed on a centerline drogue, this time at the upper edge of the closure-speed envelope with a downward vector. This set up another sine wave, but this time the drogue won and came away with a probe.

The rest of the Class Cs, Es and HAPs were a mixed bag.

—During contact with a heavy receiver, a boom flight control degraded light illuminated. The receiver noticed a foot-long piece of metal sticking up from the boom. As the MBO retracted the boom, sparks and liberated debris were observed. The ice shield, a fuel transducer, and boom nozzle and marker lights were damaged.

—Painted over anti-skid isle strips, a metal cargo band, and a boom operator performing a cargo check on a wet floor conspired to inflict deep lacerations and severed tendons to the hand of the unwitting boom operator.

—During a full-stop landing, a thrust reverser failed to stow after landing. Damage was discovered to the thrust reverser components.

—During a planned autopilot go-around, the MA pitched up excessively, reaching 35 degrees nose-high before the MC was able to control it. A failure in the No. 1 INS platform was to blame.

—During landing, tower informed one crew that smoke was coming from their tires. The MC noticed a burning rubber smell as they slowed. The tiller became unresponsive and the aircraft felt sluggish. They stopped straight ahead and discovered a broken nosewheel steering follow-up cable and the nosegear at full right deflection.

—During an attempted engine start, the situation drove a manual start. During the manual start a tail pipe fire ensued and things went downhill from there. This, like many of these snippets, is a worthwhile read and can be obtained in full at your safety office.

That wraps it up for FY02. Have a great '03, and fly safe!

Nine of the 13 Class C mishaps were centerline drogue or WARP-related.

The Strategic Airlifters

C-5 C-17 C-141

USAF Photo

MAJ DAVID KRAL
HQ AFSC/SEFF

I applaud you in the Strategic Airlift community (C-5 Galaxy, C-17 Globe Master III and C-141 Starlifter) for your endurance and performance over a long year with significant time away from home. It's hard to believe that a mere 18 months ago, a lot of you were twiddling your thumbs, begging to fly. What a difference a year makes. On the down side, mishaps have increased along with the flying hours. Class A, B and C rate-producing mishaps totaled 40 in FY02 versus 26 in FY01.

Class A, B and C rate-producing mishaps totaled 40 in FY02 versus 26 in FY01.

Class A Mishaps

The C-17 had two Class A Flight mishaps and the C-141 had a Class A Ground Ops mishap.

C-17

Both Class A mishaps occurred while performing assault landings in the Operation ENDURING FREEDOM AOR. Both were thoroughly investigated by safety and legal boards. Using details from the Accident Investigation Board (nonprivileged), here is a detailed summary of the first mishap.

The Mishap Crew (MC) was current and qualified for the mission. Once overhead the destination, the MP decided to fly an assault approach and landing to decrease his landing roll. The MP had not performed a night, heavyweight assault landing in several months and had minimal short field/tactical experience. The MP began his approach descent from approximately 1000 feet AGL, 2.2 NM from the runway and 34 knots fast. He pulled the power to idle, initiating the descent and slowing. By one NM he was still five knots fast but on glideslope with a descent rate exceeding 1500 feet per minute (fpm). The pilot ultimately reduced the MA's airspeed to eight knots below computed approach speed while still maintaining a high sink rate in excess of 1300 fpm. He allowed the flight path vector to fall below the approach path indicator and short of the landing surface. The pilot also made two significant roll inputs at approximately 100 feet AGL. Prior to impacting the ground, the copilot directed a go-around and the impact occurred during this procedure, approximately 2000 feet short of the runway. The aircraft impacted the ground in excess of 1300 fpm, registering a "hard landing" message. Following the go-around, the crew entered holding and checked for damage. After inspection, the crew raised the gear and returned to their base of origin. Post-flight inspection revealed damage to the nose gear assembly and tires, underside of the fuselage, right side of the fuselage, including the leading edge of the outboard main gear door, engine cowl, and numerous main gear tires and tire temperature sensors.

In the opinion of the AIB president, the primary cause of this mishap was the aircraft commander's failure to control the aircraft in a proper descent angle or glidepath for approach and landing. The MP's inability to properly establish these parameters resulted in: an excessively high sink rate, low power setting for the aircraft's gross weight, and untimely deployment of the wing spoilers on very short final caused by either inadvertent activation of direct lift control or excessive pilot side-to-side (roll) inputs on very short final approach.

The second mishap involved some significant differences from the previous one. The first two approaches resulted in go-arounds. During the third approach, the MA was at 200 feet AGL and 20 knots fast a little more than a mile from the runway. At 140 feet, idle power was selected along with a forward push on the stick. At 80 feet, the throttle was increased and a roll motion was induced. Additional roll inputs led to a lateral pilot-induced oscillation. Just prior to impact, a go-around was initiated and the aircraft touched down with six degrees of right bank, 9.5 degrees of pitch and a rate of descent of 1080 fpm. The go-around was continued and the fourth approach terminated with an uneventful landing.

The touchdown, after initiating the go-around, damaged the number 12 tire and the right gear pod, and exceeded the structural design limits of the right landing gear. The underside of the cargo ramp was also damaged.

C-141

This ground ops, system-involved mishap occurred while the aircraft was being fueled for a mission. A summary from the Accident Investigation Board follows:

The aircraft was in fuel cell to determine the location of a fuel leak. Maintenance personnel inserted fuel tank vent plugs and pressurized the fuel tank to locate the leak. They did not make a mandatory writeup in AFTO Form 781A about placing the vent plugs in the fuel tank. The leak was discovered and fixed. However, once the repair was completed, the fuel systems technician exited the fuel tank but failed to document or request a mandatory in-process inspection (IPI). The IPI is required to ensure all tools and material are removed from the fuel tank and fuel tank plugs (if used) are extracted from the fuel vents. Due to failure by the technician to inventory tools and equipment prior to or after maintenance actions and failure to document the required IPI, a fuel vent plug was not removed. As the MA was being fueled, upon reaching approximately 120,000 pounds of fuel, the interior left wing fuel pressure exceeded wing structural tolerances, and pressure was unable to vent due to the forgotten plug. Over-pressurization resulted in catastrophic failure of the left wing structure at the root.

In the opinion of the AIB president, the primary cause of the mishap was over-pressurization of the left wing fuel tanks. The over-pressurization was a direct result of the fuel system technician's failure to remove a fuel tank vent plug. The forgotten fuel tank vent plug, in turn, caused the fuel tank over-pressurization, leading to its rupture.

Class B Mishaps

A summary of the Class B rate producing mishaps follows.

C-5

An airspeed indicator malfunction on takeoff roll led to a high-speed (120 kts) abort. Once on the taxiway, the brakes were fine but the #1 MLG outer assembly had cracked.

There were three engine mishaps; two failures during climbout and one birdstrike. During climbout, the Turbine Inlet Temperature spiked above 1000 degrees. The engine was shut down with the fire handle, and fire agent was discharged. The second climbout incident brought smoke into the cockpit but no fire agent was discharged. Again, the engine was shut down. Both crews made uneventful three-engine landings. The third engine incident occurred when a bird flew into an engine on takeoff roll. The takeoff was aborted and upon inspection, there was massive damage to the engine and cowling.

The touchdown damaged the number 12 tire, the right gear pod and the underside of the cargo ramp.

C-17

There were three flight or flight-related main landing gear mishaps this year. The first was an MLG strut failure after landing. The aircraft was not carrying cargo at the time of the mishap. A second aircraft developed a crack on the MLG post. The third mishap occurred after an aborted takeoff. The aircraft developed hot brakes, and all 12 tires deflated after the fuse plugs melted.

There were four engine mishaps: a compressor blade failure on takeoff roll, successfully aborted; a compressor blade failure on climbout resulting in a fire; a stator failure which led to an overheat; and a birdstrike in the engine and on the outboard slat at 300 kts and 500 ft.

There were three airframe mishaps. Lightning accounted for the first two. One occurred on approach, damaging and partially separating a winglet. The second damaged the left elevator. An unstable landing caused the third mishap, which damaged the left slat, wingtip and aileron during a 3/4-flap landing.

C-141

Both C-141 mishaps were engine-related due to FOD.

Class C Mishaps

Class Cs led the way in numbers. If not fully investigated and deficiencies corrected, these have the potential to lead to Class A and B mishaps.

C-5

The C-5 experienced five Class C mishaps this year. One occurred when a thrust reverser failed to open after landing. Two engine problems on climbout consisted of an overheat and a pressure augmentation valve malfunction (bleed air). There was one #2 hydraulic system quantity loss that caused the Ram Air Turbine (RAT) to deploy. The RAT maintained pressure in the system. The last item was a lightning strike that damaged the radome. The aircraft was flying at 2000 ft. with no thunderstorms forecast in the area.

C-17

The C-17 had thirteen Class C mishaps. There were three landing gear/tire mishaps. The first was an anti-skid manifold failure that led to a blown tire. In the second, a set of wheel bearings failed during taxi and led to tire, brake and axle beam damage. The last damage occurred at an undetermined point during a round-robin mission and was discovered after landing. The landing gear, L/R

The C-5 experienced five Class C mishaps this year.

wheel well, aircraft skin and six brake/tire assemblies were damaged.

There were four birdstrikes; three caused engine damage and the fourth put a hole in a slat.

There were three events of loose engine fairings around the thrust reversers. All led to large holes in the fan duct assembly.

There was a cargo winching mishap that occurred when a chain snapped. The components involved and the extent of damage is unclear due to incomplete reporting.

And finally, there were two personal injury mishaps. One individual broke his arm when the aircraft he was on performed a breakaway during air refueling. The other injured his finger and back when he somehow fell into the storage areas in the upper portion of the closed cargo door.

C-141

The C-141 experienced four Class C mishaps this year. There were two engine mishaps; one included an overtemp and the other an overspeed. A birdstrike caused damage to a radome. During the last mishap, a lightning strike caused damage to a radome and the empennage deice panel on the leading edge of the elevator.

Conclusion

Guess where the two biggest problem areas are? There were 40 mishaps; 20 were engine-related and eight were gear-related. Strategic Airlift crews and maintenance did not invent any new mishaps in FY01. They did, however, spend a lot of time, money and effort figuring out why these mishaps occurred.

What is being done or can be done to prevent similar mishaps in FY03? Engineering problems are continuously being looked at to see if there is an affordable fix to the structural points of failure. Avoid birds and bad weather whenever possible. Don't push the rules for a training line. Know what your T.O. and AFI guidance says, and follow that direction. If you need to use a work-around to perform your job because the guidance is unclear, FIX IT! Submit an AF Form 22 or 847 so the new airman or the new pilot can follow clear and concise guidance and therefore have less of an opportunity to make a mistake that leads to a mishap. Do what you can to keep my article to one page or less next year. Fly safe and fly smart.

There were 40 mishaps; 20 were engine-related and eight were gear-related.

USAF Photo

F-15

Two of the five FY02 Class A mishaps were of the "engine-confined" variety.

MAJ JASON SMITH, CAF
HQ AFSC/SEFF

"Keep your craniums up, your wits about you, and I look forward to lauding the achievements of the Eagle community next year." That's the statement I used to end last year's article, so what will it be this year? Will it be accolades all around, or a "thumbs down" to Eagle drivers and/or maintainers? Well, looking strictly at the numbers for FY02, don't bother looking up accolades. The FY02 Class A rate came in at 2.65, up from 1.09 in FY01. *(Editor's note: Last year's article stated the FY01 rate as 1.12 but this changed slightly as actual flying hours were updated after publication.)*

Now just a minute, though, before you hang your head in shame or go and do something drastic, keep that dictionary handy and let's take a little closer look at those numbers. While there were five rate-producing Class A mishaps in the F-15 community this year compared with only two last year, two of the five FY02 mishaps were of the "engine-confined" variety. If you remove these "dollar only" Class As from the equation, the rate comes out at a more respectable 1.59. Another mishap was attributed to structural failure and if you discount this one, the two remaining mishaps add up to a rate of 1.06. Now that's more like it!

You might be wondering, however, does it really make the situation better by breaking down the mishaps as I have just done or is it simply making excuses? I believe that it serves a purpose to separate the "human factor" mishaps from the "logistics" mishaps because human factor mishaps are always preventable and they also tend to account for the majority of mishaps. Of course, there is still room for improvement in aircraft design, and we cannot ignore this area, but nowadays advances in this area are much more difficult to achieve. Less human error, through training and other education, can be a much more attainable goal and safety programs should key on this aspect.

So, when looked at in the context of clearly preventable mishaps, maybe FY02 wasn't quite so bad after all. Continuing on this positive note, the number of Class B mishaps was also down, dropping from 19 in FY01 to seven in FY02. Tempering these positive notes, however, is the fact that while only two aircraft were destroyed, an irreplaceable aviator was also lost. No one can dispute that this last "statistic" is one that is difficult to accept.

Now, let's take a closer look at what happened throughout the year.

USAF Photo

As the mishap aircraft continued down the runway, the left main gear collapsed.

Class A Mishaps

As stated earlier, there were two engine-confined Class A mishaps, both involving F-15E aircraft. For a more detailed look at these mishaps, refer to the Engine-Related Mishap Summary article, also appearing in this issue.

• Structural Failure: The following information was derived from the Accident Investigation Board's (AIB) report: The mishap sortie was a Standard Compatibility Flight Profile (CFP) test sortie. During a maximum speed dive test point, the Mishap Aircraft (MA) achieved 780 KCAS in a descent through 27,000 feet. The MA then experienced a severe yaw to the left, which caused a departure from controlled flight and severe structural overloads. The MA broke up into several sections. At some point in the departure and break-up sequence, the Mishap Pilot (MP) likely initiated the ejection sequence at an airspeed well outside survivable parameters, likely sustaining immediately fatal injuries. The MP was never recovered. The AIB found that the MA experienced a structural failure in the honeycomb material supporting the leading edge of the left vertical stabilizer. This failure caused the leading edge of the surface to depart the aircraft, which in turn resulted in the severe left yaw and subsequent departure from controlled flight.

• Spin/Ejection: The MP and his lead were providing adversary support during an ACM sortie when the lead aircraft experienced an aircraft malfunction. The lead aircraft returned to base with the MP in chase. Following the uneventful recovery of the lead aircraft, the MP returned to the working area to accomplish an alternate mission. While in the working area, the MA entered a spin, culminating with the MP ejecting successfully. The MA was destroyed upon impact but was never recovered given the depth of the water in which it crashed.

• Landing Gear Damage: The MA was number two in a two-ship, radar trail, ILS approach. The MA touched down in the overrun, 60 feet short of the runway threshold and subsequently struck a construction trench in the overrun. An airfield lighting upgrade project was being carried out and the overrun was NOTAMed closed for "open trenches in the overrun." Striking the trench wall damaged the MA's left main gear, and as the MA continued down the runway, the left main gear collapsed. The MA settled onto the centerline tank, left horizontal stab, and left wingtip before departing the runway surface and coming to rest. The MP egressed the aircraft without injury.

Class B Mishaps

In addition to several engine-confined mishaps, here is a brief synopsis of the remaining Class Bs (see your local Safety shop for more detailed information.):

- During a takeoff roll, the pilot experienced a nose-wheel shimmy that worsened, prompting the pilot to abort the takeoff. As the aircraft began to slow, the severe shimmy continued and the nose gear collapsed, allowing the centerline fuel tank and the radome to contact the runway. The aircraft slid to a stop on the runway and the pilot egressed without injury. The nose-wheel steering crank upper stub had failed, resulting in the loss of shimmy dampening for the nose-wheel.
- A hard landing resulted in a blown tire and damage to both main landing gear struts.
- While flying in radar trail, a four-ship flew through an imbedded thunderstorm resulting in hail damage to all four aircraft. Lightning strikes also damaged two of the aircraft.
- While exiting the runway following the landing roll-out, the aircraft departed the prepared surface and sustained damage to the left wing tip, landing gear struts, brakes, radome and both engines.

Almost one-quarter of the 68 Class Cs were "structural failure" incidents involving pieces falling off of aircraft.

Class C Mishaps

A very obvious trend is apparent when looking at the Class C mishaps. Almost one-quarter of the 68 Class Cs were "structural failure" incidents involving pieces falling off of aircraft. The majority of the components affected were the leading edges of the horizontal stabilator. This susceptibility has been well documented and the introduction of the new "Gridlock" design control surfaces directly addresses the problem. We'll have to wait and see how the new design fares in resisting the water intrusion/freezing/delamination issue.

Lessons Learned

So what do we take away from the events of FY02? I honestly do not see any glaring deficiencies in the area of human factors. Errors were made, but as the old saying goes, "To err is human." In the flying game, however, errors can be deadly, not to mention expensive, so we must strive for perfection. We have seen ops tempo ramp up noticeably in most MDSs, and people get tired. Tired people are more prone to mistakes, so supervisors and individuals must attempt to mitigate this risk factor. Often this involves simply a self-acknowledgement that you are tired and an extra, concerted effort to keep your guard up and perhaps be a little more methodical in your tasks. Pilots are flying more of the "boring holes in the sky" missions, which are a breeding ground for complacency and inattention. Those two factors can kill you faster than any MiG driver could ever dream of.

We also saw that engines, while pretty darn reliable in the overall scheme, can still "give up the ghost" at inopportune times. This is where being well versed in emergency procedures can really make a difference, and much of this preparation can be accomplished on the ground and in the simulator. Do not let yourself get into the situation where you are learning the finer points of single engine approaches while doing one for real.

An area that I, and probably most of you, find troubling is the structural failure issue. While the airplane doesn't seem to be in great peril when the leading edge of a horizontal stab lets go, we saw the catastrophic results of a vertical stab failure when it occurs near the edge of the speed envelope. Not knowing whether your aircraft can withstand operation within its design envelope is not conducive to instilling confidence among aviators. Obviously, attention must continue to be directed at mitigating the factors involved, and hopefully time will show that the tragic test flight incident was an isolated occurrence.

One thing that you can virtually count on is that operational demands on the Eagle are not likely to diminish anytime soon. There is the possibility of increased deployed operations, and these will severely test the abilities of flyers, maintainers and leadership to accomplish the mission effectively. Remember, it is everyone's responsibility to practice risk management. There are enough adversaries out there without being our own worst enemy by just being stupid. Here's to many "splashed" hostiles and "bombs-on-time-on-target" in FY03!

707 Variants: AWACS, JSTARS, Rivet Joint

USAF Photo

MAJ JOEL HARVEAUX
HQ AFSC/SEFF

The E-3 AWACS (Airborne Warning and Control System) and E-8 JSTARS (Joint Surveillance and Target Attack Radar System) enjoyed another outstanding, safe year, with no Class A mishaps and only one Class B. A hearty "Well Done" to maintainers and operators alike.

E-3

—The one Class B occurred during an E-3 heavyweight night air refueling (AR) mission. On the fourth contact, most of the way through a 70,000-pound offload with the MCP at the controls, a "Breakaway" was called. In the course of the separation, the boom nozzle was separated from the boom and impacted the MA on the rudder and elevator.

—The E-3 also only experienced one Flight Class C, which occurred when a foreign object became lodged in the AR receptacle. This subsequently damaged the sleeve of the sliding valve during AR.

The other significant E-3 events centered around flight control issues and smoke/fumes.

—There were three incidents of uncommanded inputs to the flight controls. Two of these were due to failures of the series yaw damper coupler. The third event was experienced after a rupture in the utility pressure line on the Number 3 engine which ultimately led to spoiler float.

—There were seven reported smoke/fume incidents this year. They resulted from varied sources: a failed electronic load control unit power contractor, a seized radar power feeder fan, a faulty mission console monitor, an overheating synch-bus power supply unit, a failed upper strobe power supply, a damaged radar transmitter high-voltage filter and a failed coffee brewer (what we go through for a good cup of Joe!).

E-8

The JSTARS experienced four Class C mishaps.

—Approximately 15 minutes into flight, the MC noticed smoke coming from a console and returned to base while running the appropriate checklists. Following the landing, several fuse plugs melted, deflating tires. An electrical short in the essential bus transformer-rectifier caused the smoke.

—Post-flight inspection discovered FOD damage to the Number 4 engine.

—Post-flight inspection revealed damage to the mishap engine when a rivet stem was ingested.

—A left outboard flap and aileron were damaged due to an improperly installed flap track bracket.

The E-8 experienced three Class-E events.

—In two instances, an Operator Work Station (OWS) began to give off electrical fumes and shut itself down. The MC confirmed the source/containment of the fumes and continued the mission. In both cases maintenance found a short/failure in the OWS data processor power supply.

—Three hours into one mission, a crew member experienced physiological symptoms due to flying while fighting a cold.

As life just seems to get busier and busier, make sure you are keeping your focus where it needs to be. Keep yourself alert and sharp. Be prepared for anything the mission, the weather or your airframe can throw at you. Keep your head in the game and take pride in a job well done. Fly Safe!

There were three incidents of uncommanded inputs to the flight controls.

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

THE GOOD, THE BAD AND THE UGLY!

MAJ DAN "RCR" BAKER
HQ AFSC/SEFF

When I wrote last year's bomber article we were all recoiling from the events of September 11, and that tragedy was fresh on all our minds. We were going to war, and our way of life had changed in an instant. We were entering a new and long-term battle, one like we hadn't experienced before. It was obvious we would be operating in new environments, visiting locations many of us had never heard of and employing new tactics and equipment. It was obvious at that time we would need to apply sound ORM practices and evaluate the way we conducted our operations. Unfortunately, that does not appear to have happened. This was the worst year we've experienced in the past 15. The number of aircraft lost and personnel killed is appalling. A review of the past year's mishaps reveals multiple cases of complacency, technical order deviations and poor risk assessment. These are unacceptable.

However odd this may read to some of you, I feel fortunate that we in the bomber world only lost one aircraft, a B-1. We lost *only* one bomber. We were lucky there was no loss of life associated with that mishap, and I'll go into more detail on that later. On another good note, for the most part (with the above exception, of course), all three bomber weapons systems maintained a fairly consistent safety record over the past few years.

B-2 (The Good)

The B-2 record of flight mishaps was fairly clean this past year. There was only one reportable mishap, a Class B ice FOD that resulted in $414,000 of damage.

B-52 (The Bad)

The B-52 record had a few more reportable mishaps with five Class C mishaps and an interesting Class E. All the Class Cs were engine-related and accounted for $264,000 in damage. These consisted of FOD-induced mishaps and internal engine failures.

The Class E involved a four-engine flameout. Fortunately, the crew was able to restart two of the flamed-out engines and safely recover the aircraft.

B-1 (The Ugly)

In the case of the B-1, "The Ugly" represents the past year's flying safety record and not its physical

appearance. The B-1 had 22 reportable mishaps, consisting of 11 Class Cs ($988,000), 10 Class Bs ($3,766,000) and one Class A ($298,000,000/loss of aircraft). This is not a pretty picture. There were multiple engine-related and FOD-induced mishaps, as well as a bird strike, inflight hatch loss and electrical malfunctions. There were several instances of tire tread failures directly related to heavyweight operational missions. We as a community are very fortunate that none of these tire failures resulted in a loss of an aircraft. In one of these instances the FOD from a failed tire at a critical phase of flight resulted in the shutdown of an engine.

The biggest news was the loss of a B-1 in December 01. Shortly after takeoff from Diego Garcia for an OEF mission, the aircrew experienced multiple systems failures which resulted in the loss of aircraft control and the aircrew ejecting from the aircraft. According to the Accident Investigation Board report, the mishap crew shut down the number one engine due to an oil over-temperature. The associated primary generator fell off-line normally during the engine shutdown. The crew decided to abort the mission and return to Diego Garcia. En route, the number two primary generator dropped off line, accompanied by loss of the mishap aircraft's computer navigation complex. The pilot switched on the emergency generator, in accordance with the appropriate emergency procedure for single generator operation. Shortly thereafter, the pilots determined their primary and standby aircraft attitude (i.e., level flight, turning, climbing, etc.) information was unreliable.

Though weather at the cruise altitude of FL 200 was clear, there was no lunar illumination and neither pilot could discern the horizon. The OSS and DSO noted increasing uncommanded bank angle displays up to 120 degrees accompanied by rapidly decreasing altitude and increasing airspeed, and advised the pilots. Passing 15,000 feet MSL, the OSO determined the aircraft was out of control and, in accordance with Tech Order guidance, ejected, followed quickly by the DSO. The pilots confirmed the OSO and DSO altitude and airspeed indications but could not positively determine the MA attitude. Convinced the aircraft was out of control and unrecoverable, the pilots ejected. The aircraft was destroyed upon impact with the water and sank. A US Navy vessel in the area rescued all four crew members. After lengthy salvage operations, the aircraft was never located, and no parts of the aircraft were recovered.

Investigation based primarily on witness testimony revealed the mishap was likely caused by a progression of aircraft malfunctions, aggravated by aircraft design and T.O. emergency procedures, creating a situation where the pilots were unable to maintain control of the aircraft. Fortunately for all involved, nobody was killed in this mishap.

There is a lot we can learn from this year's mishaps, but some of the gems we can take away include: We can never know too much about our aircraft systems and how certain failures affect other on-board systems. Rock-solid crew coordination is crucial, both during normal ops and during critical emergencies or phases of flight. Simulator training is great for learning to handle basic IFEs, as well as ugly, worst-case, multiple systems emergencies. And finally, when in doubt, the nylon let down (ejection) is the approved solution.

It is imperative we continue to apply proven ORM and safety practices to all we do. Don't be afraid to step forward when something doesn't look or sound right. If there's a potential design deficiency or a T.O. procedure that doesn't make sense, we need to highlight that immediately. Remember the basics. Make sure you know your technical orders, systems and regulations, as well as your tactics. If everyone continues to do business the way we have for the last year, our next year will be just as good, if not better.

USAF Photo by SSgt Jerry Morrison
Photo Illustration by Dan Harman

FY02 Mishap Stats

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

This data is correct as of this printing. However, ongoing investigations may result in a mishap being upgraded or downgraded at a later date. If so, corrections will appear in next year's annual round-up. Asterisks indicate there is a correction—flying hours and/or data—from last year's stats. Finally, please note that since tallies haven't been finalized, flying hours for FY02 for all aircraft are estimated for Jul-Sep 02.

Those interested in earlier numbers may view them at the AFSC web page at: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html (".mil" and ".gov" users only).

A-10

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY93	2	1.74	0	0.00	2	1.74	1	1	115,064	2,924,480
FY94	4	3.35	0	0.00	5	4.19	1	1	119,329	3,043,809
FY95	2	1.69	1	0.84	2	1.69	1	1	118,602	3,162,411
FY96	2	1.63	0	0.00	2	1.63	1	1	122,953	3,285,364
FY97	3	2.40	1	0.80	3	2.40	2	2	125,100	3,410,464
FY98	1	0.81	0	0.00	1	0.81	0	0	124,119	3,534,583
FY99	2	1.63	3	2.45	1	0.82	0	0	122,629	3,657,212
FY00	2	1.80	13	11.70	1	0.90	1	1	111,111	3,768,323
*FY01	2	1.78	4	3.55	2	1.78	0	0	112,662	3,880,985
FY02	2	1.71	8	6.84	3	2.56	2	2	116,960	3,997,945
LIFETIME CY72-FY02	96	2.40	74	1.85	97	2.43	49	56	3,997,945	
5 YR AVG	1.8	1.53	5.6	4.77	1.6	1.36	0.6	0.6	117,496.2	
10 YR AVG	2.2	1.85	3.0	2.52	2.2	1.85	0.9	0.9	118,852.9	

U-2

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	18,085	292,109
FY94	2	12.79	0	0.00	2	12.79	1	1	15,643	307,752
FY95	1	5.64	0	0.00	1	5.64	1	1	17,726	325,478
FY96	2	12.11	0	0.00	1	6.05	1	2	16,518	341,996
FY97	1	8.62	0	0.00	0	0.00	0	0	11,601	353,597
FY98	0	0.00	0	0.00	0	0.00	0	0	11,431	365,028
FY99	2	17.49	0	0.00	0	0.00	0	0	11,436	376,464
FY00	0	0.00	0	0.00	0	0.00	0	0	11,435	387,899
*FY01	0	0.00	0	0.00	0	0.00	0	0	10,285	398,184
FY02	1	6.87	0	0.00	0	0.00	0	0	14,550	412,734
LIFETIME CY63-FY02	28	6.78	1	0.24	20	4.85	7	12	412,734	
5 YR AVG	0.6	5.07	0	0.00	0.0	0.00	0.0	0.0	11,827.4	
10 YR AVG	0.9	6.49	0	0.00	0.4	2.88	0.3	0.4	13,871.0	

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	1	3.31	1	3.31	1	3.31	2	4	30,179	164,783
FY94	0	0.00	1	3.40	0	0.00	0	0	29,383	194,166
FY95	0	0.00	3	10.80	0	0.00	0	0	27,781	221,947
FY96	0	0.00	1	3.79	0	0.00	0	0	26,371	248,318
FY97	1	4.03	3	12.10	1	4.03	2	4	24,803	273,121
FY98	1	4.21	2	8.42	1	4.21	0	0	23,744	296,865
FY99	0	0.00	1	4.37	0	0.00	0	0	22,884	319,749
FY00	0	0.00	6	24.29	0	0.00	0	0	24,703	344,452
*FY01	0	0.00	2	8.12	0	0.00	0	0	24,628	369,080
FY02	1	4.02	12	48.25	1	4.02	0	0	24,871	393,951
LIFETIME CY84-FY02	13	3.30	38	9.65	7	1.78	6	11	393,951	
5YR AVG	0.4	1.66	4.6	19.04	0.4	1.66	0.0	0.0	24,166.0	
10 YR AVG	0.4	1.54	3.2	12.34	0.4	1.54	0.4	0.8	25,934.7	

B-1

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	0,455	1,118
FY94	0	0.00	0	0.00	0	0.00	0	0	0,976	2,094
FY95	0	0.00	0	0.00	0	0.00	0	0	2,415	4,509
FY96	0	0.00	0	0.00	0	0.00	0	0	3,248	7,757
*FY97	0	0.00	0	0.00	0	0.00	0	0	3,734	11,491
FY98	0	0.00	0	0.00	0	0.00	0	0	3,078	14,569
FY99	0	0.00	1	21.74	0	0.00	0	0	4,600	19,169
FY00	0	0.00	0	0.00	0	0.00	0	0	5,446	24,615
*FY01	0	0.00	0	0.00	0	0.00	0	0	5,668	30,283
FY02	0	0.00	1	15.17	0	0.00	0	0	6,594	36,877
LIFETIME FY90-FY02	0	0.00	2	5.42	0	0.00	0	0	36,877	
5 YR AVG	0	0.00	0	7.88	0	0.00	0	0	5,077	
10 YR AVG	0	0.00	0	5.52	0	0.00	0	0	3,621	

B-2

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	1	1.88	0	0.00	0	0	53,293	7,341,946
FY94	1	3.11	1	3.11	1	3.11	4	0	32,146	7,374,092
FY95	1	4.13	1	4.13	0	0.00	0	0	24,223	7,398,315
FY96	0	0.00	0	0.00	0	0.00	0	0	25,506	7,423,821
FY97	0	0.00	0	0.00	0	0.00	0	0	23,297	7,447,118
FY98	0	0.00	0	0.00	0	0.00	0	0	22,852	7,469,970
FY99	0	0.00	0	0.00	0	0.00	0	0	21,643	7,491,613
FY00	0	0.00	6	27.84	0	0.00	0	0	21,554	7,513,167
*FY01	0	0.00	6	27.30	0	0.00	0	0	21,975	7,535,142
FY02	0	0.00	0	0.00	0	0.00	0	0	32,332	7,567,474
LIFETIME CY55-FY02	97	1.28	176	2.33	76	1.00	100	311	7,567,474	
5 YR AVG	0	0.00	2.4	9.87	0	0.00	0	0	24,071.2	
10 YR AVG	0.2	0.72	1.5	5.38	0.1	0.36	0.4	0	27,882.1	

B-52

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	2	2.55	0	0.00	0	0	78,319	1,389,303
FY94	0	0.00	4	5.49	0	0.00	0	0	72,899	1,462,202
FY95	0	0.00	1	1.55	0	0.00	0	0	64,608	1,526,810
FY96	0	0.00	0	0.00	0	0.00	0	0	67,499	1,594,309
FY97	0	0.00	1	1.58	0	0.00	0	0	63,120	1,657,429
FY98	0	0.00	0	0.00	0	0.00	0	0	64,506	1,721,935
FY99	0	0.00	0	0.00	0	0.00	0	0	56,988	1,778,923
FY00	0	0.00	2	3.78	0	0.00	0	0	52,872	1,831,795
*FY01	1	1.72	1	1.72	0	0.00	0	0	58,244	1,890,039
FY02	0	0.00	5	5.52	0	0.00	0	0	90,655	1,980,694
LIFETIME CY68-FY02	16	0.81	45	2.27	4	0.20	5	168	1,980,694	
5 YR AVG	0.2	0.31	1.6	2.47	0	0.00	0	0	64,653.0	
10 YR AVG	0.1	0.15	1.6	2.39	0	0.00	0	0	66,971.0	

C-5

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	26,072	670,922
FY94	0	0.00	0	0.00	0	0.00	0	0	25,087	696,009
FY95	0	0.00	1	3.83	0	0.00	0	0	26,119	722,128
FY96	0	0.00	0	0.00	0	0.00	0	0	24,602	746,730
FY97	0	0.00	0	0.00	0	0.00	0	0	23,260	769,990
FY98	0	0.00	0	0.00	0	0.00	0	0	21,361	791,351
FY99	1	4.95	0	0.00	0	0.00	0	0	20,205	811,556
FY00	0	0.00	0	0.00	0	0.00	0	0	19,868	831,424
*FY01	0	0.00	0	0.00	0	0.00	0	0	21,254	852,678
FY02	0	0.00	1	4.76	0	0.00	0	0	21,006	873,684
LIFETIME CY68-FY02	3	0.34	3	0.34	1	0.11	3	3	873,684	
5 YR AVG	0.2	0.96	0	0.96	0	0.00	0	0	20,738.8	
10 YR AVG	0.1	0.44	0.2	0.87	0	0.00	0	0	22,883.4	

C-9

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	54,266	437,163
FY94	0	0.00	0	0.00	0	0.00	0	0	52,289	489,452
FY95	0	0.00	0	0.00	0	0.00	0	0	43,381	532,833
FY96	2	3.87	0	0.00	0	0.00	0	0	51,725	584,558
FY97	0	0.00	0	0.00	0	0.00	0	0	50,181	634,739
FY98	0	0.00	0	0.00	0	0.00	0	0	48,809	683,548
FY99	0	0.00	1	1.88	0	0.00	0	0	53,286	736,834
FY00	1	2.05	0	0.00	0	0.00	0	0	48,746	785,580
*FY01	1	2.19	3	6.52	0	0.00	0	0	45,590	831,170
FY02	1	1.24	4	4.96	0	0.00	0	0	80,698	911,868
LIFETIME CY81-FY02	7	0.77	13	1.43	0	0.00	0	0	911,868	
5 YR AVG	0.6	1.08	1.6	2.89	0	0.00	0	0	55,425.8	
10 YR AVG	0.5	0.95	0.8	1.51	0	0.00	0	0	52,897.1	

KC-10

C-12

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	27,099	335,694
FY94	0	0.00	0	0.00	0	0.00	0	0	16,500	352,194
*FY95	0	0.00	0	0.00	0	0.00	0	0	21,455	373,649
*FY96	0	0.00	0	0.00	0	0.00	0	0	4,739	378,388
*FY97	0	0.00	0	0.00	0	0.00	0	0	4,728	383,116
*FY98	0	0.00	0	0.00	0	0.00	0	0	5,666	388,782
*FY99	0	0.00	0	0.00	0	0.00	0	0	4,416	393,198
*FY00	0	0.00	0	0.00	0	0.00	0	0	3,689	396,887
*FY01	0	0.00	0	0.00	0	0.00	0	0	3,927	400,814
FY02	0	0.00	1	25.63	0	0.00	0	0	3,902	404,716
LIFETIME CY75-FY02	2	0.49	2	0.49	1	0.25	2	6	404,716	
5 YR AVG	0	0.00	0.2	4.63	0	0.00	0	0	4,320.0	
10 YR AVG	0	0.00	0.1	1.04	0	0.00	0	0	9,612.1	

C-17

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	1,252	1,799
FY94	0	0.00	0	0.00	0	0.00	0	0	4,454	6,253
FY95	0	0.00	0	0.00	0	0.00	0	0	12,968	19,221
FY96	1	4.75	1	4.75	0	0.00	0	0	21,050	40,271
*FY97	1	3.78	1	3.78	0	0.00	0	0	26,487	66,758
*FY98	1	2.35	0	0.00	0	0.00	0	0	42,623	109,381
*FY99	0	0.00	0	0.00	0	0.00	0	0	56,676	166,057
FY00	0	0.00	3	5.13	0	0.00	0	0	58,423	224,480
*FY01	0	0.00	3	3.70	0	0.00	0	0	81,072	305,552
FY02	2	1.90	12	11.41	0	0.00	0	0	105,138	410,690
LIFETIME FY91-FY02	5	1.22	20	4.87	0	0.00	0	0	410,690	
5 YR AVG	0.6	0.87	3.6	5.23	0	0.00	0	0	68,786.4	
10 YR AVG	0.5	1.22	2.0	4.88	0	0.00	0	0	41,014.3	

C-20

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	6,046	58,895
FY94	0	0.00	0	0.00	0	0.00	0	0	6,617	65,512
FY95	0	0.00	0	0.00	0	0.00	0	0	6,469	71,981
FY96	0	0.00	0	0.00	0	0.00	0	0	6,651	78,632
FY97	0	0.00	0	0.00	0	0.00	0	0	6,335	84,967
FY98	0	0.00	0	0.00	0	0.00	0	0	6,817	91,784
FY99	0	0.00	0	0.00	0	0.00	0	0	6,757	98,541
FY00	0	0.00	1	18.05	0	0.00	0	0	5,539	104,080
*FY01	0	0.00	0	0.00	0	0.00	0	0	5,516	109,596
FY02	0	0.00	0	0.00	0	0.00	0	0	5,066	114,662
LIFETIME CY83-FY02	0	0.00	1	0.87	0	0.00	0	0	114,662	
5 YR AVG	0	0.00	0.2	3.37	0	0.00	0	0	5,939.0	
10 YR AVG	0	0.00	0.1	1.62	0	0.00	0	0	6,181.3	

C-21

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	48,421	472,477
FY94	0	0.00	0	0.00	0	0.00	0	0	47,336	519,813
FY95	1	2.13	0	0.00	1	2.13	2	7	47,020	566,833
FY96	0	0.00	0	0.00	0	0.00	0	0	46,239	613,072
FY97	0	0.00	0	0.00	0	0.00	0	0	46,743	659,815
FY98	0	0.00	0	0.00	0	0.00	0	0	45,231	705,046
FY99	0	0.00	1	2.16	0	0.00	0	0	46,234	751,280
FY00	0	0.00	0	0.00	0	0.00	0	0	46,485	797,765
*FY01	0	0.00	1	2.04	0	0.00	0	0	49,045	846,810
FY02	1	2.07	1	2.07	1	2.07	2	2	48,373	895,183
LIFETIME CY84-FY02	3	0.34	3	0.34	3	0.34	6	11	895,183	
5 YR AVG	0.2	0.42	0.6	1.27	0.2	0.42	0.4	0.4	47,073.6	
10 YR AVG	0.2	0.42	0.3	0.64	0.2	0.42	0.4	0.9	47,112.7	

C-130

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	1	0.33	0	0.00	1	0.33	2	6	300,157	13,269,890
FY94	1	0.36	1	0.36	1	0.36	0	8	279,923	13,549,813
FY95	1	0.35	1	0.35	1	0.35	2	6	282,864	13,832,677
FY96	1	0.34	1	0.34	1	0.34	2	9	294,075	14,126,752
FY97	2	0.70	1	0.35	2	0.70	2	13	283,997	14,410,749
FY98	0	0.00	0	0.00	0	0.00	0	0	282,876	14,693,625
FY99	0	0.00	0	0.00	0	0.00	0	0	283,542	14,977,167
FY00	1	0.37	12	4.42	0	0.00	0	3	271,724	15,248,891
*FY01	2	0.73	11	4.03	0	0.00	0	0	272,957	15,521,848
FY02	3	0.97	11	3.54	2	0.64	2	13	310,475	15,832,323
LIFETIME CY55-FY02	148	0.93	176	1.11	85	0.54	136	629	15,832,323	
5 YR AVG	1.2	0.42	6.8	2.39	0.4	0.14	0.4	3.2	284,314.8	
10 YR AVG	1.2	0.42	3.8	1.33	0.8	0.28	1.0	5.8	286,259.0	

C-135

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	1	0.41	0	0.00	0	0	245,711	10,470,755
FY94	0	0.00	0	0.00	0	0.00	0	0	219,206	10,689,961
FY95	0	0.00	1	0.45	0	0.00	0	0	219,880	10,909,841
FY96	0	0.00	1	0.46	0	0.00	0	0	215,105	11,124,946
FY97	0	0.00	3	1.41	0	0.00	0	0	212,055	11,337,001
FY98	1	0.47	0	0.00	0	0.00	0	0	211,206	11,548,207
FY99	1	0.48	1	0.48	1	0.48	2	4	207,796	11,756,003
FY00	0	0.00	1	0.56	0	0.00	0	0	177,394	11,933,397
*FY01	0	0.00	5	2.71	0	0.00	0	0	184,227	12,117,624
FY02	0	0.00	4	1.74	0	0.00	0	0	230,153	12,347,777
LIFETIME CY57-FY02	79	0.64	131	1.06	64	0.52	134	629	12,347,777	
5 YR AVG	0.4	0.20	2.2	1.09	0.2	0.10	0.4	0.8	202,155.2	
10 YR AVG	0.2	0.09	1.7	0.80	0.1	0.05	0.2	0.4	212,273.3	

C-141

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY93	1	0.49	0	0.00	2	0.98	4	13	203,264	9,650,238
FY94	0	0.00	0	0.00	1	0.78	0	0	127,938	9,778,176
FY95	0	0.00	0	0.00	0	0.00	0	0	157,059	9,935,235
FY96	0	0.00	0	0.00	0	0.00	0	0	146,417	10,081,652
FY97	1	0.83	1	0.83	1	0.83	2	9	121,043	10,202,695
FY98	1	0.97	0	0.00	0	0.00	0	0	102,917	10,305,612
FY99	0	0.00	1	1.13	0	0.00	0	0	88,888	10,394,500
FY00	0	0.00	5	7.74	0	0.00	0	0	64,581	10,459,081
*FY01	0	0.00	3	5.79	0	0.00	0	0	51,807	10,510,888
FY02	0	0.00	1	2.28	0	0.00	0	0	43,780	10,554,668
LIFETIME CY64-FY02	34	0.32	39	0.37	16	0.15	34	161	10,554,668	
5 YR AVG	0.2	0.28	2.0	2.84	0	0.00	0	0	70,394.6	
10 YR AVG	0.3	0.27	1.1	0.99	0.4	0.36	0.6	2.2	110,769.4	

E-3

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	27,782	396,509
FY94	0	0.00	0	0.00	0	0.00	0	0	24,381	420,890
FY95	1	3.90	0	0.00	1	3.90	2	22	25,612	446,502
FY96	0	0.00	0	0.00	0	0.00	0	0	25,430	471,932
FY97	0	0.00	0	0.00	0	0.00	0	0	21,752	493,684
FY98	0	0.00	0	0.00	0	0.00	0	0	20,960	514,644
FY99	0	0.00	1	5.06	0	0.00	0	0	19,762	534,406
FY00	0	0.00	0	0.00	0	0.00	0	0	19,665	554,071
*FY01	0	0.00	1	4.56	0	0.00	0	0	20,436	574,507
FY02	0	0.00	1	3.75	0	0.00	0	0	26,651	601,158
LIFETIME CY77-FY02	1	0.17	4	0.67	1	0.17	2	22	601,158	
5YR AVG	0	0.00	0.4	1.86	0	0.00	0	0	21,494.8	
10 YR AVG	0.1	0.43	0.2	0.86	0.1	0.43	0.2	2.2	23,243.1	

E-4

	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	#	RATE	#	RATE	A/C	RATE	PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	1	74.96	0	0.00	0	0	1,334	32,867
FY94	0	0.00	0	0.00	0	0.00	0	0	1,587	34,454
FY95	0	0.00	0	0.00	0	0.00	0	0	1,697	36,151
FY96	0	0.00	0	0.00	0	0.00	0	0	1,401	37,552
FY97	0	0.00	0	0.00	0	0.00	0	0	1,310	38,862
FY98	0	0.00	0	0.00	0	0.00	0	0	1,363	40,225
FY99	0	0.00	1	78.74	0	0.00	0	0	1,270	41,495
FY00	0	0.00	0	0.00	0	0.00	0	0	1,373	42,868
*FY01	0	0.00	1	56.56	0	0.00	0	0	1,768	44,636
FY02	1	58.48	0	0.00	0	0.00	0	0	1,710	46,346
LIFETIME CY75-FY02	2	4.32	4	8.63	0	0.00	0	0	46,346	
5 YR AVG	0.2	13.36	0.4	26.72	0	0.00	0	0	1,496.8	
10 YR AVG	0.1	6.75	0.3	20.25	0	0.00	0	0	1,481.3	

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	1,219	1,842
FY94	0	0.00	0	0.00	0	0.00	0	0	0,524	2,366
FY95	0	0.00	0	0.00	0	0.00	0	0	0,361	2,727
FY96	0	0.00	0	0.00	0	0.00	0	0	0,724	3,451
FY97	0	0.00	0	0.00	0	0.00	0	0	1,305	4,756
FY98	0	0.00	0	0.00	0	0.00	0	0	2,106	6,862
FY99	0	0.00	0	0.00	0	0.00	0	0	3,327	10,189
FY00	1	23.99	1	23.99	0	0.00	0	0	4,169	14,358
*FY01	0	0.00	0	0.00	0	0.00	0	0	5,575	19,933
FY02	0	0.00	0	0.00	0	0.00	0	0	7,366	27,299
LIFETIME FY91-FY02	1	3.66	1	3.66	0	0.00	0	0	27,299	
5 YR AVG	0.2	4.44	0.2	4.44	0	0.00	0	0	4,508.6	
10 YR AVG	0.1	3.75	0.1	3.75	0	0.00	0	0	2,667.6	

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YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	3	1.38	5	2.30	3	1.38	0	0	217,547	2,869,932
FY94	4	1.90	3	1.43	4	1.90	1	1	210,241	3,080,173
FY95	4	1.94	5	2.42	3	1.45	1	2	206,649	3,286,822
FY96	4	1.99	2	1.00	3	1.49	0	0	200,766	3,487,588
FY97	3	1.56	5	2.60	2	1.04	0	0	192,081	3,679,669
FY98	3	1.59	5	2.66	2	1.06	0	0	188,204	3,867,873
FY99	7	3.70	9	4.76	6	3.17	1	2	189,109	4,056,982
*FY00	3	1.67	21	11.71	1	0.56	0	0	179,372	4,236,354
*FY01	2	1.09	19	10.34	2	1.09	2	2	183,706	4,420,060
FY02	5	2.65	7	3.71	2	1.06	1	1	188,700	4,608,760
LIFETIME CY72-FY02	114	2.47	201	4.36	102	2.21	38	45	4,608,760	
5 YR AVG	4.0	2.15	12.02	6.57	2.6	1.40	0.8	1.0	185,818.2	
10 YR AVG	3.8	1.94	8.1	4.14	2.8	1.43	0.6	0.8	195,637.5	

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YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	18	4.15	2	0.46	18	4.15	4	5	433,960	3,729,882
FY94	16	4.00	2	0.50	15	3.75	3	27	400,474	4,130,356
*FY95	9	2.33	1	0.26	9	2.33	1	1	386,429	4,516,785
FY96	8	2.14	5	1.34	7	1.87	0	1	374,517	4,891,302
FY97	11	3.06	0	0.00	11	3.06	1	1	360,038	5,251,340
FY98	14	3.89	1	0.28	12	3.33	5	6	360,245	5,611,585
FY99	18	5.11	3	0.85	16	4.54	2	2	352,275	5,963,860
FY00	9	2.62	8	2.33	9	2.62	2	2	343,085	6,306,945
*FY01	13	3.85	9	2.67	13	3.85	4	6	337,315	6,644,260
FY02	7	1.98	4	1.13	5	1.42	2	2	352,779	6,997,039
LIFETIME CY75-FY02	293	4.19	56	0.80	277	3.96	75	112	6,997,039	
5 YR AVG	12.2	3.49	5.0	1.43	11.0	3.15	3.0	3.6	349,139.8	
10 YR AVG	12.3	3.32	3.5	0.95	11.5	3.11	2.4	5.3	370,111.7	

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F-117

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	2	15.95	0	0.00	0	0	12,538	41,894
FY94	0	0.00	0	0.00	0	0.00	0	0	12,136	54,030
FY95	2	15.62	0	0.00	1	7.81	1	1	12,804	66,834
FY96	0	0.00	1	7.59	0	0.00	0	0	13,171	80,005
FY97	3	23.69	0	0.00	1	7.90	0	0	12,661	92,666
FY98	0	0.00	0	0.00	0	0.00	0	0	12,470	105,136
FY99	1	7.35	1	7.35	0	0.00	0	0	13,599	118,735
FY00	0	0.00	0	0.00	0	0.00	0	0	13,585	132,320
*FY01	0	0.00	1	7.25	0	0.00	0	0	12,801	145,121
FY02	0	0.00	0	0.00	0	0.00	0	0	13,012	159,133
LIFETIME FY91-FY02	7	4.40	5	3.14	3	1.89	1	1	159,133	
5 YR AVG	0.2	1.50	0.4	3.01	0.0	0.00	0.0	0.0	13,293.4	
10 YR AVG	0.6	4.62	0.5	3.85	0.2	1.54	0.1	0.1	12,977.7	

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YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	25,945	1,421,784
FY94	1	4.15	1	4.15	1	4.15	0	0	24,099	1,445,883
FY95	1	4.60	0	0.00	1	4.60	0	0	21,761	1,467,644
FY96	1	4.73	0	0.00	1	4.73	0	0	21,141	1,488,785
FY97	0	0.00	0	0.00	0	0.00	0	0	20,716	1,509,501
FY98	1	5.05	0	0.00	1	5.05	0	0	19,787	1,529,288
FY99	0	0.00	0	0.00	0	0.00	0	0	19,354	1,548,642
FY00	1	5.26	0	0.00	1	5.26	0	0	19,005	1,567,647
*FY01	0	0.00	0	0.00	0	0.00	0	0	19,901	1,587,548
FY02	1	5.15	0	0.00	1	5.15	0	0	19,412	1,606,960
LIFETIME CY71-FY02	54	3.36	14	0.87	40	2.49	21	52	1,606,960	
5 YR AVG	0.6	3.08	0	0.00	0.6	3.08	0	0	19,491.8	
10 YR AVG	0.6	2.84	0.1	0.47	0.6	2.84	0	0	21,112.1	

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YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	12,019	351,038
FY94	0	0.00	0	0.00	0	0.00	0	0	12,106	363,144
FY95	1	8.43	0	0.00	1	8.43	0	0	11,857	375,001
FY96	1	7.44	0	0.00	0	0.00	0	0	13,436	388,415
FY97	0	0.00	0	0.00	0	0.00	0	0	12,996	401,433
FY98	0	0.00	0	0.00	0	0.00	0	0	13,926	415,359
FY99	1	7.36	1	7.36	1	7.36	0	1	13,578	428,937
FY00	1	7.00	1	7.00	0	0.00	0	0	14,293	443,230
*FY01	0	0.00	2	14.67	0	0.00	0	0	13,634	456,864
FY02	5	24.10	4	19.28	1	4.82	0	0	20,743	477,607
LIFETIME CY66-FY02	33	6.91	23	4.82	21	4.40	24	81	477,607	
5 YR AVG	1.4	9.19	1.6	10.50	0.4	2.63	0	0.2	15,234.8	
10 YR AVG	0.9	6.49	0.8	5.77	0.3	2.16	0	0.1	13,858.8	

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	1	4.37	0	0.00	1	4.37	1	12	22,871	91,111
FY94	2	8.25	1	4.13	1	4.13	0	0	24,229	115,340
FY95	1	3.75	1	3.75	1	3.75	2	5	26,666	142,006
FY96	0	0.00	0	0.00	0	0.00	0	0	27,809	169,815
FY97	0	0.00	0	0.00	0	0.00	0	0	26,004	195,819
FY98	1	3.84	0	0.00	2	7.69	4	12	26,014	221,833
FY99	0	0.00	0	0.00	0	0.00	0	0	26,383	248,216
FY00	1	3.90	0	0.00	0	0.00	0	0	25,649	273,865
*FY01	0	0.00	0	0.00	0	0.00	0	0	26,494	300,359
FY02	3	10.79	1	3.60	1	3.60	0	0	27,792	328,151
LIFETIME CY82-FY02	12	3.66	3	0.91	8	2.44	9	34	328,151	
5 YR AVG	1.0	3.78	0.2	0.76	0.6	2.27	0.8	2.4	26,466.4	
10 YR AVG	0.9	3.46	0.3	1.15	0.6	2.31	0.7	2.9	25,991.1	

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YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	18,063	18,064
FY94	0	0.00	0	0.00	0	0.00	0	0	32,304	50,368
FY95	0	0.00	0	0.00	0	0.00	0	0	41,055	91,423
FY96	0	0.00	0	0.00	0	0.00	0	0	48,186	139,609
FY97	0	0.00	0	0.00	0	0.00	0	0	58,420	198,029
FY98	0	0.00	0	0.00	0	0.00	0	0	78,618	276,647
FY99	0	0.00	1	1.01	0	0.00	0	0	98,994	375,641
FY00	0	0.00	2	1.95	0	0.00	0	0	102,376	478,017
*FY01	0	0.00	2	2.06	0	0.00	0	0	97,280	575,297
FY02	0	0.00	1	0.98	0	0.00	0	0	101,640	676,937
LIFETIME FY92-FY02	0	0.00	6	0.89	0	0.00	0	0	676,937	
5 YR AVG	0	0.00	1.2	1.25	0	0.00	0	0	95,781.6	
10 YR AVG	0	0.00	0.6	0.89	0	0.00	0	0	67,693.6	

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YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY00	1	114.94	0	0.00	1	114.94	0	0	,870	,870
*FY01	0	0.0	0	0.00	1	12.93	0	0	7,731	8,601
FY02	0	0.0	0	0.00	0	0.00	0	0	37,547	46,148
LIFETIME FY00-FY02	1	2.17	1	2.17	1	2.17	0	0	46,148	

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T-37

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	1	0.56	0	0.00	1	0.56	0	0	179,933	11,344,745
FY94	0	0.00	0	0.00	0	0.00	0	0	151,651	11,496,396
FY95	1	0.74	0	0.00	1	0.74	0	0	134,425	11,630,821
*FY96	0	0.00	0	0.00	0	0.00	0	0	144,079	11,774,900
FY97	1	0.63	0	0.00	1	0.63	0	0	159,855	11,934,755
FY98	0	0.00	0	0.00	0	0.00	0	0	183,911	12,118,666
FY99	0	0.00	0	0.00	0	0.00	0	0	201,993	12,320,659
FY00	1	0.49	0	0.00	1	0.49	0	1	202,950	12,523,609
*FY01	1	0.50	0	0.00	1	0.50	0	0	199,417	12,723,026
FY02	1	0.56	0	0.00	1	0.56	1	2	178,508	12,901,534
LIFETIME CY56-FY02	136	1.05	31	0.24	134	1.04	27	78	12,901,534	
5 YR AVG	0.6	0.31	0	0.00	0.6	0.31	0.2	0.6	193,355.8	
10 YR AVG	0.6	0.35	0	0.00	0.6	0.35	0.1	0.3	173,672.2	

T-38

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	3	1.33	0	0.00	3	1.33	0	0	225,105	11,443,817
FY94	0	0.00	0	0.00	0	0.00	0	0	194,161	11,637,978
FY95	1	0.63	0	0.00	1	0.63	0	0	158,422	11,796,400
FY96	1	0.75	0	0.00	1	0.75	0	0	133,959	11,930,359
FY97	0	0.00	0	0.00	0	0.00	0	0	135,011	12,065,370
FY98	0	0.00	1	0.71	1	0.71	0	0	141,448	12,206,818
FY99	0	0.00	0	0.00	0	0.00	0	0	141,575	12,348,393
FY00	0	0.00	2	1.39	0	0.00	0	0	144,311	12,492,704
*FY01	2	1.37	1	0.68	3	2.05	0	1	146,151	12,638,855
FY02	0	0.00	0	0.00	0	0.00	0	0	140,805	12,779,660
LIFETIME CY60-FY02	191	1.49	93	0.73	186	1.46	75	135	12,779,660	
5 YR AVG	0.4	0.28	0.8	0.56	0.8	0.56	0.0	0.2	142,858.0	
10 YR AVG	0.7	0.45	0.4	0.26	0.9	0.58	0.0	0.1	156,094.8	

T-43

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	FATAL ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	9,179	289,447
FY94	0	0.00	0	0.00	0	0.00	0	0	7,069	296,516
FY95	0	0.00	0	0.00	0	0.00	0	0	7,917	304,433
FY96	1	14.28	0	0.00	1	14.28	2	35	7,003	311,436
FY97	0	0.00	0	0.00	0	0.00	0	0	6,496	317,932
FY98	0	0.00	0	0.00	0	0.00	0	0	4,866	322,798
FY99	0	0.00	0	0.00	0	0.00	0	0	5,066	327,864
FY00	0	0.00	0	0.00	0	0.00	0	0	5,782	333,646
*FY01	0	0.00	0	0.00	0	0.00	0	0	5,067	338,713
FY02	0	0.00	0	0.00	0	0.00	0	0	4,968	343,681
LIFETIME CY74-FY02	1	0.29	6	1.77	1	0.29	2	35	343,681	
5 YR AVG	0	0.00	0	0.00	0	0.00	0	0	5,149.8	
10 YR AVG	0.1	1.14	0	0.00	0.1	1.14	0.2	3.5	8,771.4	

T-41

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY93	0	0.00	0	0.00	0	0.00	0	0	23,755	593,268
FY94	0	0.00	0	0.00	0	0.00	0	0	17,881	611,149
FY95	0	0.00	0	0.00	0	0.00	0	0	,578	611,727
FY96	0	0.00	0	0.00	0	0.00	0	0	,671	612,398
FY97	0	0.00	0	0.00	0	0.00	0	0	,622	613,020
FY98	0	0.00	0	0.00	0	0.00	0	0	,834	613,854
FY99	0	0.00	0	0.00	0	0.00	0	0	,780	614,634
FY00	0	0.00	0	0.00	0	0.00	0	0	1,090	615,724
FY01	0	0.00	0	0.00	0	0.00	0	0	,929	616,653
FY02	0	0.00	0	0.00	0	0.00	0	0	,790	617,443
LIFETIME CY82-FY02	9	1.46	5	0.81	4	0.65	1	2	617,443	
5 YR AVG	0	0.00	0	0.00	0	0.00	0	0	,885	
10 YR AVG	0	0.00	0	0.00	0	0.00	0	0	4,793	

RQ-1

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY97	2	102.12	0	0.00	2	102.12	NA	0	1,958.5	1,958.8
FY98	0	0.00	0	0.00	0	0.00	NA	0	2,963.7	4,922.2
FY99	2	40.38	0	0.00	2	40.38	NA	0	4,953.5	9,875.7
FY00	1	24.32	1	24.32	1	24.32	NA	0	4,111.3	13,987
FY01	3	46.37	1	15.46	3	46.37	NA	0	6,469.7	20,456.7
FY02	5	45.27	0	0.00	4	36.21	NA	0	11,046	31,502.7
LIFETIME FY97-FY02	13	41.27	2	6.35	12	38.09	NA	0	31,502.7	
5 YR AVG	2.2	37.23	0.4	6.77	2.0	33.85	NA	0	5,908.84	

RQ-4

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY02	2	167.50	0	0.00	2	167.50	NA	0	1,194	1,194
LIFETIME FY00-FY02	2	167.50	0	0.00	2	167.50	NA	0	1,194	

F-22

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY02	1	44.19	0	0.00	0	0.00	0	0	2,263	2,263
LIFETIME FY02	1	44.19	0	0.00	0	0.00	0	0	2,263	

BASH: How Did We Do This Past Year?

BIRD AIRCRAFT STRIKE HAZARD

MAJ PETE WINDLER
HQ AFSC/SEFW

First of all, let me just congratulate everyone for doing a great job of wildlife strike reporting and collecting feather remains this past year. Once again, the number of birdstrike feather remains sent to the Smithsonian Institution for identification surpassed 1300 this fiscal year. I cannot overemphasize the importance of sending remains in for identification. Wildlife strike species information is vital to the USAF for maintaining access to critical training airspace, protecting our airfields against encroachment from potentially hazardous land use practices such as landfills and wastewater treatment facilities, and development of bird avoidance technologies (Bird Avoidance Model and Avian Hazard Advisory System).

For FY02, 3390 wildlife strikes were reported for a total cost to the Air Force of $8,661,458 in damage. That's an average of $2,555 per strike. The number of strikes decreased slightly from last year (3887), but the cost decreased significantly from last year's total of $31,648,039. The decrease is due to only one Class A FOD mishap in FY02 as compared to two significant Class A birdstrike mishaps in FY01. In terms of number of strikes, our Top 5 perpetrators for FY02 didn't change significantly from FY01, with the Top 5 being Mourning Doves, Perching Birds, Horned Larks, Barn Swallows/Swallows, and Eastern Meadowlarks. All of these birds are commonly found in the airfield environment. By cost, the Top 5 species for FY02 changed significantly as compared to FY01; with the Top 5 being Loon, Red-tailed Hawk, Stone Curlew/Thick-Knee, Mallard, and Pigeon. Strikes by phase of flight remained the same with 49% of all strikes occurring in the airfield environment, which is consistent with our historical data.

August, September and October were still our busiest months. In these three months alone, the Air Force reported a total of 1264 strikes causing $1,121,300 in damage, which is below FY01 totals for the same months (1442 strikes at a cost of $1,328,749). These specific months directly coincide with the fall migration season. The young birds, fresh from the nest, are still learning the finer points of flying resulting in a higher potential for damaging strikes to aircraft.

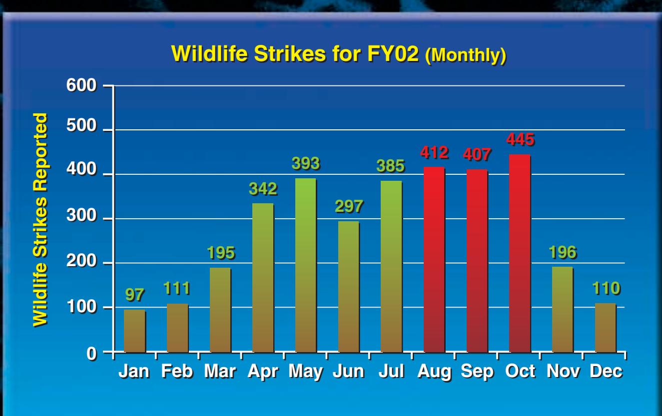
Even though wildlife strike reporting seems to pull you away from other important safety functions, it is a very important part of your unit's BASH program. The USAF BASH website, http://safety.kirtland.af.mil/AFSC/Bash/home.html, contains all the information you should need to help improve your BASH program. A strike history statistics page can also be found there for more in-depth analysis of Air Force wildlife strikes. Please contact any Air Force BASH Team member to request more specific data and answer any questions you may have.

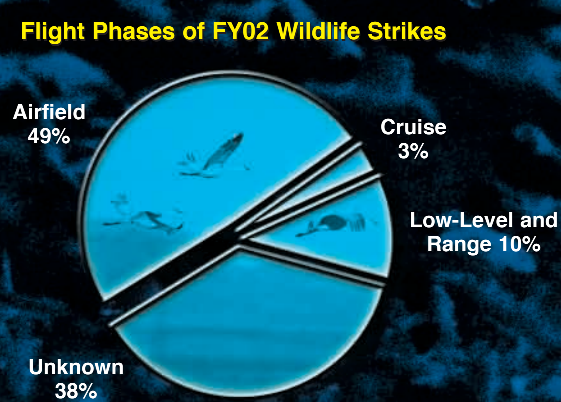
Top 10 Wildlife Strikes Counts (FY02)

Common Name	No. of Strikes
American Mourning Dove	134
Perching Birds	133
Horned Lark	103
Barn Swallow/Swallow	89
Eastern Meadowlark	55
Chimney Swift	54
Killdeer	54
American Kestrel	46
Common Nighthawk	34
Swallows/Martins	32

Top 10 Wildlife Strikes Costs (FY02)

Common Name	Total Cost
Common/Great Northern Loon/Diver	$4,831,478
Red-Tailed Hawk	$709,099
Mexican/Do.-Str. Stone Curlew/Thick-Knee	$642,510
Mallard	$622,211
Rock Dove/Pigeon	$505,800
California Gull	$220,000
No Feather Remains Found	$215,050
Turkey Vulture	$132,996
Black Vulture	$123,269
American Mourning Dove	$105,647





TRAINERS

MAJ MIKE FOLKERTS
HQ AFSC/SEFF

T-1

FY02 was a very successful and safe year for the T-1, as it flew over 94,000 hours without a Class A. This continues a Class A-free streak started from the T-1's inception in 1992, an accomplishment Jayhawk pilots and support personnel can be justifiably proud of.

During last year, the T-1 had just one Class B and 4 Class Cs. The Class B occurred when the mishap aircraft encountered a flock of birds while flying an instrument approach to a civil field immediately after sunset. One of the birds caused significant damage when it was ingested into the #1 engine. Something to keep in mind is that the Avian Hazard Advisory System (AHAS) does not include most civilian fields. A workaround involves selecting a military low-level route near the civil field to obtain an insight into the bird hazard.

The long-term solution is the display of real-time bird activity to aircrews and supervisors. To achieve this, small mobile radars are under development, which will be placed on airfields to monitor birds in a six-mile radius around the unit. For now, though, the best defenses against birdstrikes remain the models currently available, along with active monitoring of the airfield by SOFs, tower/RSU controllers, airfield management and aircrew.

There were four Class Cs last year, one involving an engine cowling departure in flight. The fasteners on the inboard side of the engine are harder to spot, a fact highlighted by this mishap. Rounding out last year's Class Cs were a birdstrike, a towing incident and an attitude-heading failure.

The Jayhawk cockpit is sometimes visited by smoke and fumes, which accounted for 21 of the 27 Class Es in FY02. Overuse of "Y" intercom cords has been highlighted as one reason for smoking audio amplifiers. High Accident Potential (HAP) reports last year included a failed throttle cable, binding flight controls, and a failed gap de-ice remote control circuit breaker failure, which led to a fire in the horizontal stabilizer heater horn/mat.

T-38

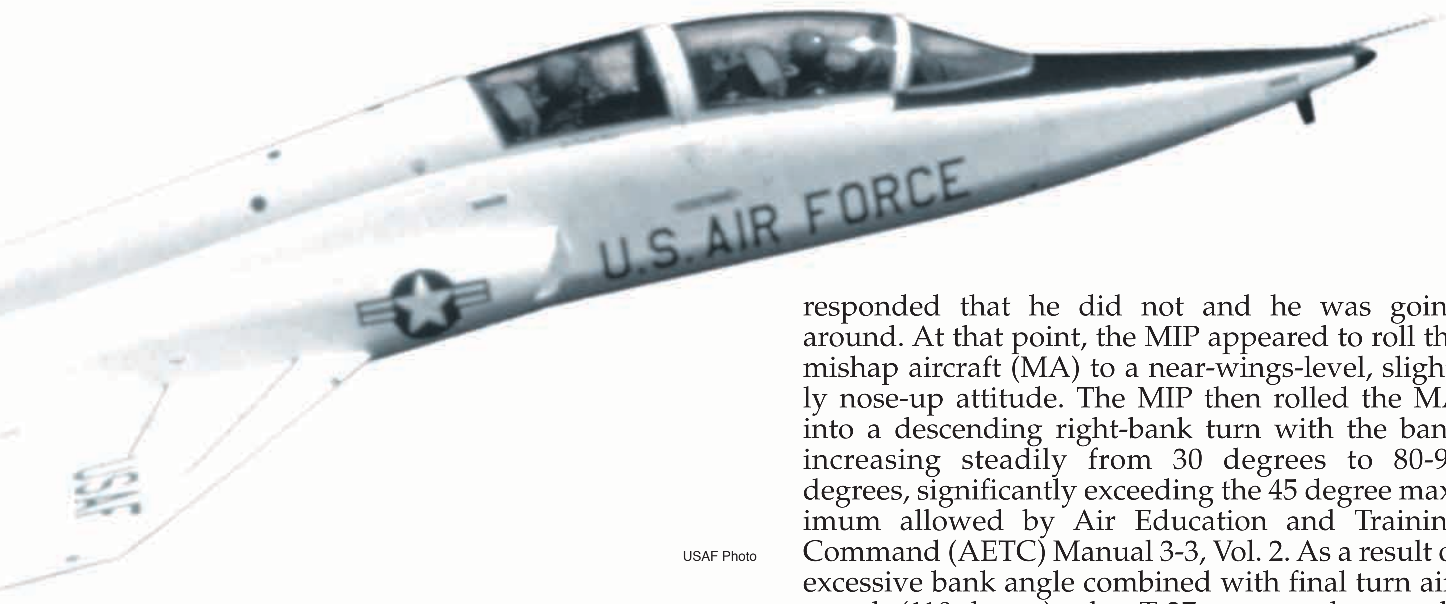
The White Rocket had an outstanding FY02, flying over 140,000 hours with no Class As or Class Bs. This was a great comeback from the two Class A mishaps of FY01.

Twenty-three Class Cs and 41 Class Es occurred in FY02, which continues a decreasing annual trend begun in 2000. A night solo student had a wild ride when his Talon suddenly became an in-flight convertible. The seat attach bolts were not secure, which allowed the ejection seat to slide up the rails (during a negative G encounter) until the canopy piercer shattered the canopy. The student successfully recovered the aircraft, although both engines suffered damage from ingesting pieces of the canopy.

Ten of last year's Class Cs were engine-related, to include FOD, compressor blade failure/stalls, overtemps and stuck nozzles. Three Class Cs resulted from departing the runway surface after aborted takeoffs or touch-and-gos, highlighting the importance of timely and sound abort decisions. Rounding out last year's Class Cs were three birdstrikes, a hard landing, flap/wingtip structural failures and a failed shoulder stud, which resulted in a nose-gear-up landing.

For Class Es, about half were engine-related, to include nine flameouts, three compressor stalls, three FCF restart failures (faulty igniters) and a stuck throttle due to FOD. Also, a loose B-nut under the front windscreen resulted in failure of the front cockpit airspeed indicator. Smoke and fumes continue in the Talon cockpit, with eight occurrences last year, most of them related to an air conditioner turbine failure or a "dirty sock."

The T-38C is coming on line, with its share of unique problems. Water intrusion to the avionics is an increased threat. Also, incidents of cockpit instruments freezing in place (without off-flags) are not uncommon, which is more hazardous given the relatively small standby ADI. Again, a very successful year. Let's have another in '03!



USAF Photo

LT COL MICHAEL BAUMGART, GAF
HQ AFSC/SEFF

T-37 Tweet

The T-37 Tweet is still the primary flight trainer for the US Air Force. For more than 46 years this trainer has done its daily job, enabling many young flight students to learn the business of flying. So, even though it has become a very familiar face to the pilots who fly this aircraft, we must not let this familiarity make us complacent. While an old friend may forgive you in many different circumstances, the T-37 is not so forgiving.

In FY02 the Air Force T-37 had one Class A, no Class B, 14 Class C and multiple Class E mishaps. We've seen a decrease from 49 Class C mishaps in FY00 to 19 Class C mishaps in FY01 to 14 in FY02. But even though we are moving in the right direction with the reduction of total T-37 mishaps, we were very unfortunate to have lost two young pilots during this year in one Class A mishap. It has been over 10 years since a pilot has lost his or her life in a T-37 mishap, and now we must strive to reduce that number again to zero.

In the only Class A mishap, the mishap student (MS) and mishap instructor pilot (MIP) were flying a syllabus-directed local dual training mission. The Accident Investigation Board president stated that in his opinion clear and convincing evidence indicates the MIP was flying the aircraft in the final turn for a touch-and-go landing. At the same time, another T-37 was on a straight-in approach to the runway. When the MIP reported "Gear down" to the Runway Supervisory Unit (RSU) without additionally stating he had the straight-in aircraft in sight, the RSU controller questioned the MIP if he had the straight-in traffic in sight. The MIP responded that he did not and he was going around. At that point, the MIP appeared to roll the mishap aircraft (MA) to a near-wings-level, slightly nose-up attitude. The MIP then rolled the MA into a descending right-bank turn with the bank increasing steadily from 30 degrees to 80-90 degrees, significantly exceeding the 45 degree maximum allowed by Air Education and Training Command (AETC) Manual 3-3, Vol. 2. As a result of excessive bank angle combined with final turn airspeed (110 knots), the T-37 appeared to stall, departing controlled flight with a rapid right descending roll (nose-low attitude). Due to the low altitude of the stall, the MIP and MS were unable to successfully recover the aircraft prior to ground impact. Neither crewmember attempted to eject.

Looking over the rest of the T-37's mishaps/events for trends, two trends become evident. First, there were 17 GLOC incidents this year—all attributed to inadequate anti-G straining maneuver by student pilots. In previous years, a T-37 Class A involved a solo student who GLOC'd and ended up in a spin and bailed out. This underscores that every GLOC represents a potential Class A, and a potential fatality! Of interest, only four of the 17 incidents occurred at anything significantly over four Gs. The second trend was the continued occurrence of smoke/fume incidents—28 this year. Of those, 12 involved the air conditioning system, five an oil leak, five others from electrical problems, and the other six from a mixed bag of reasons.

T-6 Texan II

The T-6 Texan II has been in service from November 2001 and continues with its outstanding safety record. In FY02 the T-6 was involved in only one Class C flight mishap and no Class As or Bs. The Class C mishap occurred when the landing gear would not extend correctly and the crew performed an intentional gear-up landing. Both crewmembers egressed uneventfully.

Finally, the T-6 has experienced three reported cases of attitude heading reference system (AHRS) failure over the past year. Crews need to be diligent in reporting these and any other significant events through safety channels to ensure proper tracking and elimination of the inevitable "bugs" that pop up with new airframes.

Congratulations to T-37 and T-6 pilots!

HELICOPTERS: H-1 H-53 H-60

USAF Photo

LT COL DOUG TRACY
HQ AFSC/SEFF

Unfortunately, Fiscal Year 2002 was the worst in 33 years for USAF helicopter Class A mishaps. During the year, there were nine (five MH-53, three HH-60 and one H-1), for an annual rate of 13.25 mishaps per 100,000 flight hours. By contrast, the USAF had a total of 35 Class A aviation mishaps, for an annual rate of 1.52, the highest in the last ten years. During the same period, our sister services experienced the following Class A helicopter mishap rates: Army—2.83; Navy—4.28; Marine Corps—3.46; and Coast Guard—2.93.

The USAF groups mishaps by categories: Operations Related, Logistics Related, Maintenance Related and Other. During FY02, 66.7 percent of USAF Class A aviations mishaps were categorized as Operations Related, 27.7 percent Logistics Related, 2.7 percent Maintenance Related and 2.7 percent Other. 100 percent of the helicopter mishaps in 2002 were Operations Related. Furthermore, since 1996 there have been 17 Class A helicopter mishaps and they have all been Operations Related. One has to go back to 1995 in order to find a non-Operations Related helicopter Class A mishap.

Fortunately, there were no fatalities in FY02 as a result of USAF helicopter mishaps.

During FY01, there were no USAF helicopter Class A mishaps. What was done differently in 2001 that should have been done in 2002?

Because there is privileged information in Class A Aviation Mishap reports, I must address the bottom line of mishaps without linking them to a specific MDS, location, date or unit.

A mishap happened during a SAR mission. The mishap crew was tasked to locate a downed aircraft at night in a high-altitude environment. Approximately seven and a half hours into the mission, the mishap crew located the downed aircraft. The mishap crew then set up to make an approach into the mountainous mishap location. This mishap occurred because the mishap pilot failed to adequately assess the hazards in order to minimize risks associated with the rescue. Additionally, the mishap crew misperceived height and proximity of the trees conflicting with the flight path.

A mishap involved an aircrew conducting Combat Search and Rescue (CSAR) training. The mishap pilot overbanked the aircraft to approximately 90 degrees, placing it in an unrecoverable situation. Additionally, the mishap crew did not back the mishap pilot up with the required calls and proper crew coordination. A reason CRM was lacking amongst this crew was the mishap pilot had a history of non-responsiveness to inputs from his crewmembers.

Another mishap occurred during a "life or death" operational mission. During the mission weather became questionable, and the mishap crew unsuccessfully attempted to negotiate the weather. The mishap aircrew delayed an abort decision because they did not know the weather had closed in behind them. While avoiding the weather and terrain, the mishap pilot initiated a turn that exceeded the aerodynamic and power capabilities of the mishap aircraft and he entered a rate of descent he could not arrest.

A mishap occurred because the mishap flight engineer failed to ensure the engine air particle separator doors were closed, due to not accomplishing all checklist items. During a go-around out of dust-out conditions, the mishap aircraft's number two engine compressor stalled due to cumulative dust ingestion, resulting in loss of lift.

Another mishap occurred during shipboard operations training. The mishap pilot failed to apply enough aircraft control input and continued to drift toward the ship's superstructure. Also, the mishap right scanner failed to confirm that the mishap aircraft had stopped drifting right.

A mishap occurred during a high-altitude mountainous SAR mission. The mishap crew miscalculated aircraft gross weight, resulting in errors in their aircraft's performance computations. Additionally, the mishap crew failed to plan for increases in power required to hover caused by variable wind. While attempting to recover the survivor, the mishap aircraft's rotor RPM begin to decay and the mishap pilot delayed executing his escape plan. The rotor RPM worsened and tail rotor effectiveness was lost.

A mishap was again the result of poor CRM, this time in assessing the degree of slope in the landing zone during NVG operations. Moreover, the mishap crew failed to properly monitor the aircraft's attitude and height above the slope with the nose positioned on the upslope side. The nose wheel then slipped down the slope and the mishap pilot applied forward cyclic, causing the main rotor blades to strike the fuselage.

A mishap involved an emergency procedures sortie where the student pilot was having difficulties with manual fuel operations in a hover. The student pilot incorrectly increased the throttle, inducing a swapped torque condition and causing a small climb. He noticed the swapped condition and applied up collective and inadvertently added additional throttle, further increasing the swapped condition and climb. The instructor pilot then took the controls, without stating he was assuming control of the aircraft, and reduced the throttle on the automatic engine. Then the student pilot made a simultaneous throttle reduction on the manual engine and the mishap aircraft impacted the ground.

Finally, a mishap occurred following a CSAR mission when the mishap crew was taking off to return to home station. The mishap pilot attempted an NVG marginal power takeoff using a technique that did not allow the mishap aircraft to get through Effective Translational Lift prior to entering brownout conditions. The mishap pilot then failed to transition to an instrument takeoff commensurate with the rapid loss of outside visual cues. The mishap pilot increased power demand and further decayed the main rotor below 95 percent RPM, forcing the mishap aircraft to descend and impact the terrain.

It was a tough year for the USAF helicopter community. Most of these missions involved little or no margin for error. Common themes throughout these mishaps are the fact that our aircrews are operating at high altitude in difficult environmental conditions, the missions are high priority and the operations are high-risk.

Now, what needs to be done to turn around this trend? Headquarters need to ensure the adequacy of procedural and operational guidance. Additionally, they need to review both formal and continuation training to ensure their aircrews are trained for the demands of operational requirements. Also, because of the nature of these high-risk operations, headquarters need to ensure their aircrews are adequately equipped for success.

Unit leadership needs to take a hard look at their Operational Risk Management programs and remember ORM is not just an item to be accomplished prior to takeoff, but rather a continuous, iterative process. Also, two of the four ORM Principles are especially critical in high-risk operations: accept no unnecessary risk and accept risk when benefits outweigh the cost. The Air Force lost combat capability as a result of these mishaps, and in each case where a helicopter was lost on a SAR, CSAR or exfiltration mission, those people who were the object of the mission were recovered by other means following the helicopter mishap.

For the aircrew: When you are training don't "blow off" the basics. Basics are the building blocks for the more complicated tactical events. If you cannot successfully accomplish non-tactical remote area operations to a high-altitude, snow-covered, forested mountaintop on NVGs, do not expect to succeed in a tactical environment. Also, after accomplishing your ORM and proceeding on the mission, if the situation and environmental conditions turn for the worst, turn around and come home. Better to preserve combat capability and fly another day than to be on the five o'clock news in a flag-draped coffin being taken off a C-17.

Fly Safe! The mission comes first, but do it smartly!

C-130

MAJ MIKE FOLKERTS
HQ AFSC/SEFF

During the last year, the C-130 community has been tasked to fly some extremely challenging and critical missions. Operating from forward locations with harsh conditions, C-130 crews and support personnel can be justifiably proud of their tremendous efforts in the war against terrorism. Although it's not surprising that mishap rates have increased to some degree during contingency missions, many of the Class A and B mishaps this past year were very preventable.

Class As

The three C-130 Class A mishaps of FY02 can be summarized with a "four letter word": CFIT (Controlled Flight Into Terrain). Two of the Class As occurred in support of Operation ENDURING FREEDOM, while the third mishap occurred during a training mission. A fourth Class A nearly occurred during an airdrop mission, when an MC-130H's cargo ramp struck the ground on run-in to the DZ. The cumulative result was the unfortunate loss of 13 lives and three destroyed aircraft. Last year's Class A rate of 1.02 per 100,000 flying hours was the worst for the C-130 community since 1981.

The Class A mishaps of this past year highlight two areas of concern for Herc operators. The first involves mishaps on which aircrews "let their guard down" during a critical phase of flight. When flying at low altitudes, there is no task of higher priority than clearing your flight path from the ground. Whenever distractions or unplanned events occur while flying in the low-level environment, the P_k of the ground must always be respected.

The second concern is a willingness by aircrews to proceed with missions when only a narrow margin separates success from disaster. The environmental conditions and fluid taskings of contingency missions present unique challenges, many of which are not present during normal training. With this in mind, it is even more important for aircrew members and supervisors to aggressively search for ways to create and maintain an acceptable operational safety margin.

MC-130P Class A, Feb 02

The mishap crew (MC) departed on a high-priority contingency mission to refuel three MH-47 helicopters. Approximately 3.5 hours after departure, the mishap aircraft (MA) impacted approximately 100 feet from the top of a 10,000-foot MSL ridgeline in a remote, mountainous area of Afghanistan. Fortunately, the aircraft impacted into an area of heavy snow at approximately 80 knots, which allowed all crewmembers to survive. An accident investigation board was not convened for this mishap, and all sources of information were obtained from privileged testimony. If you have not been briefed on this mishap, ask your flight safety officer to show you the safety message.

MC-130H Class A, Jun 02

No other C-130 units in the Area of Operations (AO) had used the LZ, which was an unimproved dirt and gravel runway (5700 feet in length at an elevation of 7000 feet) in mountainous terrain. The MC landed and uploaded cargo for a planned gross weight of 152,000 pounds. Accident board analysis revealed aircraft weight was actually approximately 156,000 pounds, due to inaccurate load planning by the deployed ground forces. During the attempted initial climbout, the MA impacted on sandy, rolling terrain at a distance of 2.4 miles from the departure end of the LZ. The two loadmasters and one passenger were fatally injured. All remaining crewmembers and passengers egressed with minor or no injuries.

USAF Photo

The runway surface consisted of 6-10 inches of loose sand, resulting in the aircraft using almost the entire length of the runway to reach takeoff speed. The aircraft lifted off at max effort takeoff speed, but was denied the opportunity for additional acceleration on the ground prior to liftoff.

The aircraft was operating at the edge of the performance envelope. Flight test data indicated that maximum effort takeoffs at high gross weights and high altitudes are critical maneuvers requiring extremely precise control of pitch during initial climbout. This margin for error was very small, especially when compared to the margin available for typical max effort operations at lower altitudes and gross weights.

Flying near the edge of the performance envelope is the most important time to mitigate risk. Reduce gross weight by taking less cargo or fuel. Be consciously aware that the aircraft will not perform at high altitudes like it does at lower altitudes. Look at alternative methods to accomplish the mission.

MC-130H Class A, Aug 02

The mishap crew (MC) flew 25 minutes of an uneventful, night, low-level training route, with no lunar illumination and broken skies. According to the cockpit voice recorder, 36 seconds prior to impact, the mishap navigator (MN) directed the MP to initiate a slight right turn to deviate from weather and the electronic warfare officer (EWO) gave a turnpoint briefing. Twelve seconds prior to impact, the terrain-following system gave the MC an Obstacle Warning (OW). The OW is a visual and aural indication that the aircraft may be incapable of climbing over terrain directly in front of the aircraft.

Ten seconds prior to impact, the MP verbally informed the MC that the OW system might be detecting weather. Eight seconds prior to impact, the MP told the MC that his TA scope was clear and informed the MC of his intention to stay down instead of climbing. Five seconds prior to impact, both the MN and the mishap command pilot (MCP) directed the MP to climb, and the MP indicated he was beginning a climb. Three seconds prior to impact, the TF system gave the crew a low altitude warning. The MA impacted terrain approximately 100 feet from the top of a ridgeline in a 4° nose-up attitude, fatally injuring all on board.

We must understand our written guidance may not be perfect. Also, things happen very quickly during flights close to the ground. For MC-130 crewmembers, there are several important lessons to be learned from reading the safety message on this mishap.

Class B Taxi Mishaps

This last year, two "slick" C-130s suffered Class B damage while taxiing. The first mishap occurred during a contingency mission at an austere field. The crew reverse-taxied with very low visibility (due to dust) and struck a parked helicopter.

The second taxi mishap also occurred at night, when a maintenance stand was left out on a combined parking apron/primary taxiway. The crew apparently did not see the maintenance stand in time, and the number one prop hit the stand.

Smoke/Fumes

As the Herc ages, there continues to be no shortage of items burning up or rupturing/leaking. During FY02, 36 smoke and fumes incidents were reported, which accounted for over 80 percent of all Class E mishaps. Culprits ranged from static line retrievers to bleed air duct insulation to hydraulic leaks. When noticing an odor, be sure to take the conservative path and don your oxygen mask while evaluating the problem.

Turbine Failures

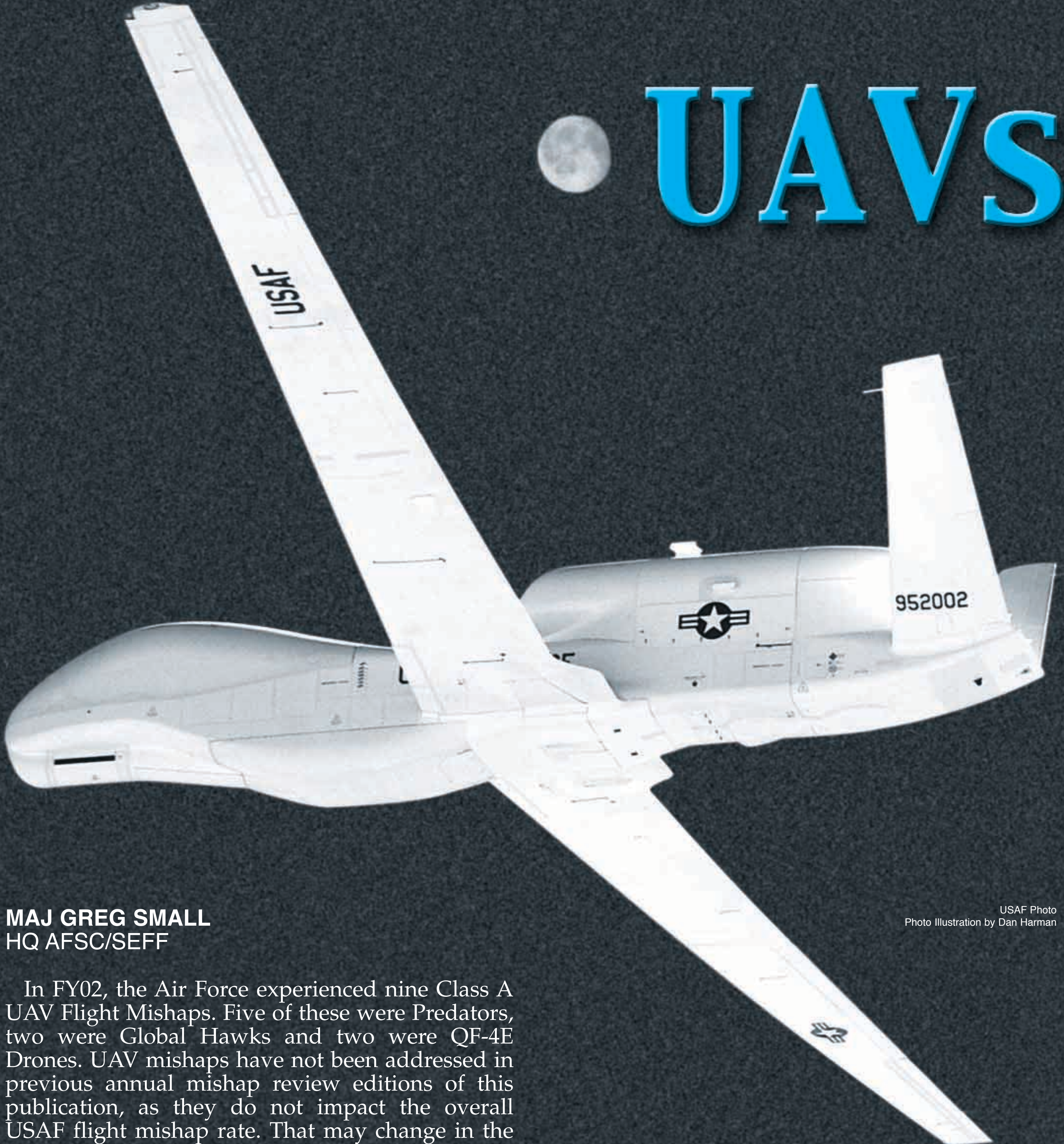
Nothing interrupts a smooth flight and gets your attention like a turbine failure. Unfortunately, turbine failures in the Herc continue to be an all-too-common occurrence. This fact was highlighted at this year's Systems Safety Group Conference, as the C-130 program office elevated turbine improvements to its number one priority.

Three logistics actions are occurring to help curb/mitigate turbine failures. The first action is depot inspection of the fourth stage rotor to spot oversize blade roots. As of Nov 02, inspection for oversize blade roots is about 40 percent complete. The second logistics action is an improved Z-shroud blade design for the 1st stage turbine. Starting in Oct 02, rotor production was increased from 10 per month to 30 per month. Finally, energy absorbing rings (EARs) have been installed around the turbine to mitigate damage during turbine failures. To date, EARs have been installed on 98 percent of C-130 T56-7 engines.

"Contingency" Operational Risk Management

When flying contingency missions, an increase in the acceptable level of risk is a given. Even so, be sure to guard against the mindset that "almost no risk is too great" to successfully complete a high priority mission. The challenging and fluid nature of contingency missions demands that even more attention be paid to risk management, not less. Good luck and Godspeed over the next year.

UAVs



USAF Photo
Photo Illustration by Dan Harman

MAJ GREG SMALL
HQ AFSC/SEFF

In FY02, the Air Force experienced nine Class A UAV Flight Mishaps. Five of these were Predators, two were Global Hawks and two were QF-4E Drones. UAV mishaps have not been addressed in previous annual mishap review editions of this publication, as they do not impact the overall USAF flight mishap rate. That may change in the near future, so it is our intent with this article to introduce the readers to some of the more significant mishaps.

Global Hawk

One of the Global Hawks was returning from a truncated operational mission in support of Operation ENDURING FREEDOM when it departed controlled flight, entering an unrecoverable right spin. It impacted the ground in an uninhabited area approximately 80 miles south of the classified Forward Operating Location landing site. The damage to the Mishap Aircraft (MA), including the sensor package, was estimated at $40.6 million.

During the return flight, the right outboard ruddervator actuator control rod failed, allowing the ruddervator to travel unrestrained beyond its normal range. The control rod failure was caused by metal fatigue induced by a bend in the rod that occurred when it contacted an improperly installed actuator nut plate bolt. While the MA was descending through approximately 54,000 feet MSL during the second of three 90-degree planned left turns, the lift spoilers fully deployed to assist the descent. Twenty-nine seconds later, the MA departed controlled flight, entering a right spin.

Once the four lift spoilers were raised to their maximum 45-degree deflection at this altitude, the ensuing turbulent air induced violent flutter on the unconstrained right outboard ruddervator. The energy of the resultant flutter was absorbed by the right V-tail main spar, and quickly resulted in delamination of the spar caps and center webbing from the root to over one-third the length of the spar. The flexing of the spar and continuing flutter eventually caused failure of the double torsion box construction of the right V-tail, further subjecting the V-tail to increasing torsional loading. The overall result was the structural failure of the right V-tail inducing the right spin.

Predator

A mishap occurred in Operation ENDURING FREEDOM during a planned handoff of control between two ground control stations using a lost link recovery orbit point. When accomplishing this lost link handover, the mishap crew failed to accomplish checklist steps in the proper order, resulting in the MA's Stability Augmentation System (SAS) and engine ignition being turned off immediately after enabling the satellite command link. When the MA received the commands to turn the SAS and the engine off, it entered an uncommanded dive. The MA impacted the ground nine miles off the end of the runway of the classified Forward Operating Location and was destroyed. The loss was estimated at $3,251,400.

In a second OEF Predator mishap, the MA crashed while landing at a classified Forward Operating Location. The mishap pilot's (MP) first attempted landing resulted in a go-around due to the effects of gusty winds. During the second approach under similar wind conditions, the MA's nose ballooned in the flare. The MP attempted to push the nose forward to correct this condition. Before he had the opportunity to initiate go-around procedures again, the MA's nose pitched forward beyond his control. The nose gear struck the runway with excessive force, breaking the nose landing gear strut. As an additional result of the excessively hard landing, the MA's right tailplane separated from the fuselage. The resulting asymmetrical pitch and yaw caused the MA to bank sharply to the right. It impacted the ground approximately 100 yards east of the runway and was destroyed. The primary cause of the mishap was the MP's inability to maintain positive control of the aircraft due to the adverse effects of strong wind gusts. The resulting structural damage from a nose gear-first landing further inhibited control of the aircraft, which then impacted the ground. Gust wind speeds reported just prior to the mishap were at the maximum limit for Predator landings. Gusts five minutes after the mishap were out of limits.

We lost another Predator when it experienced a catastrophic engine failure while conducting a mission in support of Operation SOUTHERN WATCH. The Mishap Crew recognized an engine malfunction approximately two hours after takeoff and immediately initiated an RTB. As the MA approached the airfield, the engine malfunction became catastrophic, causing an engine failure and seizure that negated all possibility of a safe landing. The crew diverted the MA to an unprepared landing surface. The MA suffered extreme damage upon impact, primarily to the landing gear and payload. The loss is valued at almost $1.5 million.

Drones

The first of two QF-4E Class A flight mishaps occurred during a planned automatic takeoff (ATO) using the automatic flight control system (AFCS). During takeoff roll the MA began to experience slight but increasing negative and positive pitch oscillations. These continued as the MA commenced rotation, pitching up initially to 14.5 degrees nose-high and then pitching down to –20.3 degrees nose-low, ultimately causing the MA to impact the runway. The MA was destroyed upon impact and the resulting post-crash fire. The tri-axis rate gyro, which provides pitch, roll and yaw rate information to the AFCS executing the ATO, was incorrectly installed.

The second QF-4E mishap also occurred during a launch in ATO mode. The ATO failed to progress normally, so the primary drone controller attempted to take control manually and fly it off the runway. The primary attitude reference system, the ANI AJB-7, failed. Among other things, the ANI AJB-7 provides primary attitude references to the controller's computer screen. This allows the controller to monitor the drone's performance and take over manually when necessary. At rotation speed of 160 knots, the attitude displayed on the controller's monitor indicated a normal takeoff attitude of twelve degrees nose-high. Post-mishap analysis of telemetry data revealed the actual attitude to be four degrees less. Because of this discrepancy, the controller thought the takeoff was progressing normally when in reality the MA did not rotate enough to lift off the runway. By the time the controller recognized the failure to rotate, the MA was traveling at a speed of over 250 knots. The controller went to manual control, and due to the high airspeed, commanded an excessive nose-up pitch rate. The MA was destroyed upon impact in a heavily wooded, unpopulated area. Several human factors, including the lack of "seat of the pants" feedback to the controller and arrangement of console monitors and controls, substantially contributed to the excessive nose-up command.

FY02 Maintenance Wrap-Up

USAF Photo by SSgt Shane Cuomo
Photo Illustration by Dan Harman

CMSGT JEFF MOENING
HQ AFSC/SEMM

Forgetting the simple things cost us more work than we can afford.

Well, fellow maintainers, we have ended another fiscal year and the body count for our peers has been heavy. Unfortunately, one of our fellow maintainers is not with us due to an on-duty mishap. Why did he die? Was his death preventable? Check out the mishap report from your safety office to read the real story. Tough things for a group of professionals to hear.

When I went to the data folks here at the Safety Center and asked for the maintenance-related Class A, B and C mishaps for FY02 in flight and ground, I was shocked with the almost 800-page report I received. (I did not print out the report, so I saved a tree.) What are we doing to ourselves?

I then had the task of sifting through the mishaps to try and find out some of the key facts and factors that may give you some insight in preventing these mishaps in FY03.

Here are a few one-liners about the dumb things we did to our high-priced aircraft this year and the result.

- Technician failed to detect stray voltage in lower breech during an ops check—inadvertent bomb release.
- Two inlet guide vane spacers were improperly installed—engine trashed.
- Incorrect screw installed in weapons bay hinge—FOD damaged engine.
- Mishap worker failed to use the T.O. during installation of a throttle control assembly—engine fire.
- Hydraulic pressure hose installed without required spacer—complete loss of hydraulics in-flight.
- Unauthorized and modified fuel vent plug assembly used—destroyed aircraft.

That's just a few of the mistakes we made, and I think you have the idea of how little things can add up quickly. As I went through the 98 pages of flight mishaps caused by maintenance, here is the top 10 list of things we did wrong.

1. Technician failed to follow published tech data or local instructions.
2. Worker used an unauthorized procedure not referenced in tech data.
3. Operational checks were not completed as required by tech data.
4. Technician did not document their actions in the AFTO Form 781A or engine work package.
5. Inattention to detail/complacency.
6. Technician installed improper hardware on the aircraft/engine.
7. Technician completed an unauthorized modification of the aircraft.
8. Worker failed to conduct a tool inventory after completion of the task.
9. Technician was not trained or certified for the task.
10. Ground support equipment improperly positioned for the task.

You should have noticed that the first three were all about tech data. We are human beings and we all have bad days, but we are given tech data that guides us for each task for a reason. If the tech data is wrong, we have methods to correct it. It may take a while, but at least it will get fixed.

The two main indicators that I pulled from all the mishaps were complacency and inattention to detail, which goes hand-in-hand with failure to follow tech data. We could have reduced our mishaps by over 80 percent if we had followed the tech data, used the right tool and accounted for it and installed the right hardware. Forgetting the simple things cost us more work than we can afford.

That's enough about the flying side. How about the maintainer who gets hurt at work? Here are a few of the injuries we sustained.

• Tried to lift a 198-pound 20 mm ammo can—strained back.

• Tried to lift 166-pound Universal Ammo Loader system—strained back.

• Worker was pinned between man lift and aircraft surface—abrasions and strains.

• Moved a jack and jack pad fell on his head—stitches.

• Struck in the eye with pressurized water—eye injury.

• Tried to lift an F-16 ventral fin—strained back.

• Improperly installed an aircraft ladder and it fell on him—cuts.

• Washed an aircraft and fell off—fractured ankle.

• Used drill to install a panel and it slipped and hit him in the mouth—broken teeth.

• Unclogged stuck snow blower—severed finger.

• Pushed 7400-pound air conditioner by himself—strained back.

These are a few of the ways we injured ourselves this year, and it seems to be a repeat of past years, especially back injuries. Having worked the line for 22 years, and being one of the statistics a couple of times, I find the amount of people we injure on-duty each year AF-wide is staggering. So, here are the top ten reasons for flightline ground mishaps.

1. Judgment or lack thereof
2. Attention management
3. Inadequate risk management
4. Perceptions
5. Accepted risk
6. Discipline
7. Preparation
8. Faulty part
9. Design
10. Training

The one thing you see here is that the list is fairly similar to the flight mishaps. We have a young Air Force, and sometimes they don't have the experience that we old heads have. That is where we, the old heads, come into play and teach the young airmen the right and safe way to do the task. Not the shortcuts that could get them injured. The airmen will follow the leader, and when they see supervision accepting shortcuts and work-arounds they follow suit, and don't think anything about it until someone gets hurt. Then the investigation happens and fingers get pointed about why this and why that happened. The *time* to fix the problems is *before* they happen, and only we, the maintainers, can do that.

We are our own police force. We have quality assurance to follow us up, but they can't watch every task, and they shouldn't have to. We have supervisors who *must* be on the flightline, which is why the AMCAB wants MSgts to spend more time out on the line—to spread the experience and give the young troops the benefit of their greater knowledge and expertise.

To wrap things up, it wasn't a good year for maintenance in the safety arena. We lost a "qualified technician," and we injured ourselves way too often due to bad judgment. Here is where you can use ORM to mitigate the risk. Whether it is the lone individual on the line making a judgment call, or supervision making the call for the entire unit, mitigate the risk to the full extent possible. We live and work in a dangerous environment and *stuff happens*, but when *stuff happens* because a person didn't follow published guidelines or supervision accepted shortcuts that endangered personnel, then we have room for improvement.

If you want more detailed data on last year's mishaps, talk to your wing safety office, or contact me. My number is in the front of the magazine and I'm on the global e-mail listing. If you want topics for an upcoming safety day briefing, give me a call. I'll be glad to help. I'll even come give the briefing for you, if funds and time allow, so you can get the AF Safety Center's perspective on mishaps. Be safe out there maintainers, and remember, fix the aircraft like *your* life depends on it. Because *your* life and someone else's life *does* depend on it!

The time to fix the problems is before they happen, and only we, the maintainers, can do that.

FY02 Engine-Related Mishap Summary

HQ AFSC Photo by Rich Greenwood

A GOOD NEWS STORY!

BILL BRADFORD
CAPT TOM FEHRINGER
RICH GREENWOOD
JOHN MAYNARD
HQ AFSC/SEFE

(Information in this article came from Accident Investigation Board and/or Part I of Safety Investigation Board Reports. None of this material was derived from privileged communications. Ed.)

12.0% is lowest percentage of USAF destroyed aircraft due to engines in over twenty years.

The past year was particularly good for those of us in the engine community. The USAF matched the lowest number of engine-related destroyed aircraft (three) for any other year over the past three decades. Figure 1 shows how this year matches up with the past. You can see how the graph staggers up and down, especially over the past five years. With engines accounting for only 12.0% of the destroyed aircraft this year, we've found ourselves in one of the better years, so we can consider ourselves either good, somewhat lucky, or both. This is lowest percentage of USAF destroyed aircraft due to engines in over twenty years.

The bad news part of this good news story is that two of these destroyed aircraft were the result of previously known failure modes (one of which had resulted in a previous Class A mishap) where risk mitigation actions simply were not strong enough. Another of these destroyed assets resulted from a failed fuel nozzle on a UAV engine.

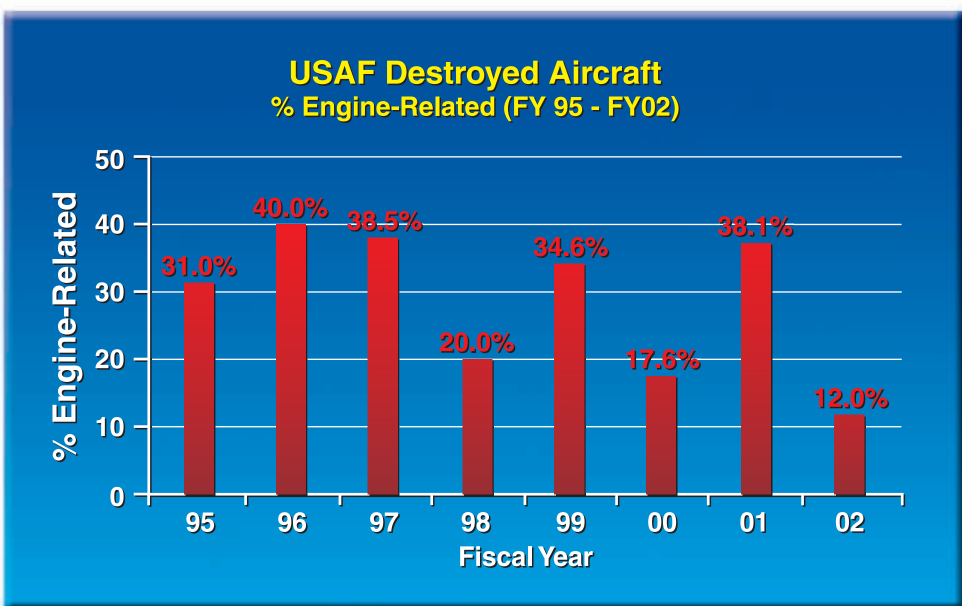


Figure 1

Now let's take a look at how engines stacked up against other causes of destroyed aircraft. Figure 2 tells us that engines made up the smallest category resulting in destroyed aircraft this year. Again, this is good news for the engine community, at least relative to the airframe and ops side of things.

Since there were only three engine-related mishaps resulting in destroyed aircraft, we'll include all USAF engine-related Class A mishaps in the remaining summary plus a few others for good measure. There were a total of ten engine-related Class A mishaps for FY02. This includes both in-flight mishaps and other mishaps resulting in over $1 million in damage to engines and/or aircraft. Note that two of these mishaps occurred in test cells.

FY02 Destroyed Aircraft
All

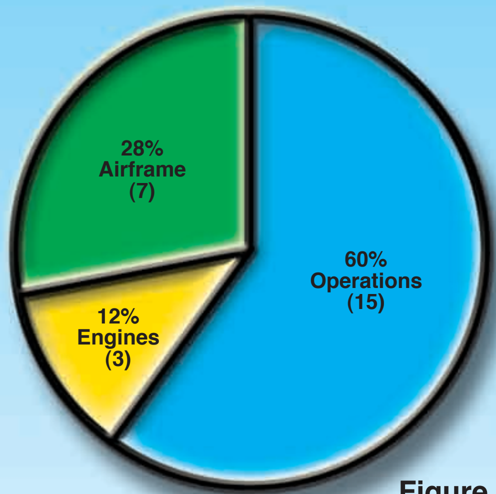


Figure 2

FY02 Engine-Related
Class A Mishaps by Engine Section

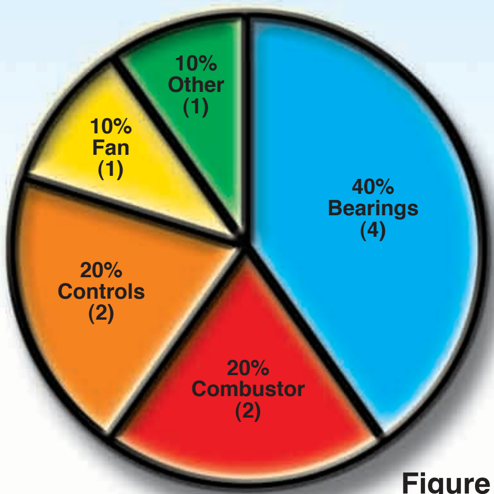


Figure 3

Engine-Related Class A Mishaps By Engine Section

Let's break the ten engine mishaps down by engine section and identify what systems within the engine gave us the greatest issues. Figure 3 gives a quick visual breakdown of the areas of the engine and how many failures cropped up from each of these. As you can see, the turbine provided us the largest number of mishaps. Of the four turbine mishaps, only one of these resulted from a new failure mode, while the other three were from known failure modes. The combustor and fuel nozzles account for two of last year's Class A mishaps. Engine control systems, absent from the previous year's culprits, were the source of two of last year's mishaps. The fan mishap shown in Figure 3 is our only engine foreign object damage (FOD) Class A this year. And finally, the only Class A listed as "Other" is a piston engine. Yes, we still have piston engines in the Air Force, albeit on a UAV.

Figure 4 presents us with an overview of this past year's mishap factors. Even a quick glance reveals that the majority of engine-related mishaps fall under "Logistics." Of these seven logistics-related mishaps, three were known failure modes with either corrective mea-

Engine control systems were the source of two of last year's mishaps.

FY02 Engine-Related
Class A Mishaps by Factors

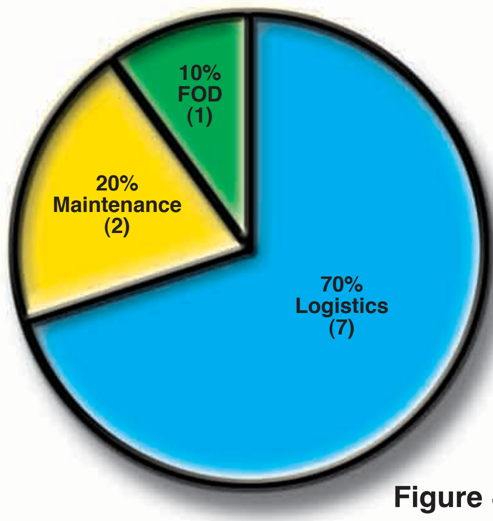


Figure 4

sures or mitigating actions in place to try to reduce failures. These actions have been "beefed up" since the mishaps. The other four logistics-related mishaps were new failure modes and the engine management offices and manufacturers are addressing corrective actions. Two of this past year's mishaps were maintenance-related. These two mishaps both occurred in test cells. And, of course, no year seems to be complete without an engine FOD Class A.

Many of these failures would admittedly be difficult to foresee. However, of those with known failure modes, we can be confident in stating that risk mitigation actions must be thorough and aggressively pursued. As always, attention to detail would have gone far in helping prevent our two maintenance-related failures.

F-15 and F-16 Destroyed Aircraft and Class A Mishap Rates

Focusing on the USAF's fighter aircraft, we'll now compare this past year's destroyed aircraft rates with previous years. The following tables show engine-related destroyed aircraft rates calculated as the number of destroyed aircraft per 100,000 engine flight hours (EFH) for both the F-15 and F-16.

Various engine types power the F-16 fleet. Table 1 shows each engine and its associated rate. Combining them all for a total rate illustrates once again that FY02 was an exceptional year for engines. This is not only the lowest rate we've seen for the past three years, but even beyond that into the 1990s.

The rate itself is not the only indicator. Simply looking at the numbers alone, it's obvious that only two destroyed aircraft in a year makes for one of our better years. It also makes the goal of zero per year seem that much more achievable.

An added chart this year, Figure 5, shows just how good a year it was for F-16s and particularly F-16 engines. Figure 5 compares F-16 Class A totals and F-16 engine-related Class A mishaps for the past five years. Not only does it show that the total number of F-16 Class A mishaps is down, but that also the number of F-16 engine-related Class A mishaps is way down. Not evident from this chart, however, is that both of these numbers are the lowest in the past ten years!

Turning to the F-15 fleet, the engine statistics get even better. Table 2 shows that once again, the F-15 engine-related destroyed aircraft rate, for all engines, is perfect. You can't beat that! And, if you look back just a little further, that's four years in row!

Granted, two engines certainly helps, but much of this can be attributed to aggressive risk mitigation and thorough maintenance.

Figure 6 is a five-year comparison of F-15 Class A mishap totals as compared to F-15 engine-related Class A mishaps similar to the previous F-16 bar chart. Although we've not lost any F-15 aircraft in the past four years due to engine problems, Figure 6 graphically depicts that we still are suffering numerous Class A "dollar amount" mishaps which severely impact the readiness of the F-15 fleet, and the trend is not a decreasing one.

Now that you have a good idea of the overall assessment of engine-related mishaps for FY02, and particularly our statistics for fighter engines, we can delve into each particular mishap. Let's see what areas offer us a chance to bring our rates even lower.

This is not only the lowest rate we've seen for the past three years, but even beyond that into the 1990s.

F-16 Engine-Related Destroyed Aircraft Statistics						
Fiscal Year	FY00		FY01		FY02	
Engine	Aircraft Losses	FY00 Rate	Aircraft Losses	FY01 Rate	Aircraft Losses	FY02 Rate
F100-PW-100	0	0.00	0	0.00	0	0.00
F100-PW-220	2	1.59	2	1.72	0	0.00
F100-PW-229	0	0.00	0	0.00	0	0.00
F110-GE-100	1	0.74	4	2.76	1	0.62
F110-GE-129	0	0.00	1	1.77	1	1.86
All Engines	3	0.87	7	2.08	2	0.55

Table 1

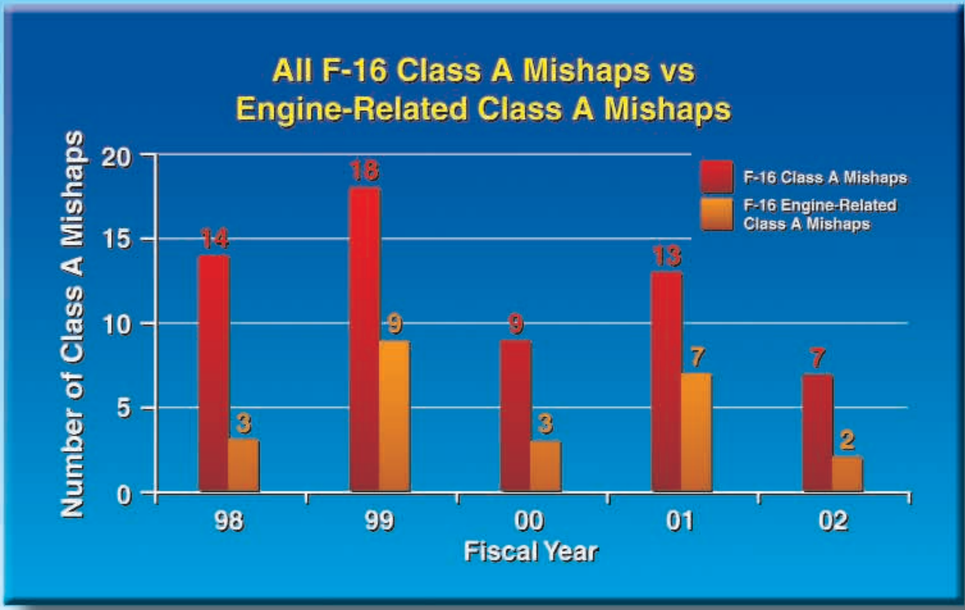


Figure 5

F-15 Engine-Related Destroyed Aircraft Statistics						
Fiscal Year	FY00		FY01		FY02	
Engine	Aircraft Losses	FY00 Rate	Aircraft Losses	FY01 Rate	Aircraft Losses	FY02 Rate
F100-PW-100	0	0.00	0	0.00	0	0.00
F100-PW-220	0	0.00	0	0.00	0	0.00
F100-PW-229	0	0.00	0	0.00	0	0.00
All Engines	0	0.00	0	0.00	0	0.00

Table 2

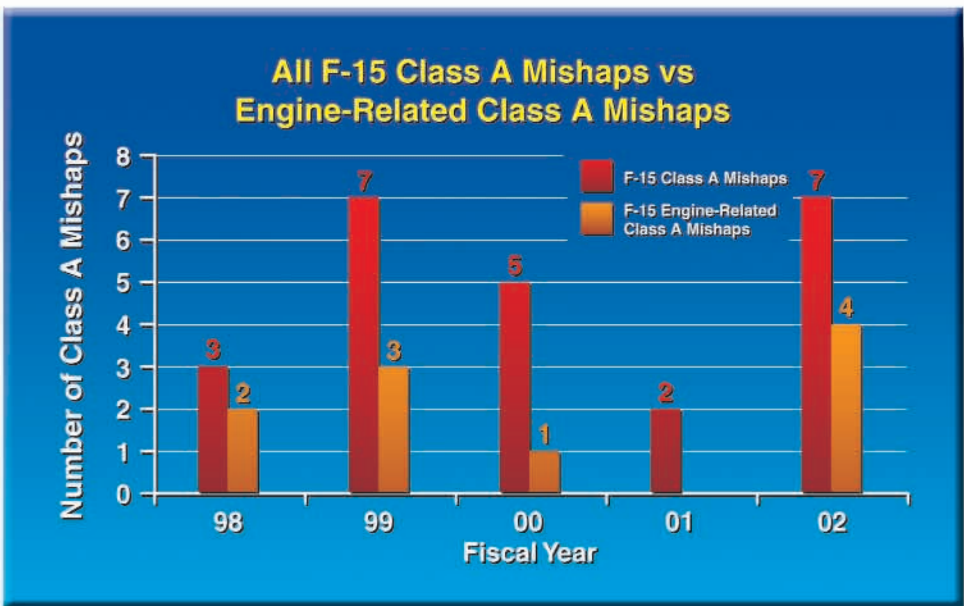


Figure 6

We still are suffering numerous Class A "dollar amount" mishaps which severely impact the readiness of the F-15 fleet.

F110 Engine Mishaps

There were just two engine-related F-16/F110 Class A mishaps in FY02, both of which resulted in destroyed aircraft: One involved the F110-GE-100 engine and the other involved the F110-GE-129 engine. There were no "dollar amount" Class A mishaps involving the F110 family of engines. The total number of Class A mishaps in the F110/F-16 fleet was down 60% from the previous fiscal year. With the F110 powering a majority of the F-16 fleet, this is a good news story if ever there was one. We in the safety community want to thank everyone involved with the F110 engine—the maintainers, the operators, Air Logistic Centers, and the contractor—on the tremendous decline in F110 engine-related Class A mishaps this FY. Let's all strive for a *zero* mishap rate in FY03!

The total number of Class A mishaps in the F110/F-16 fleet was down 60% from the previous fiscal year.

F110-GE-100

The F-16/F110-GE-100 engine-related mishap occurred during a routine local training mission. During a climbing safe maneuver from a high angle dive bomb pass, at 7040 feet MSL, 424 KCAS, the mishap pilot (MP) heard two bangs from the engine and noted a rapid decrease of engine RPM. After zooming and attempting to jettison two external wing tanks, the MP attempted two air starts that were unsuccessful. The MP glided on a course directly towards a local civilian airport, decided he could not make the runway, and successfully ejected. The mishap aircraft impacted the ground in a clear area short of the runway and was destroyed.

Subsequent teardown, analysis, and laboratory investigation revealed a liberation of the outer tang sections of the high pressure turbine (HPT) disk post resulting from low cycle fatigue cracking that initiated at the edge of the pressure faces. Current plans call for a reduction in the life of the current RENÉ 95 HPT disk and replacing it with a drop-in RENÉ 88DT HPT disk which is a more damage-tolerant material.

F110-GE-129

The F110-GE-129 mishap occurred during a basic fighter maneuver mission. After approximately 60 degrees of turn at 15,000 feet, the mishap pilot experienced an engine compressor stall, violent vibrations, and engine RPM decreasing to eight percent. Four unsuccessful air start attempts were performed before the pilot successfully ejected. Inspection and teardown of the engine along with metallurgical analysis revealed that a High-Pressure Turbine (HPT) blade failed due to a fatigue crack. In the past there have been eleven F110-GE-129 engines removed from service due to HPT blades cracking beyond T.O. limits. All were discovered during routine borescope inspections. This is the first case where one of these blades failed in flight. OC-ALC in conjunction with GE put together and implemented a more stringent borescope inspection for the F-16/F110-GE-129 fleet to include more frequent inspections that focus on the HPT blade area where the cracking initiates. Also, the actual amount of damage permitted before rejecting an engine has been decreased. In addition to these actions, a Component Improvement Program (CIP) task has been initiated to develop a permanent fix for this blade fatigue cracking issue.

F100 Engine Mishaps

There were no engine-related Class A mishaps, either from destroyed aircraft or costs, in the USAF F100-powered F-16 fleet for fiscal year 2002. This is a great tribute to the entire engine community. The maintainers are to be commended for their many hours of hard work, dedication and attention to detail. Kudos also go out to the folks at OC-ALC and Pratt & Whitney for their pro-active risk management programs and quality work. It's no secret that the F-16 is usually a leader in the number of engine-related mishaps in the USAF. This year's achievement speaks highly to all those involved.

There were also no destroyed aircraft due to engine problems in the USAF F-15 fleet for fiscal year 2002. There were, however, two dollar value "rate-producing" and two dollar value "non-rate producing" Class A mishaps. "Rate-producing" means the mishaps are counted in Air Force flight mishap statistics per AFI 91-204. Non-rate producers (in this case two Aircraft Ground Ops mishaps) are not counted in the Air Force flight mishap statistics.

F100-PW-229

The first rate-producing mishap was from an F100-PW-229 powered F-15E. The MA was number two of a two-ship on a Basic Surface Attack mission. In the arming/quick check area a few minutes prior to takeoff, the crew noted a left engine control light illuminated, indicating the engine had auto-transferred from primary control mode (PRI) to secondary control mode (SEC). Following flight manual procedures, the crew cycled the engine control switch. The light went off and the crew proceeded with the mission as planned. Shortly after takeoff at 800 feet AGL, the left engine control light again illuminated. The crew felt a thud, heard a loud noise, and fire was seen exiting the left engine. The MP climbed to a safe altitude and accomplished checklist procedures for the emergency to include engine shutdown. Upon taking these actions, the fire was extinguished. The MP flew an uneventful straight-in approach and landing, followed by an emergency ground egress.

The Accident Investigation Board determined that shortly after takeoff the engine again auto-transferred to SEC (most likely due to a power lever angle system discrepancy), and stalled. The stall margin of the engine, having been reduced by compressor deterioration from a previous stall several months before, was further reduced by the SEC transfer. SEC also does not have the stall recovery ability of PRI. Because they were still in the takeoff phase of the flight, the crew elected to keep the throttles in a high power setting until a safe altitude and airspeed could be achieved, exacerbating the non-recoverable stall and fire.

The F-15 flight manual has been revised to not permit cycling of the engine control switch to clear a SEC transfer that has occurred on the ground prior to takeoff. An analysis is also being conducted to see if more stall margin can be made available during SEC operation.

A non-rate producing Class A mishap involved an F100-PW-229 engine installed on a test cell. During the initial engine start a fire developed in the engine tailpipe, which the base fire department eventually successfully extinguished. Subsequent investigation revealed extensive damage to the low and high-pressure turbines, turbine cases, aft fan ducting and sprayrings.

Work completed on the mishap engine prior to installation in the test cell included replacement of the power lever angle shaft seal on the main fuel control. During the shaft seal replacement, the main fuel control was incorrectly rigged, precluding its ability to shut off fuel to the engine. It also supplied more fuel to the engine than indicated by the throttle lever position.

T.O.s are being revised to clarify the rigging procedures to be used when power lever angle shaft seals are replaced. Test cell throttle rigging procedures and pre-start engine checks are also being revised.

Although not previously discussed, nor presented in any of the preceding charts, there was an F100-PW-229-powered F-16CJ Class A mishap this year that was a Singapore asset, but flown by a USAF pilot. Because it was not a USAF asset, it is not included in any of the USAF statistics, nor any of the charts in this article. A brief synopsis of this mishap follows.

While performing a BFM maneuvers training sortie, the MP reported an engine fire to his wingman. The pilot ejected successfully and the mishap aircraft was destroyed by ground impact. Investigation revealed a fourth stage turbine blade fractured from fatigue about 0.4 inches above the blade platform.

An on-wing 50-hour eddy current inspection has been implemented for both the F-15 and F-16 –229-powered fleets, along with increased focused inspections at the blade vendor.

F100-PW-220

The second rate-producing Class A mishap involved an F-15E with an F100-PW-220 engine. The mishap aircraft departed as a single ship on an afterburner takeoff. At about 450 feet, the pilot pulled both throttles from AB to military power. The crew then felt a loud bang and thump and noticed the number one engine fan turbine inlet temperature climbing with the engine RPM decreasing. The pilot then went to full AB on the number two engine and idle on the number one, however, number one FTIT continued to increase

The crew felt a thud, heard a loud noise, and fire was seen exiting the left engine.

while RPM continued to decrease, along with increasing aircraft vibrations. The MP shut down the #1 engine and returned to base for a single-engine landing.

Investigation revealed the engine suffered a third stage turbine blade tip fracture. The ensuing vibrations also fractured number five bearing compartment oil tubes, resulting in an oil fire.

The F100-PW-100/200/220/220E fleet is currently being retrofitted with the new Reliability Enhancement Program (REP) turbine, which will eliminate the third stage turbine tip curl fractures. As of 30 September 2002, the retrofit of the F100 fleet with the REP upgrade looked like this:

F-16/-220	100% complete
F-16/-200	31% complete
F-15/-220	83% complete
F-15/-100	41% complete

For engines without the REP upgrade, borescope inspections and recurrent borescope inspector training are being used to mitigate fleet risk.

If you find that Tech Data is not up-to-date, submit the AFTO 22 to get it changed.

F100-PW-100

A second non-rate producing Class A mishap involved an F100-PW-100-powered F-15C. The mishap aircraft was started and operated in the chocks for approximately 20 minutes. The pilot then felt heavy vibrations and received an FTIT overtemp warning. Both engines were shut down and ground personnel discharged Halon 1211 in the inlet of the number one engine. Teardown of the engine revealed damage to the high pressure turbine in the area of the second stage airseal ring and retaining plate. The post-investigative analysis into the root cause of the mishap is still on-going.

F101 Engine

A non-rate-producing F101-GE-102 Class A mishap occurred in FY02 on an engine test cell. The engine was installed on the test cell for a routine maintenance run. During installation of the main engine control (MEC), the throttle control assembly was improperly connected. This improper connection showed the engine in the cutoff position when the engine was actually in an idle power setting. As air was supplied to start the engine, fuel began flowing prematurely and ignition occurred, igniting the excess fuel in the combustor. The cell operator put the test cell throttle in cutoff, but due to the improper throttle connection, fuel flow cutoff could not be achieved. This resulted in a sustained internal engine fire without sufficient RPM to supply internal cooling to the turbine. The test cell fire system failed and the local fire department was called to extinguish the fire. The internal engine fire caused extensive heat damage to the engine hot section, resulting in over $1 million damage.

This F101 mishap illustrates the importance of following established Technical Data Procedures. A number of unauthorized local "work-arounds" were in place that failed. It would be a good time for each unit to examine their local Test Cell/Hush House operating procedures and ensure they are in compliance with established Technical Data. If you find that Tech Data is not up-to-date, submit the AFTO 22 to get it changed. Do not establish a local work-around and ignore the real issue of correcting the Tech Data. It is every Air Force member's responsibility to ensure Tech Data is up-to-date and to comply with the Tech Data that is currently in place.

F103 Engine

A KC-10/F103-GE-101 incurred a Class A FOD mishap during a local air-refueling mission, when a failure was noted in the number two-engine performance-monitoring coupon. All readings were well off the established baseline. Later during the flight another performance check was made, and these readings also showed the engine well off the baseline. While accomplishing a go-around, the tower notified the aircrew that sparks were coming out of the number two engine. The aircrew retarded the engine to idle and immediately landed. After taxiing clear of the runway the number two engine was shut down. Initial inspection revealed extensive internal engine damage over $1 million. The investigation found that an aircraft panel fastener was ingested during flight. It struck a compressor blade, which caused a tear in the blade and led to the blade failing. The failed blade caused extensive compressor and turbine damage. The fastener is common to a number of aircraft in the US Air Force inventory including the mishap aircraft. An inspection of the mishap aircraft revealed no missing fasteners.

F119-PW-100 Engine

There was a birdstrike in FY02 that resulted in Class A damage to an F119 engine that was especially noteworthy and not discussed in any of the preceding paragraphs or charts.

An F-22A Raptor departed on an aircraft delivery mission. Just prior to rolling out from a right-hand banked turn, the MA struck a large bird. The chase aircraft conducted a battle damage assessment, with no damage noted. The MP did not have any cockpit indications to suggest bird ingestion by either engine. After reducing gross weight the MP flew an uneventful straight-in full stop landing back at the departure base. Damage to the right-hand engine was discovered during post-flight inspections. Teardown of the engine revealed bird remains and airfoil damage throughout all nine stages of the fan and compressor. A portion of a first-stage fan blade was also broken off and ingested by the engine.

Analysis of the bird remains indicated it was a Common Loon, which has an average weight of nine pounds! Despite ingestion of this large bird, the engine continued to operate with minimal vibration and without secondary failures. Additionally, the comprehensive engine diagnostic unit did not record any fault codes. Kudos go to the F119 team for the design of such a robust engine.

RQ-4A Mishap (Rolls-Royce AE-3007H Engine)

The mishap aircraft was an unmanned aerial vehicle (UAV) flying a combat mission in support of Operation ENDURING FREEDOM. The preflight through the first seven hours of the mishap flight was normal. The UAV then had FADEC and Engine Vibration caution indications. Additional Engine Vibration cautions ensued. Approximately ten minutes later the UAV experienced a failure code indicating two of the four navigation systems were invalid. A return to base was initiated, and during the return the UAV experienced a catastrophic engine failure. The UAV impacted the ground and was destroyed. Teardown and analysis of the mishap engine revealed a single fuel nozzle stuck in the takeoff flow metered position. This caused sufficient heat distress downstream such that the material strength of the first stage LPT disk was diminished enough that it could not retain the mass of the disk rim and blades. The disk rim and blades unzipped and exited the engine in a half-circle arc of the fan duct. The engine continued to run; however, the loss in fan case duct structural integrity allowed the low pressure (LP) spool rear bearing to go out of alignment. This severe misalignment allowed rubbing to occur between the high pressure (HP) and LP shafts, which eventually resulted in HP shaft failure and subsequent spooldown of the engine. The post-investigative analysis to determine the root cause of the fuel nozzle failure is still on-going.

RQ-1B Mishap (ROTAX 914 Engine)

The RQ-1B, more commonly known as the Predator, is an unmanned aerial vehicle (UAV) used for reconnaissance missions. It's powered by the ROTAX 914 piston engine. The mishap aircraft was two hours into an Operation SOUTHERN WATCH reconnaissance mission when it experienced a sudden reduction in thrust and began descending. The UAV was turned back to base and during return, experienced a sudden loss of oil. The engine seized and, on final approach, the UAV crash-landed on soft terrain. The UAV was severely damaged, but USAF personnel determined it repairable. The reduction in power resulted from a broken exhaust valve rocker arm. The broken rocker arm resulted in the eventual failure of the valve train. This caused the pushrod to eventually punch through the valve cover, thereby allowing oil to escape through the hole. Without oil, the engine quickly seized and the UAV could no longer maintain level flight. This engine is a Commercial Off The Shelf item. Its commercial use may expedite the incorporation of a more robust rocker arm. Until then, the UAV's managing office is working to improve USAF assets.

It has indeed been a good news year. Let's all strive to make 2003 even better!

Analysis of the mishap engine revealed a single fuel nozzle stuck in the takeoff flow metered position.

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

Ejection Summary

BOB CAMPBELL
HQ AFSC/SEFE

Since the introduction of the ejection seat in U S Air Force aircraft in 1949, there have been 5446 ejection attempts (through 30 Sep 02). The survival rate for this period is 82.3 percent (see Figure 1). Improvements in ejection seat technology have improved the survival rate to over 91 percent and reduced injuries during the ejection sequence.

USAF Ejections (5,446 Total)
1949 - 30 Sep 02

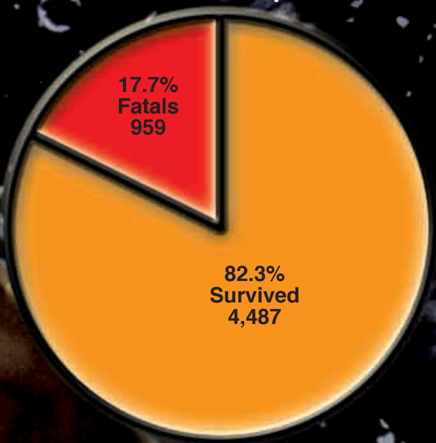


Figure 1

During FY02, 20 ejection seat-equipped aircraft were involved in Class A mishaps. The mishaps involved 26 crewmembers; seven ground-egressed with no injuries, 14 made the decision to eject, and five failed to eject. There were seven fatalities. During a high-speed ejection (650-700 kts) the pilot died from severe head injuries during the ejection sequence. One crewmember was released from his torso harness (leg ejector snaps not connected) during the ejection sequence. Five crewmembers did not make the ejection decision. The overall ejection survival rate for FY02 was 85.7 percent, below the overall Air Force Advanced Concept Ejection Seat (ACES II) rate of 91 percent (see Charts 1 and 2). The ACES II was used for all FY02 ejection attempts.

Class A Ejection Statistics (01 Oct 01 - 30 Sep 02)

Number/ Aircraft	Ejections		No Ejections	
	Survived	Fatal	Survived	Fatal
8/F-16	6	0	0	2
3/A-10	1	1	0	1
1/B-1B	4	0	0	0
4/F-15	1	1	4	0
1/F-22	0	0	1	0
1/T-37	0	0	0	2
1/U-2	0	0	1	0

Chart 1

Aces II Ejection Rates (08 Aug 78 - 30 Sep 02)

Aircraft	Survived		Fatal	
	Number	Rate	Number	Rate
A-10	40	83%	8	17%
F-15	58	91%	6	9%
F-16	237	92%	20	8%
B-1B	19	95%	1	5%
F-117	2	100%	0	0%
Totals	356	91%	35	9%
Total Ejections 391				

Chart 2

ACES II Modification Program

In the early 70s, the Air Force selected ACES II to meet future Air Force requirements. This system was subsequently installed in the A-10, F-15, F-16, B-1B, F-117, F-22 and B-2 aircraft.

The ACES II is a lightweight, high performance escape system configured for optimum performance for a 0 to 600-knot escape envelope. The ACES II has reduced the injuries sustained during the ejection sequence and improved the survivability of Air Force pilots.

Current aircraft and ejection seats were designed to accommodate the 5th-95th percentile of the 1960s male population. The ACES II ejection seat was not designed for small stature crewmembers and is qualified for crewmembers weighing 140 pounds to 211 pounds. The new Air Force requirement is to accommodate crewmembers in the range of 103-245 pounds. Introduction of lightweight crewmembers created a potential stability problem during high-speed ejections, which increases the probably of major flailing injuries during high-speed ejections (400+ kts). The Air Force is working a modification program, which will improve stability and reduce the potential for major flailing injuries during the ejection sequence. The recommended modifications are an Enhanced Drogue for improved stability, Limb Restraints to reduce flailing injuries and Seat Accommodation Kit to expand the anthropometrics capability of the current seat for the small crewmember.

The Leading Cause

Out of the design envelope ejections and collision with the ground (no ejection attempt) continue to be the leading cause of fatalities in escape system-equipped aircraft. Be prepared to use your escape system and make a timely escape decision. Safe flying!

USAF Class A Flight Mishaps

FY03 Flight Mishaps (Oct 02-Jan 03)	FY02 Flight Mishaps (Oct 01-Jan 02)
7 Class A Mishaps	8 Class A Mishap
3 Fatalities	0 Fatalities
7 Aircraft Destroyed	3 Aircraft Destroyed

18 Oct	♣	A TG-10D glider crashed during a student sortie.
24 Oct		An F-15 experienced an engine failure during takeoff.
25 Oct	♣✶	An RQ-1 Predator crashed during a training mission.
25 Oct	♣♣	Two F-16s collided in midair during a training mission. One pilot did not survive.
13 Nov	♣	An F-16 crashed during a training mission. The pilot did not survive.
05 Dec	♣♣	Two A-10s collided in midair during a training mission. One pilot did not survive.
18 Dec		Two F-16s collided in midair during a training mission.
20 Dec	♣	Two T-37s collided in midair during a training sortie.
02 Jan	♣✶	An RQ-1 Predator crashed during a training mission.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF military fatalities.
- "♣" Denotes a destroyed aircraft.
- "✶" Denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.
- Flight and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html
- **Current as of 16 Jan 03.**

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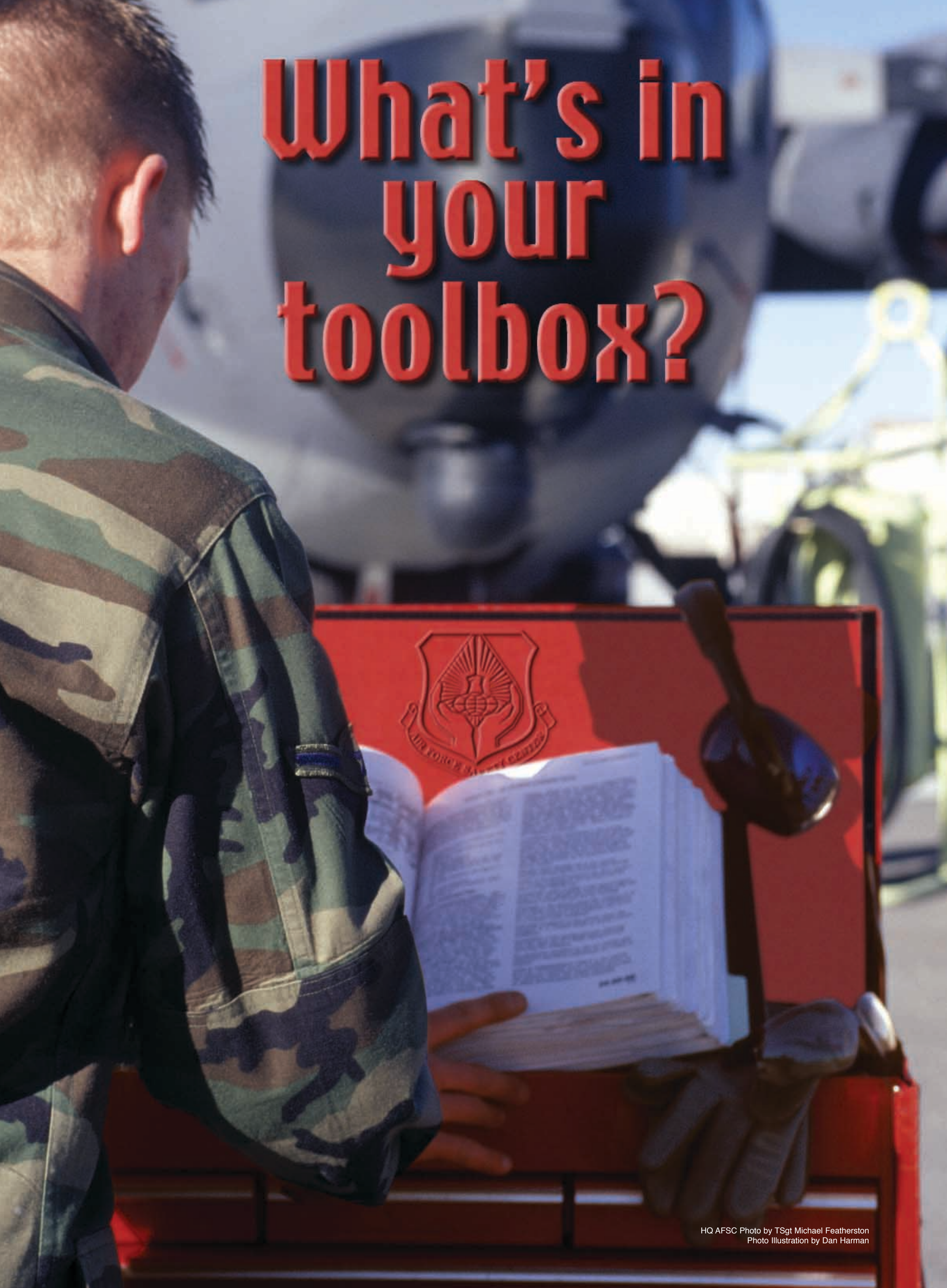

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