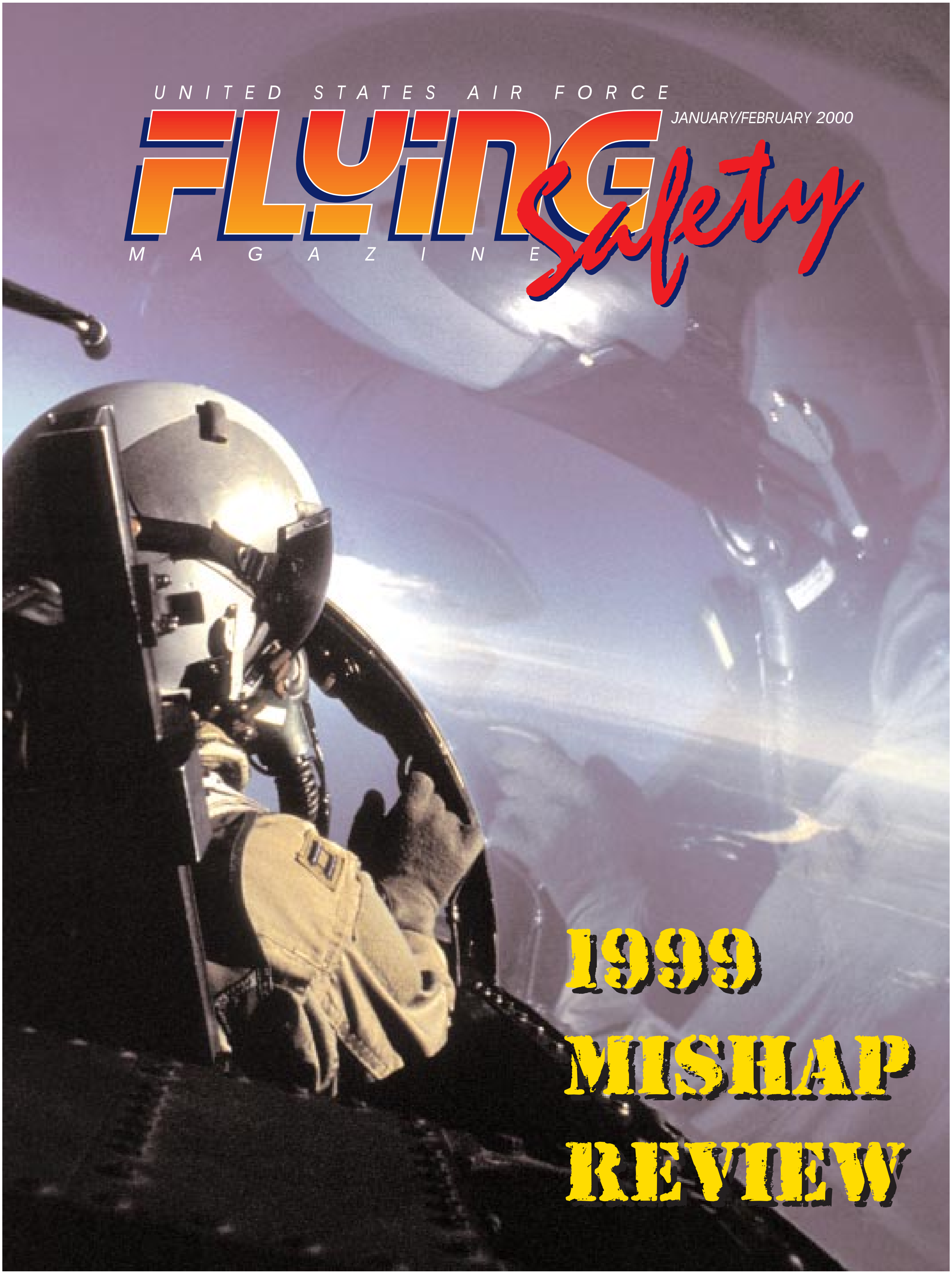
UNITED STATES AIR FORCE

FLYING Safety

MAGAZINE

JANUARY/FEBRUARY 2000



1999 MISHAP REVIEW

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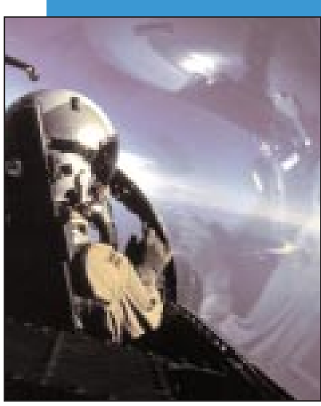

Cover Photo by SSgt Andrew N. Dunaway, II, USAF

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A Message from the Chief of Safety

MAJ GEN FRANCIS C. GIDEON, JR.
THE USAF CHIEF OF SAFETY

As we enter the New Year, it's fitting to take a quick look back at FY99's high and lows. For those of you who didn't see the September 1999 Blue Four News, here's the snapshot.

9 Fatalities
30 Class A Mishaps
25 Aircraft Destroyed

On a positive note, the nine fatalities we experienced were the fewest flight mishap fatalities in USAF history. Of those nine, five were pilot fatalities, which were also the fewest in USAF history. Nine fatalities represents half the number the USAF suffered in FY98, but it's imperative that we—*all of us*—not focus on numbers alone. While it's wonderful that we didn't lose as many Air Force personnel in FY99 as we did in FY98, we mustn't forget that every single one of those fatalities represents an indescribable loss to a family and this country. What would I really like for you to remember? Just this: Even one fatality is too many.

By most other measures, it wasn't a good year in aviation safety. The 30 Class A flight mishaps and 25 destroyed aircraft equates to an overall mishap rate of 1.40, the highest (and worst) since FY95. For the fighter/attack community, the mishap rate was 3.69, the highest since FY88. FY99's mishaps drew attention to areas that need improvement in both Operations and Logistics. Some of these solutions are neither simple nor cheap, so until fixes are fully implemented, *learn* from these mishaps, be aware of the hazards, and be prepared to cope.

As you read through this annual mishap recap edition of *Flying Safety* magazine (FSM), I'd ask you to give special attention to two articles.

The first one, "What's Wrong With January Revisited," is a follow-up to Major Pat Kostrzewa's article that appeared in the December 1998 issue of FSM. In it, Major Kostrzewa pointed out that in the 1990s, with few exceptions, mishap rates have been highest in the month of January. The original article was intended to bring this phenomenon to your attention and assist you in planning appropriate risk control measures. In this year's article, Major Kostrzewa tells how we did in January 1999 and offers some sound advice for January 2000—and for that matter, *every* month.

The second article, by Major Dave Burris, is entitled simply, "FY99: Midair Collisions." In FY99, we experienced five Class A and two Class C midair collisions. While seven aircraft were destroyed, we were fortunate that no one died. If not for superior ejection systems and life support equipment, and the crews' preparedness to make the ejection decision before it was too late, the outcomes could have been tragically different. Each of these midair collisions had some factors in common that I believe you'll find both surprising and sobering. I encourage you to pay particular attention to both of these articles and keep them in mind each time you prepare to take to the cockpit.

As we begin a New Year and a new decade, here are some final thoughts I'd like for you to take back to your duty section, whether it's a cockpit, a backshop, or the flightline. Our business of defending this great nation has more than its share of hazards. Don't increase your risk foolishly. Adhere to established guidance. Follow tech data. Suggest changes that make operations safer. Don't jeopardize your safety to impress someone. Don't cut corners to save five minutes. And don't be afraid to correct your buds if they do something unsafe. Fix 'em safe. Fly safe.

Best wishes to you and your loved ones for a safe and prosperous New Year! ✈

USAF Photo by SSgt Andrew N. Dunaway, II

MAJ KURT SALADANA (CAF)
HQ AFSA/SEF

Although there were two A-10 Class A mishaps during FY99, the year was still a good one (the Safety Center logged 37 Class Cs, one HAP and no Class Bs). There were no fatalities or serious injuries and the lessons learned may very well prevent future mishaps.

So, what lessons did we learn? Well, it became apparent once again that cockpit storage / stowage is a problem. Maps, charts, FLIPs, environmental clothing and NVGs / NVG cases crowd the cockpit. While personal preferences and organization help control the clutter, it becomes extremely frustrating when you can't see a switch or dial at a crucial time because something is in the way. Is there anything that the operator can do to prevent the problem? Cockpit discipline can help, but secure stowage can only be assured with an engineering fix. Many individual units attacked the problem of NVG storage, and a standardized and approved modification for the NVG stowage bracket is underway. At present, a temporary modification that can be manufactured and installed locally is approved for one year, and by the spring a final mod should be in place.

We also relearned that the throttle cables are susceptible to fatigue failure. Ideally there will be an engineering fix, and the problem is receiving lots of attention. Unfortunately, the fix will be expensive and complicated. All engineering changes / fixes to any airframe have to be applied to a risk matrix. It isn't unusual for a change to be disapproved because the cost far outweighs the gain and would siphon money from other, more critical changes or improvements to the aircraft. If approved, any change to the throttle cables is going to take time. So, what can the operators do? On any type of aircraft, the better prepared the crew is to handle an emergency, the more likely their success. During training sessions, discuss throttle cable failure. Talk about failure mode, cockpit indications, aircraft performance characteristics and what you can do to get the plane on the runway and safely stopped. This is one of the many cases when the older, more experienced aviators can help out the new guys and tell "war" stories at the same time.

There are other safety concerns for everyone in the A-10 community. The ADI, for instance, has been a problem for several years and is the number one priority for the SPO. That said, there was only one safety report implicating the ADI distributed in FY99. With over 124,000 hours flown, this failure rate seems insignificant. The rate, however, does not consider the number of ADIs that failed maintenance or ground checks / inspections. The fact of the matter is that to justify new equipment, the old must be proven defective or unsuitable. Realistically, visibility is probably the single most important factor in gaining support for any expenditure. The best way to get visibility is to document failures and submit reports through the proper channels; i.e., if you have any problem with your ADI, contact your safety officer and submit a HAP or other class report, as appropriate.

Looking over the assembled A-10 safety reports for FY99, engine failure is by far the most common incident. The community is doing a superb job at keeping these occurrences from turning into Class As. That's the good news. The bad news is that the problem is going to get worse before it gets better. There isn't going to be a quick fix and, although there isn't an A-10 pilot around who hasn't wished for new engines, the money just isn't available.

The future is going to be challenging for everyone involved in the A-10 program. There isn't another aircraft in the world that can do the A-10's mission with anything near the same success and survivability rates. To protect this asset, keep doing what you are doing. Keep your eyes open, practice emergency procedures as often as possible, and report all mishaps even if they seem inconsequential. Unless we can identify a trend or problem area, we can't take steps to come up with a fix. ✈

U-2

USAF Photo

MAJ DAVE BURRIS
HQ AFSC/SEFF

The U-2 program, on the books, had a bad year. Two Class A mishaps, not just in the same fiscal year, but in the same calendar month! A closer look reveals the positive side: There were no fatalities or destroyed aircraft. It has now been three years since a pilot or an aircraft has been lost in the U-2 program. Further, there were no Class B mishaps, and only one Class C mishap. This is especially noteworthy when you consider the high operations tempo at deployed locations around the globe. The U-2 has specialized sensor packages that are unique. Because these products are in high demand from the national and theater-levels, the U-2 weapon system is heavily tasked. At any one time, the 9th Reconnaissance Wing has roughly one-third of its pilots and maintainers and half of its aircraft deployed to locations worldwide.

The Class A mishaps this year were purely driven by the cost involved. The first one involved a canopy that opened and shattered on climbout passing FL140. Fragments of the shattered canopy transparency caused damage to the left intake, multiple stages of the engine compressor section, the vertical stabilizer, and lower fuselage antenna structure. The mishap pilot (MP) declared an emergency, initiated fuel dump, and returned to the departure field. Even though all indications were normal, the MP was concerned about possible engine damage and performed a precautionary flameout pattern. He landed and egressed normally, without further incident.

The second Class A involved a hydraulic failure that started with fluctuations (within limits) shortly after takeoff. Passing 47,000 ft, the MP reported loss of hydraulic pressure. He attempted to lower the gear, but the mains failed to indicate down and locked. He performed a localizer approach to a full-stop landing. After touchdown, the main landing gear collapsed, and the aircraft skidded approximately 1500 ft on the runway before coming to a stop. The pilot egressed successfully, with assistance from the mobile officer. The aircraft sustained fuselage damage, but there was no explosion or extensive fire.

The U-2 is a national asset, and it provides critical intelligence products to national leaders and theater commanders. It was the backbone of airborne intelligence, reconnaissance, and surveillance for Operation Allied Force. The U-2 platform attained 1300 hours of collection time during 189 combat missions, while maintaining an overall Mission Capable rate of 90 percent with no reportable mishaps.

It is essential that we continue to preserve this asset, as there is little likelihood that more airframes will be produced. While current upgrades to existing airframes will extend U-2 usefulness into the new millennium, there is an initiative to pitch production of new U-2 aircraft at a significantly reduced cost. These would augment the small RC-135 Rivet Joint fleet for collection of SIGINT, as the Global Hawk tackles more of the traditional collection roles. The newly produced U-2 aircraft would feature digital flight controls, upgrades to all systems, including the ASARS II radar, better links to ground stations, faster imagery processing, and lower operating costs. Whether or not the U-2 community gets new airframes, the trend of a small community with high operations tempo will continue. So should emphasis on Operational Risk Management (ORM) to balance risks against collection needs. ✈

THE STRATLIFTERS...

MAJ STEVEN C. PANGER
HQ AFSC/SEFF

Fiscal Year 1999 was a great year for safety in the strat airlift world. Despite the continued high ops tempo, we had no Class A mishaps and only one Class B mishap. Of course we did continue to have our fair share of Class Cs in the C-141, C-5, and C-17. The environment we work in is wide-ranging as we fly many types of operational and training missions: airland, airdrop, air refueling. We travel globally to austere locations that many of us have never been to before, while transporting many different types of cargo and personnel. Keeping the mishap rates low while in such a varied arena is evidence of the internal safety culture we all possess. Congratulations on a job well done, but let's not rest on our laurels. I challenge you to make FY00 our safest one yet. Now, on to the meat.

C-141 Starlifter

This past July, McChord received its first C-17, and it will continue to receive one a month for the next few years. Of course, this means the C-141 will draw down at approximately the same rate. We will be flying fewer and fewer hours per year. This past FY we flew 108,599 hours, the second fewest since the C-141 became world-

USAF Photo by MSgt Perry J. Heimer

wide operational in 1966, and the airlift and airdrop workhorse. Of course, the aircrews are drawing down also, so they aren't experiencing any decrease in ops tempo. This trend will continue for the next few years until the C-141 is completely phased out. We must work hard not to let our safety awareness suffer due to this turmoil. From a historical standpoint, we've experienced seven Class A mishaps and one Class B mishap over the last 15 years. We had no Class As or Bs during FY99. That's the good news. However, Class C mishaps did go up: 18 this year, compared to seven each for the previous two years. See figure 1 for C-141 Class A, B, and C mishaps over the most recent five year period.

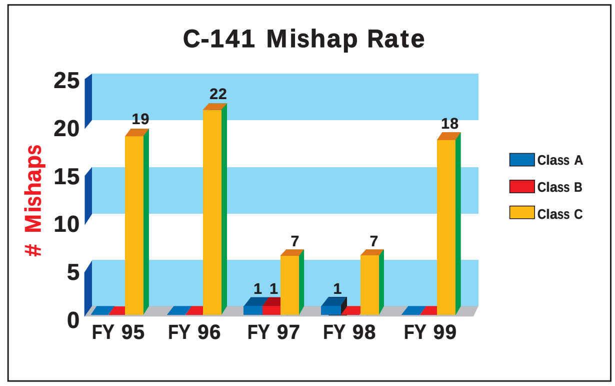

Figure 1

C-5 Galaxy

The C-5 force is in good shape. The airplane is still flying strong with no plans for reducing the force any time soon. We flew 60,149 hours this year, which is comparable to the last few years. The Class A and B flight mishap rates have also remained fairly consistent. The C-5 has had only three Class As in the last 15 years. During that same period, there were 12 Class B mishaps. However, the Class B rate has gone down. In the last five years, the Class Bs have occurred every other year, with the last Class B flight mishap occuring in FY97. There were eight Class Cs, which is three more than FY98, but six less than FY97. See figure 2 for C-5 Class A, B, and C mishaps over the most recent five year period.

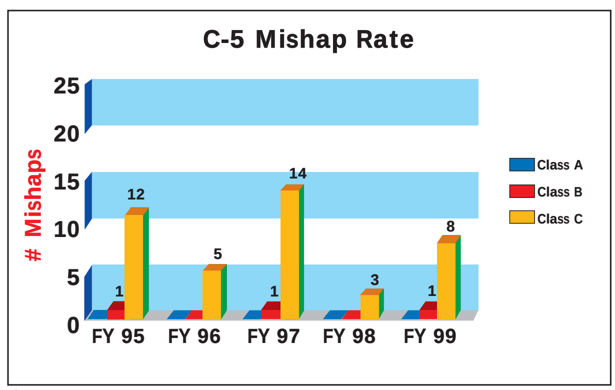

Figure 2

C-17 Globemaster III

As I mentioned above, the C-17 has made its way to McChord. If it isn't common now, it soon will be common to see them flying around the flagpole. The total number of hours the C-17 is flying continues to climb. We flew 57,980 hours in FY99, the most since the C-17 became operational. We also continue to have a great safety record: The best this year among the strat airlifters. From FY95 to the present, the C-17 community has experienced three Class As, two Class Bs, and 32 Class Cs. The Class A and B mishaps occurred during the FY96-FY98 period, but ten of the 32 Class Cs occurred in FY99. See figure 3 for C-17 Class A, B, and C mishaps over the past five years.

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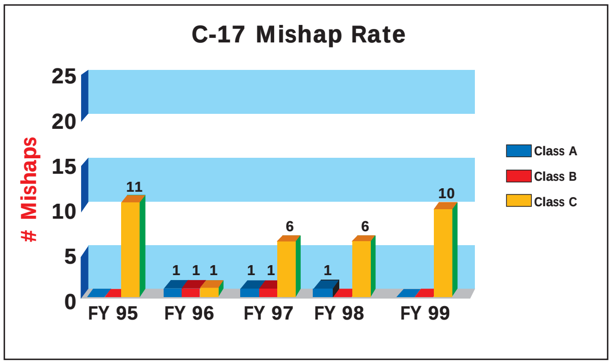

Figure 3

Strat Airlift Class C Trends

Of the reported Class C mishaps, the trends seem to be birdstrikes, lightning strikes, and fuel leaking from cargo. The C-5 also had several Class C mishaps involving the landing gear and/or brake systems.

There were more than 30 Class C birdstrikes for the C-141, C-5, and C-17 in calendar years 1994 and 1995. Since then, the numbers have decreased dramatically: Only a dozen or so in the succeeding four years. This past FY, there were five reported Class C mishaps involving birds, of which one occurred during bird condition "Low." While it may seem that the bird threat has diminished to a negligible number, there was still over $40,000 in damages to the C-141 and $230,000 to the C-17 in FY99. If you look at calendar year 1998, where the damage figure was more than $29 million to all USAF aircraft, you can see that birdstrikes are a serious problem. We average 2,500 birdstrikes every year in the Air Force. While aircrews can't do a whole lot to avoid a single bird, one thing they can do is report any bird sightings in and around the aerodrome they're transiting. Remember: What may be an insignificant sighting to you, could be something altogether different to the airfield personnel who are familiar with local bird patterns. (See the April 1999 issue of *Flying Safety* magazine for excellent information on bird avoidance programs. Ed.)

There were three lightning strikes this past year. Two occurred while the aircraft were outside the required ten-mile range below FL230. In one case, the aircrew's own radar showed them at least 30 miles from any cells while flying at 15,000 MSL. We have good rules to follow for thunderstorm avoidance, however be aware that lightning strikes may occur outside of the prescribed avoidance range.

In FY99, there were also six reported incidents where fuel leaked from aircraft cargo. This is a continuing trend for the last few years for all three airframes. The fumes affected passengers in two of the incidents. Running the "Smoke and Fume Elimination" (or equivalent) checklist after the fuel clean-up won't necessarily clear up any lingering physical effects. The consequences of a large amount of fuel leaking from a piece of equipment could prove to be disabling, not only to passengers, but also to the aircrew. Loadmasters need to be especially sensitive for equipment that potentially contains residual fuel. While the equipment in these four incidents had been checked and approved for loading by ATOC, the aircrew can—and should—double-check for potential problems.

Approach and Landing Mishaps

There were three cases where aircraft experienced a potentially catastrophic mishap, either on approach or landing. All three aircraft suffered minimal damage, but it could have been much worse. It's worth noting how each one happened.

C-141 No-Flap. In this event, a C-141 crew flew a zero-percent flap, full-stop. At the time of the mishap, the weather was VMC with rainshowers in the vicinity and a five knot headwind. A rainshower was over the airfield during the 15 minutes prior to landing. The runway was over 13,000 ft long and wet.

The pilot flew a no-flap localizer approach to a full-stop landing. The computed approach speed was 156 kts, and the computed landing distance was 7150 ft. The pilot flew a normal approach and touched down approximately 1100 ft down the runway. As the crew determined that normal braking wasn't effective, they selected emergency brakes. The aircraft skidded and fishtailed at an approximate 45 degree angle during the last 500 ft of runway length and skidded into the overrun. The aircraft then turned abruptly and came to rest entirely in the overrun at a 90 degree angle to the left of the runway.

C-5 Three-Engine Full-Stop. This second incident involved a C-5 flying a three-engine approach because of an engine malfunction. The aircraft's weight was just below the runway weight-bearing capacity of 687,000 pounds at their elected divert base. The runway was over 9000 feet in length, wet, and there was a light rainshower at the time of landing.

The crew elected to fly a partial-flap landing due to the heavy gross weight. The aircraft touched down approximately 3400 ft from beyond the approach end of the runway, and stopped straight, but with the aft mains 20 ft into the overrun.

C-17 PAR Approach. Upon arrival at the destination, the weather was 200 overcast and 3/4 miles visibility. Because the PAR allowed the crew to fly down to these weather minimums, the crew elected to fly this approach. This PAR was a nonstandard (i.e., 3.5-degree glide path) precision approach that is only available on pilot request. The ILS approach minimums were 400-1.

The crew attempted three PAR approaches to the mishap runway, all of which resulted in a missed approach. On the third approach, the PAR controller began calling the aircraft "Slightly below glidepath and holding" at two miles from touchdown, and continued the "Slightly below glidepath and holding" call to decision height. Approximately 12 seconds prior to decision height, the central aural warning system initiated GPWS Mode 5a, 5b, and 2b alerts, in sequence. GPWS Mode 5a is the "Below Glidepath" warning. GPWS Mode 5b is "Too Low, Power." GPWS Mode 2b is "Terrain, Fly Up." The crew disregarded all three alerts. The aircraft broke

USAF Photo by SSgt Andrew N. Dunaway, II

out of the weather at decision height right in front of two trees. The C-17 impacted the trees and the crew executed a go-around...

Lessons Learned. Landing is considered a critical phase of flight for good reasons. If you land on a wet runway and delay trying to slow the aircraft until the last part of the runway over numerous rubber tire deposits, you increase your odds of hydroplaning. Hydroplaning may not always be readily apparent. Of course, if you start fishtailing, you'll probably figure it out rather quickly! Be aware when landing, that if you're flying the approach faster than normal, heavyweight, with a short, wet runway and less than full reverse thrust, it's easy to depart the prepared surface. What about ducking under because you're trying too hard to land somewhere? Not a good idea, especially if your aircraft systems warn you that you're too low. Ignore those warnings, and you could very easily end up as a Class A mishap statistic.

As I read in a safety magazine a while back, *complacency kills.* In each of these three mishaps, complacency may have played a role. Instructors were at the controls of these aircraft and may have been thinking, "It can't happen to me." Complacency is insidious. Since my arrival here at the Safety Center, I've encountered a large number of mishaps where complacency played a role, from supervisors all the way down the chain to the operator. The bottom line here is to think through what you're doing. Pay attention to the details, not just in the landing phase, but in all phases, including ground operations. Don't let complacency get you. Keep up the good work again this year and FLY SAFE!!! ✈

TRAINERS... T-1 T-37 T-38

USAF Photo by SSgt Steve Thurow

LT COL JEFF THOMAS
HQ AFSC/SEFF

With the dawn of the new millennium, the T-37, T-38, and T-1 enter their second century of service. Obviously, as the calendar rolls over, all aircraft in the Air Force inventory can make the same claim. However, for the Tweet and Talon, the milestone is especially significant because, except for the B-52 and KC-135, they've been doing their jobs longer than any other Air Force aircraft. Both continue to soldier on despite having roots in the era when "I Love Lucy" was a prime time hit. Hard to believe the first UPT class to train in the T-37 was Class 59-9...over forty years ago at Bainbridge AFB, GA! And the T-38 was undergoing flight testing in the same time period prior to being unleashed on students.

Both aircraft have been witness to notable changes in the second half of the 20th century; Air Training Command became Air Education and Training Command, Specialized Undergraduate Pilot Training (SUPT) became a reality again (after being canned in the late 50s), Williams, Reese, and Mather AFBs closed, etc., etc., etc.

Another significant change has been the dramatic reduction in the mishap rate since these aircraft first entered service. In its first ten years of service (CY59-CY68), 75 T-37s were lost to Class A mishaps. By comparison, in the last ten years (FY99-FY99), five have been lost. On the Talon side, between CY62 and CY71, 93 T-38s were involved in Class A mishaps versus *nine* as this decade came to a close. And the T-1 has yet to be involved in a Class A mishap (knock on wood) since becoming operational in the early 90s.

FY99 continued the positive trend the trainer community developed as noted in the paragraph above...no T-37s, T-38s, or T-1s were lost in Class A mishaps in the last fiscal year of the old millennium. In fact, FY99 is the third time for this remarkable achievement, all occurring in the decade of the 90s.

T-37

"Is it possible to operate a large fleet of jet aircraft for one year (1 May 70 through 1 May 71) with almost new student pilots...without a major accident?" asked a June 1971 article in Flying Safety magazine. The article continued, "Many folks in the aviation community would answer this question with a firm negative." Taking these quotes in context, the T-37 community had logged over 480,000 hours (398,678 sorties!) during the lifetime referenced and trained over 4900 pilots. In FY99, the Tweet logged approximately 185,000 hours. While current annual numbers obviously don't rival those from 1970, today's T-37 community has not only managed to go Class A mishap-free for one year, but has been Class A-free (as of the writing of this article) for more than 21 months. The last T-37 Class A mishap involved two instructor pilots at the home drome flying an opposite direction approach at night contacting a raised, unlit approach-end BAK-15 barrier. The BAK-15 is a large web barrier 13 to 23 feet high which spans the entire width of the overrun. The contact slammed the hapless Tweet onto the runway, but luckily, both pilots escaped uninjured. Continuing our historical look-back, the last Class A mishap involving a solo student occurred way back in January 1995, when a successful ejection followed an unsuccessful nose-low recovery during aerobatics in the area. The last mid-air between two T-37s was in April 1992, and involved four instructor pilots flying a two-ship continuation training sortie. Both aircraft were lost, but all the pilots ejected safely. Given the high-threat environment the Tweet operates in (zero-to-low time, "new-to-jets" student pilots) and the tremendous number of annual sorties logged, these achievements are remarkable!

That's not to say there aren't some problems in the T-37 community. The single biggest issue with the T-37 is its age. In fact, the T-37 first flew in October 1954, flown by a test pilot with 91 P-47 missions in WW II...now that's old! With a replacement coming (but not yet here) in the form of the T-6, the Tweet continues to fill its role as a jet trainer admirably. However, in a show of its age, the Tweet probably has the highest Class C mishap rate per 100,000 flying hours of any aircraft in the Air Force inventory. In FY99, the T-37 had, as of the writing of this article, experienced over 85 reportable incidents, including High Accident Potential (HAP) and Class C mishaps.

One benefit of growing old is predictability; the T-37's Class C statistics didn't show any dramatic changes from FY98 (or FY97, or FY96, etc.). Leading the way for FY99, as far as reportable incidents were concerned, is what has historically been the Achilles heel of the T-37...the J69 powerplant. Engine flameouts, false fire lights, and oil system malfunctions accounted for the majority of the 60-plus engine-related incidents in FY99 (and in FY98, FY97, FY96, etc.). But don't think the T-37 is suffering from neglect due to its pending retirement to the boneyard. AETC continues to work engine problem issues, with new parts going into the main fuel controls, new engine hardware (turbine nozzles, new diffuser, etc.), replacement pendulous hoses, etc., in an attempt to improve the J69. Despite the above-noted issues and concerns, a logistics / maintenance-related Class A mishap hasn't occurred since the late 1980s when a compound emergency initiated by an engine problem resulted in the crew ejecting. Kudos to all those who maintain the venerable Tweet!

While the vast majority of reportable incidents occurred dual, solo students weren't immune from engine problems or other in-flight malfunctions. A flameout, an engine shutdown due to excessive vibration, and a fire light during a closed pull-up on a solo sortie are examples of some of the situations faced by solo students in FY99. As I've said in previous end-of-year trainer review articles, you've got to be prepared for any emergency or condition, but the smart aviator would be proficient in single-engine procedures and operations when flying the T-37.

As far as operator issues are concerned, physiological incidents involving GLOC far outpaced all other reportables, with inadequate anti-G straining maneuvers by student pilots leading the way. Like I said last year, 80 percent of all Air Force GLOC events happen in the T-37. In fact, during a recent 20 year period, 398 GLOCs were reported by the Tweet community, several occurring to solo students. With an unpressurized cockpit, very limited air conditioning, and an exceptionally high G-onset rate, the benign-appearing Tweet has the power to put one to sleep.

Wrapping up our look at the Tweet, its replacement, the T-6 Texan II, is currently in the spin-up phase at Randolph AFB. Currently, one maintenance trainer is on station, with two more projected to arrive to begin ops testing as this article goes to print. Student training is expected to begin in June 2001 at Moody AFB.

T-38

In FY99, T-38s (ATs included) flew approximately 106,000 hours, well below the record high of 605,000 hours flown in CY70. However, as mentioned in the opening paragraph, the T-38 was involved in zero Class A (and Class B) mishaps this year, compared to 17 Class As in 1970. Based just on the raw numbers, you can see we've come a long way!

Since CY60, when the T-38 first appeared in Air Force Safety Center statistics, the Talon has been involved in 189 Class A mishaps, resulting in 183 destroyed aircraft and 134 fatalities. The lifetime Class A rate is 1.55, with just over 12 million hours having been flown; pretty darn good considering the training environment and pilot experience levels. Of note, operator-caused mishaps have outnumbered logistics-related mishaps approximately two to one in those 189 Class A mishaps.

Discounting the T-38 / F-16 midair at Edwards in FY98, the T-38 community has been Class A mishap-free since FY96. The Class A that year involved an AT-38 on an FCF sortie which experienced a flight control malfunction. The pilot ejected successfully. The last time a T-38 being utilized in the training role was involved in a Class A mishap was FY95, when an engine eighth-stage compressor disk failed catastrophically on takeoff, resulting in an engine fire that ultimately led to loss of control authority. Luckily, the crew ejected safely. The last incident involving a solo student occurred in FY90, when one of two ships flying a BFM mission departed controlled flight. Determining the aircraft wasn't responding to recovery control inputs and being below the minimum ejection altitude, the mishap pilot successfully ejected, incurring only minor abrasions.

While the recent T-38 safety record has been impressive, there's no room for complacency when operating a

continued on next page

Talon. Like the T-37, the T-38 also has a recurring Class C mishap trend...engine problems. Of the reported Class C and HAP events in FY99, most involved engine flameouts and engine shutdowns for reasons which included false fire lights, loss of oil pressure, a failed gearbox, etc.

T-38 aviators know the J85 has always been touchy when operated near the edge of the envelope, and as the engine ages, it will probably become more irritable. Like the T-37, J85 flameouts have historically been related to operator technique, material factors, and component age. And like J69 flameout troubleshooting, when material factors aren't involved, duplication of exact flight parameters which existed at the time of the flameout make troubleshooting and finding the cause a difficult undertaking. Operator techniques like monitoring throttle movements when near the edge of the envelope and paying attention to critical factors like OAT, may help reduce the rate of unintentional single-engine operations.

USAF Photo by SSgt Steve Thurow

FY99 also saw a number of birdstrikes damage engines, with the vast majority of strikes coming when the aircraft is most vulnerable...in the traffic pattern. And once again, the new 400 knot / four-pound bird-resistant windscreen proved its worth by keeping several potentially catastrophic birdstrikes from entering the cockpit. Of note, in the last 15 years, birdstrikes have been fatal for one pilot and resulted in the loss of four T-38s...stay vigilant!

Like the T-37, in the T-38, solo students aren't immune from in-flight malfunctions. Among the more interesting solo student Talon incidents, were an engine flameout during rejoin as No. 2 in the MOA, a student on a solo cross-country experiencing a flameout while established in the high-altitude structure, and an engine shutdown after initial takeoff due to a suspected fuel leak. Hopefully, T-38 USEMs are reviewing these reports for realistic "stand-up" Emergency Procedures training! As stated in the T-37 section, the smart Talon operator would pay close attention to engines and their related systems while maintaining proficiency, not just currency, in single-engine operations.

What's on the horizon for the Talon? With the aircraft projected to remain in the inventory until approximately 2040, some upgrades are required to take the T-38 into the next century. All T-38s (As and Bs) will be upgraded to "C" configuration, with an avionics upgrade that includes multi-function displays, a heads-up display, etc. An upgraded prototype is currently being flown, with the first production model slated to be in service in October 2000. A propulsion modernization is also planned, and among other things, a new compressor and intake design will be fitted to the Talon. This modernization is intended to significantly reduce the J85's susceptibility to flameouts, while increasing performance.

T-1

The T-1 experienced another stellar year in FY99. There were no Class A or B mishaps, for a continuing lifetime rate of 0.00. The only other major player (not counting the "one-or-two-each" E-9, UV-18, etc.) that can make that claim is the C-20. Since its introduction at the now closed Reese AFB in 1992, the T-1 has been Class A and B mishap-free for its approximately 360,000 hour lifetime.

FY99 reflected a new FY flying hour high for the Jayhawk, with approximately 90,000 hours being flown. In fact, every year since entering service, the T-1 has exceeded the previous year's total hours flown. However, with increased flying hours, comes an increased number of incidents. Four HAPs and Class C mishaps were reported in FY96, seven in FY97, 21 in FY98, and 25 in FY99. Unlike the "mature" T-37 and T-38, which have years of historical data available for review and trending, the T-1 hasn't seemed to develop any long-term incident trends during its short service life. However, as in FYs 96, 97, and 98, the majority of incidents in FY99 appeared to involve engine problems. Among the engine reportables were an engine shutdown due to low oil pressure, several inadvertent shutdowns, and several flameouts after start / during taxi. Again, no trends other than the need for a keen awareness of engine malfunc-

USAF Photo by SSgt Steve Thurow

tions and related procedures!

While on the subject of engines, bleed air hardware malfunctions are a growing concern in the T-1 community. Although only a handful of incidents involving bleed air failures have been reported, several more have occurred that didn't meet criteria for reporting. While the majority of the incidents involved only the failure of the steel braiding around the hardware, the potential for a more serious failure remains a possibility. AETC and the contractor are currently looking at incorporating an improved braiding to the hardware to reduce the number of failures and mitigate mishap potential.

Also, the loss of engine cowl rivets resulting in engine FOD damage is a high interest area in the T-1 community. The cause of this problem has been identified and replacement is under way.

Although not as numerous as in the T-37 and T-38, non-engine related reportables in FY99 reflect the need for Jayhawk pilots to be prepared for any malfunction/situation. Among the incidents was a crew that noticed the aircraft pulling to the right during a touch-and-go landing at an outbase. The crew elected to continue the takeoff, wisely left the landing gear and flaps extended, and requested a tower flyby to get checked over for a suspected flat tire. The Tower Controllers observed that the No. 2 main landing gear tire and outboard gear door were missing. The IP decided to return to home station with present configuration (gear down, flaps at 10 degrees). Approximately 50 miles from the outbase, the crew observed a hydraulic level low annunciator illuminate, indicating less than 0.6 gallons of hydraulic fluid remaining. Hydraulic pressure was indicating normal. With a pending loss of hydraulic pressure, the crew decided to return to the outbase, since it had 13,500 ft of runway available and was closer than the home drome. The IP flew a normal 10 degree flap approach and landed on the left side of the runway approximately 1200 ft down. After touchdown, the IP was able to maintain directional control and runway centerline until the hydraulics bled off at approximately 30 knots. The T-1 came to rest approximately 75 ft right of centerline, and 6500 ft down the runway, where the IP directed an uneventful emergency egress. Lesson learned: Compound emergencies, or emergencies compounded by the original failure occur also...be prepared!

Conclusion

The Trainer community did an outstanding job in FY99, as well as anyone else in the Air Force! It would be difficult for any aircraft with the utilization rates and harsh environment the Tweet, Talon, and Jayhawk are exposed to to have a better safety record! All aviators, maintainers, and support personnel are to be commended for the amazing safety record these three aircraft have enjoyed in the decade of the 90s. Keep up the outstanding work and remember to FLY SAFE. The life you save just might be your own! ✈

USAF Photo by MSgt Perry J. Heimer

LT COL PETER JANTOS, (GAF)
HQ AFSC/SEFF

Hey, folks out there in the F-16 community. I'm the new F-16 guy here at the Safety Center. I have experience in the F-104G, F-111D, Tornado and, of course, mishap investigation, so even though I'm the German Exchange Pilot, I'm better qualified than a tanker guy to handle the "Vipers." I'll give it a try, and you in the Viper community, please bear with me. Some inputs from you all will be greatly appreciated to get me up to speed again in the one-engine world.

Looking at all the mishaps throughout the year and comparing them to the years 98, 97 and 96, we must admit that the overall trend is not very pleasant. We were not able to maintain or improve the mishap rates of the last three years. Quite the contrary. The numbers of Class A mishaps have increased steadily. We had eight in 96, 11 in 97, 14 in 98, and now we stand at 18. Class A mishap rates increased from 2.14 (96) to 3.05 (97) to 3.89 (98) to the present bone-crushing rate of 5.12. We have seen worse but let's hope this trend doesn't continue.

Comparing the individual causes shows that we still have to fight problems with material and maintenance, which represent the majority of all mishaps (11) but there have also been a fair number of ops-related mishaps (five) and two with undetermined causes, one of which claimed a fatality. One awesome improvement over last year is the reduction in fatalities. In 18 mishaps we only lost two pilots. That's a pretty good number, especially when you consider that two of those 18 mishaps were midair collisions.

Class A Operations-Related Mishaps

- Two airplanes were diverting due to weather below minimums at home base. Weather at the divert base also went below minimums for the circling approach to the active runway. The first airplane failed to stop on the runway and took the departure end cable. Then in order to avoid colliding with his wingman sitting in the cable, the pilot of the second airplane steered clear of the runway and all three landing gear collapsed, but he ground egressed uninjured.
- During a Basic Fighter Maneuver (BFM) mission, one pilot initiated a high G / high G onset rate turn. Shortly thereafter, the aircraft started a vertical dive, and the pilot did not recover the aircraft or eject before impact with the ground.
- During recovery of a four-ship to home base and after a formation split-up, two aircraft collided on short final. One pilot walked home, the other managed to land.
- During a visual formation rejoin, the wingman came in very "hot" and was directed to overshoot by the element lead. The wingman crossed behind lead and controlled the overshoot, but was still closing on lead. After impact, the wingman's airplane began uncontrollable pitching movements, and the pilot wisely abandoned the aircraft.
- Following a low-altitude attack, the pilot started a turn to avoid weather. He performed a last-ditch maneuver to avoid hitting a ridge and impacted some trees that damaged the engine, leading to its failure. The pilot ejected successfully.

Class A Logistics-Related Mishaps

- Shortly after takeoff, the mishap engine flamed out. The pilot ejected safely.
- During an incentive flight at medium-altitude, the mishap aircraft's engine flamed out. Several restart attempts were unsuccessful, and the mishap crew ejected safely.
- While returning to base, the mishap aircraft's engine flamed out. The pilot ejected successfully.
- Shortly after takeoff, the mishap aircraft experienced a loss of thrust. The mishap instructor pilot determined the crew was in an unsafe position to reach the home field and commanded a bailout. The crew ejected successfully.
- While on a range, engine problems developed, and the mishap pilot turned towards the nearest base. While trying to reach acceptable parameters for a flame-out landing and maintaining military power with secondary engine control, the engine failed catastrophi-

cally, resulting in a fuselage fire. The mishap pilot ejected successfully.

- Twelve minutes after takeoff, the mishap pilot heard a "pop" and noticed a loss of thrust. Before reaching home base again, the aircraft's aft section burst into flames and the mishap pilot ejected safely.
- During an attack on a range, the mishap aircraft encountered engine problems. While operating with afterburner thrust, a series of rapid "bangs" and moderate airframe vibrations occurred. The mishap pilot applied the critical actions and could not get an engine restart. The pilot attempted a second restart using secondary engine control that was also unsuccessful. The pilot ejected successfully.
- After experiencing an engine failure, the mishap pilot was unable to restart the engine. He safely ejected.
- The mishap pilot was Number 4 in a four-ship Continuation Training (CT) sortie. After the first two aircraft had returned to base, Numbers 3 and 4 executed a simulated attack, during which the mishap aircraft lost a missile launcher and the attached missile.

Class A Maintenance-Related Mishaps

- After experiencing an engine failure, the mishap pilot was forced to eject.
- While attempting to land, the mishap pilot experienced a landing gear malfunction. Upon landing, the left main landing gear collapsed and the mishap instructor pilot initiated a successful after-burner go-around which did not leave sufficient fuel for another approach. The mishap crew proceeded towards the controlled bailout area, the mishap engine flamed out, and the crew successfully ejected.

Class A Undetermined and Miscellaneous Mishaps

- During a four-ship low-level tactical formation flight, the Number 3 aircraft started a slight descending turn and struck the ground. The pilot was fatally injured.
- The mishap aircraft experienced electrical problems and returned to base. During the landing roll, it encountered further problems. When the aircraft departed the runway, the mishap pilot safely ejected. (Still under investigation.)

Class Bs, Cs and Others

I could continue the long list of Class Bs and Cs, but consider it sufficient to just give you some numbers. Altogether, the number of Class Bs and Cs lies in the mid-forties, with majority causes on the logistics side. Ops-related mishaps follow close behind. Out of those ops mishaps, six were loss-of-control situations where the jet could be recovered in time. Just imagine those to be Class As and we would have set a new sad record.

Since all areas related to our flying business are involved in those mishaps, we cannot pinpoint one individual problem to be the major concern. We know, of course, that operational and logistics areas are of great interest and individual problems have been highlighted, but their fixes are very costly and time-consuming. There is no hard "get well" date. Until the money comes and the fixes get installed, we all have to live with what we've got. We must stay alert throughout our daily operations to keep incidents and mishaps from striking too often. How can you improve this situation? Be prepared by knowing your CAPs cold and executing them properly and in a timely manner like the pilots did in the out-of-control situations that made it back home safely.

Our low fatality rate, only two in 18 Class A mishaps, helped the Air Force turn in its lowest fatality rate in Air Force history. We still have ejections below the recommended minimum altitude, but we're getting better. You don't want to rely too much on your survival equipment. The seat is good, yes, but ejecting in time to get prepared for the PLF is a better choice.

Food For Thought

Since we are continuously striving to improve flight safety, we must take a very critical look at all mishaps and the accompanying facts and make decisions that are not always very well understood by all aviators. What am I getting at? Very simple; I'm asking myself what can be done or changed to avoid mishaps that cost people their lives. Do we train like future missions will require us to fly? Do we really have to be down in the weeds during a low-level flight to the range? Is it worth the risk of losing man and machine due to a bird-strike or by letting our attention divert to less important things when we're close to the ground?

No. We can achieve the same results on the range by getting there at medium or high-altitude.

And it is a lot safer.

I can already hear the roars and disagreement of all those "mud-mover" pilots who love to be down in the dirt. I love low levels too, but aren't we overlooking an obvious way to improve flight safety by keeping more altitude between us and the ground and staying out of our feathered companions' way as much as possible?

Now, please relax! Think about it. If you disagree, feel free to give me a call, but remember:

- In recent conflicts, when we used medium or high-altitude approaches, our operational effectiveness remained as good as ever.
- It could be your life we save by getting there at medium or high-altitude.
- We'll have more aircraft to bring to a fight.

Weighing risks we have to take to complete the mission against flight safety concerns is a balancing act that all operators and military leaders must be concerned with. So, if anybody has new ideas on how to improve flight safety and still get the job done, please speak up. Only then have you done your duty. Let's work together to reverse the three-year trend of increasing F-16 Class A mishaps. Let's frequently review the lessons learned and recommendations made following the last few years of mishaps. Let's learn from past mistakes, think ahead to avoid future ones and reduce the number of F-16 Class As from 18 back into single-digits. ✈

C-130

USAF Photo by MSgt Perry J. Heimer

MAJ BILL WALKOWIAK
HQ AFSC/SEFF

Good news in the "Herc" world again this year! No Class A or B flight mishaps! USAF Active, AFRC, and ANG crews got to the 15 million flight hour mark for the life of the C-130! Worldwide, more than 2100 C-130s have been delivered to over 66 owner-countries, and they have amassed 25 million-plus flight-hours. I'm sitting here at the annual Hercules Operators' Conference in Atlanta soaking up all kinds of Herc stuff. I never knew so much about propeller system maintenance, non-chromate paint primers, and the C-130J Enhanced Cargo Handling System. There is a lot of neat stuff on the horizon for all you C-130 drivers, including awesome avionics upgrades and advances in training. I'm here representing the AF Safety Center, along with over 300 other attendees who represent 33 C-130 operating countries.

It seems remarkable that despite a marked decrease in crew experience amongst flight crews and maintainers, added to the military operation in Kosovo, that the C-130 managed to have one of the safest years on record. In more than 294,000 flight hours this past year, there were a total of 68 mishaps reported. These included 39 Class Cs, 13 FODs, 9 physiologicals, and seven High Accident Potential (HAP) reports. This is eight more events total than in FY98. Furthermore, there were 20 Hazardous Air Traffic Reports (HATRs) reported that each involved at least one C-130. Total damage cost of the Class C mishaps increased from $2.5 million in FY98, to $4.4 million in FY99. First let's look at two Class C mishaps that may influence your judgment, should you find yourself in similar circumstances. Then, I'll talk about a couple of HATR events that could have turned out much worse.

Cold-Weather Operations

This was a mishap that only caused $500 damage, but might have been much worse. The C-130 was on the last leg of a three-day cross-country trip. About two hours prior to takeoff, it started to snow. By takeoff time, the ramp, taxiways, and active runway were covered with snow. The crew taxied out and didn't note any difficulty maintaining directional control. The tower had no RCR information available, so the crew just pressed on. Takeoff was normal until 50-60 KIAS, when the pilot couldn't maintain centerline. The rest of the crew didn't notice since the runway was all white anyway. The pilot called for "Reject," and the aircraft continued to drift until it exited the prepared surface at 30 KIAS. As it turns out, the runway was extremely slippery. This was a U.S. military airfield, so it's reasonable to assume that it would have been possible to get a runway condition reading if the crew had been persistent. In retrospect, I'm sure that the aircraft commander (AC) would have been more cautious. Perhaps you will be, just because you've read this. I can only hope.

Hard Landing

One thing about my job at the Safety Center is that I get paid to second-guess aircrews. We all do it, but I have a luxury your wing FSO doesn't: I don't work with each of you day-to-day. So in that vein, let's look at another Class C mishap and ask ourselves, "What were they thinking?" A normal day VFR training sortie with a basic crew started off with a copilot-flown, 50 percent flaps, airborne radar-directed approach. The copilot felt he was steep and adjusted his aimpoint, landing long. The AC had him stay in the visual pattern and brief a 100 percent flap touch-and-go, which was also a little steep, with a shifted aimpoint and long landing. The AC then took the aircraft and briefed one himself. He explained that he was going to be steep and that the crew should disregard the ground collision avoidance system (GCAS), which would surely give an alert. On the approach, seeing a 1500 fpm rate of descent, the copilot parroted the last GCAS warning. It was too late. The AC swapped ends, impacting the tailskid and mains simultaneously. The impact also caused the C-130's ELT to go off. The tower reported seeing smoke and sparks and asked whether or not the crew needed assistance. After taxiing clear of the runway, the flight engineer went outside to inspect the aircraft for damage and found none. After consulting the Command Post, the AC taxied back to the active, took off, and continued the sortie. During that first pattern, the "Barrelmaster" directed a full stop through the Command Post.

Okay, let's look at this one. The mishap message may not have told the whole story, but I think there are enough details here to dig in a little bit. As an instructor pilot myself, I'd say that a copilot having trouble with one type of landing, 50 percent flaps, ought to be given instruction and demonstration in that type of landing before moving on. As a crewmember, I would be very concerned if the AC said something to the effect of, "Disregard the warning, I've done this before." Unless you're doing an assault landing practice, which this apparently wasn't, I don't see why you would disregard the GCAS. I've seen it in other aircraft as well. Finally, I can't imagine not having at least the maintenance supervisor inspect my aircraft after a hard landing before returning to flight. I think the decision to continue the sortie was pretty bad. By the way, after the second full-stop, inspection revealed $175,000 of damage.

Hazardous Air Traffic Reports

There were 20 C-130-related HATRs in FY99. Although HATRs aren't mishap reports, they do show unsafe trends in air operations, and a lot can be gained from studying them.

Eight HATRs were from the Kosovo Theater. These included near midair collisions with the players having lights and other warning systems purposely disabled. There were also a lot of hazards at deployed airfields, with unlighted helicopters and vehicles roaming the ramps uncontrolled. Much of the air traffic system was unable to handle the incredible increase in military flights as well as the regular flow of civilian air traffic. Future planning should include military operations mixing it up with civilian traffic, as well as a study on the efficacy of force protection measures versus the obvious potential of midair collisions among friendly participants.

One HATR explained how a large civilian-type jet suddenly went into 20 degrees of bank only 30 ft prior to touchdown. The pilots recovered quickly and made a safe touchdown. The wingtip of that aircraft was only a couple of feet from impacting the ground and cartwheeling. What caused this upset? A microburst? A flight control malfunction? No. One of our Hercules was performing a high-power engine run on the hammerhead with its prop wash going over the approach end of the runway. Tower had granted approval for the run, and while the tower crew couldn't see the C-130, they took it for granted the aircraft would direct its prop wash in a safe direction. My point is that the pilot in command is absolutely responsible for what his / her aircraft does, including jet blast / prop wash. Had a mishap occurred, it would certainly have been placed largely at the feet of that C-130 pilot. Listen, we have got to be careful not to do engine runs that could create hazards, or taxi so as to knock over bread trucks and power carts. That's just in case no one has told you that before. I have my doubts sometimes.

Okay, well, those are some of the highlights (or lowlights) for FY99. I want to impress upon each flight crewmember to be vigilant out there and use your heads for thinking as well as checklist reading. I believe that with a constant effort we can beat even this year's excellent safety record! ✈

USAF Photo by MSgt Perry J. Heimer

USAF Photo by SSgt Gary Coppage

MAJ STEVEN C. PANGER
HQ AFSC/SEFF

I'm not the regular crew chief for this article but I can see positive stats as well as the next guy. Pretty safe year overall. The H-53 had its share of mishaps, "scoring" the only Class As or Bs of the three this past year. The H-60 and UH-1 had a handful of Class Cs between them.

H-53

As I mentioned above, the H-53 had its share of mishaps this year. There were two Class As. One involved a fast rope exercise in which one of the participants suffered a severe injury after impacting the ground. The other involved a fatality and destroyed aircraft, which is described below.

MH-53A Class A Landing Zone Mishap

The mishap flight was planned and briefed as a night four-ship, joint formation with two US Army MH-60s. The MH-60s would be the lead element of two elements. The MH-53s would be the second element. The mission of the MH-53s was to exfiltrate ground team members. The exfiltrations were planned as single ship operations in the Landing Zones (LZs).

The formation flew a low-level route prior to breaking up the formation. The MH-53s proceeded to the laager (waiting) area. When the MH-53s received the exfiltration call they took off separately. The mishap aircraft (MA) proceeded to its LZ. The ground controllers directed the MA to approach on a heading of 160 degrees. The aircraft approached the LZ from the south. The mishap crew (MC) acquired the LZ visually, and decided on a left, turning approach. As the MA descended through 50 to 80 feet AGL, the rotor downwash began blowing up dust.

The pilot lost visual references at approximately 40 feet and transitioned to instruments. Blowing dust obscured the visual references around the LZ by the scanners. They did have a view of the ground directly below the aircraft. As the MA approached 20 to 25 feet in a right drift, the right scanner directed a go-around. The combination of a high rate of descent, right drift and high power setting caused the tail section to fracture upon touchdown. The MA became airborne, ripping the fractured tail away. The MA then yawed to the right and entered a left roll, the nose tucked, and the main rotor blades struck the ground. The aircraft came to rest inverted and was destroyed. The crew egressed the aircraft. There was one fatality.

The H-53 had one Class B. This incident resulted from an engine problem. Class Cs? Nine this year, for numerous reasons. No trends noted. These rates are up (or down, depending on your perspective) sharply from the last two years when there were no Class As or Bs.

H-60

A great year in terms of safety for the H-60. Only three Class Cs this year. One was an engine flameout while taxiing to parking after the flight. In the second one, all the rotor blades were discovered damaged after flight from an undetermined cause. The aircraft had flown numerous approaches and the crewmembers never felt a thing. The third was a wire strike while on a low-level mission. Here are the details:

HH-60G Class C Wire Strike Mishap

The mishap aircraft (MA) departed as number two of a two-ship en route to a forward location. Initially the aircraft was flown at 500 feet AGL, then descended to between 100 and 150 feet. The crew was monitoring a chart, scanning outside and monitoring a GPS. The GPS had been programmed to display known power lines (previously discovered along the route of flight) that represented a potential hazard to low-level operations. These power lines weren't necessarily CHUMed (updated in the Chart Updating Manual). Can you see where we're going now?

As they traveled along their route of flight the GPS noted a set of power lines straight ahead. The pilots visually acquired wires ahead of their flight path. As they started to climb the MA impacted the top two wires of five in a set of high tension power lines, in a nose-up attitude with a slight right bank. The first wire parted easily on the wire cutters but the second, larger wire momentarily hung the aircraft up. The aircraft began to pitch down until the wire parted. The crew determined that a piece of wire was hung up on the main landing gear. The MA landed safely in a nearby field. This obviously could have turned out much worse.

UH-1

Also, a great safety year for the Huey. No Class As or Bs. Only five Class Cs. Three of those involved engine problems with the oil and two of these were the same aircraft! The fourth Class C involved an injured parachutist. The fifth involved a hard landing where the aircraft departed the prepared surface after landing long and hot on a simulated emergency approach, as described below.

UH-1N Class C Hard Landing

The mishap occurred on a local proficiency sortie. The mishap instructor pilot (MIP) initiated a simulated engine malfunction. The MP flew the approach manually, controlling the engine speed using the throttle. The mishap aircraft (MA) touched down at approximately 40 knots somewhere between one-third and one-half of the way down the lane. The MP was unable to slow the aircraft's ground speed as it continued down the lane. The MA had reached the end of the prepared landing surface and began sliding into the rocks that comprise a 20-30 foot overrun at the end of the lane. The MIP was unable to complete the go-around sequence. The MA exited the rock area and the skid landing gear contacted the packed dirt area beyond the rocks. The MA ended up on its belly. The impact crushed the landing light and several radio antennas, and buckled the aircraft skin along the underside of the fuselage. The total distance traveled was approximately 291 feet from the point of initial touchdown. The crew egressed safely.

USAF Photo by SSgt Steve Thurow

USAF Photo by MSgt Perry J. Heimer

Risky Environment

The helicopter force in general probably has the most demanding missions in the Air Force. They operate in a low-altitude environment, land in many different types of areas and situations and generally move slower and operate closer to ground threats than any other aircraft. In that regard, the safety record is impressive. Of course, there is always room for improvement. How do we do this? One way is by expecting the unexpected.

Flying a low-level route is risky business. Lots of hazards. A good route study is crucial. Make sure the chart is CHUMed correctly. What if the power lines that are going to creep up on your route of flight are not included in the latest CHUM? Then the possibility is high that you may hit them. Take the ground threats seriously. Flying in hostile areas with no known threats does not mean that there aren't any out there. Along with the route study, do a good threat study, know the threats of hostile forces, and know their capabilities. Expect the unexpected.

Many LZs are hazardous. We need to minimize the risk during our approach into these LZs. How do we do this? Good study of the area from charts, maps, imagery, experience, etc. Never take it for granted that you've done this before many times, that you've landed here plenty of times, and that you won't have to go around. The successful completion of a go-around is directly proportional to how early the decision is made to go around. Expect the unexpected.

The choppers are doing a great job out there. I applaud all crewmembers for taking up a wide variety of missions and doing it in a safe manner. Keep up the good work, and fly safe! ✈

FY99 STATS

This is our annual Aircraft Statistics pullout guide. This year, in the interest of getting as many aircraft end-of-year summaries as possible in this one issue, we have abbreviated the numbers to cover just the past 10 years. Statistics for FY99 are current as of 30 September 99. However, in most cases, flying hours for Aug and Sep 99 are estimated. Lifetime averages are included that cover the entire history of each aircraft for its Air Force career. Anyone interested in earlier figures can find them at the AFSC web-site: http://www-afsc.saia.af.mil/AFSC/RDBMS/Flight/stats/index.html . Please note these statistics are for flight mishaps only, and don't include Flight-Related or Ground mishaps.

A-10 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	3	1.35	0	0.00	3	1.35	3	3	222,399	2,414,974
FY91	2	0.88	0	0.00	3	1.31	2	2	228,273	2,641,768
FY92	3	1.79	0	0.00	3	1.79	1	1	167,648	2,809,416
FY93	2	1.74	0	0.00	3	1.74	1	1	115,064	2,924,480
FY94	4	3.35	0	0.00	5	4.19	1	1	119,329	3,043,809
FY95	2	1.69	1	0.84	2	1.69	1	1	118,602	3,162,411
FY96	2	1.63	0	0.00	2	1.63	1	1	122,953	3,285,364
FY97	3	2.40	1	0.80	3	2.40	2	2	125,100	3,410,464
FY98	1	0.79	0	0.00	1	0.79	0	0	124,119	3,534,583
FY99	2	1.61	0	0.00	1	0.80	0	0	124,571	3,659,154
LIFETIME CY72-FY99	90	2.46	46	1.26	91	2.49	46	53	3,659,154	
5 YR AVG	2.0	1.63	0.4	0.33	1.8	1.46	0.8	0.8	123,069.0	
10 YR AVG	2.4	1.63	0.2	0.14	2.5	1.70	1.2	1.2	146,805.8	

U-2 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	1	5.56	0	0.00	1	5.56	0	0	18,001	237,607
FY91	0	0.00	0	0.00	0	0.00	0	0	19,820	257,427
FY92	1	6.03	0	0.00	1	6.03	1	1	16,597	274,024
FY93	0	0.00	0	0.00	0	0.00	0	0	18,085	292,109
FY94	2	12.79	0	0.00	2	12.79	1	1	15,643	307,752
FY95	1	5.64	0	0.00	1	5.64	1	1	17,726	325,478
FY96	2	12.11	0	0.00	1	6.05	1	2	16,518	341,996
FY97	1	8.62	0	0.00	0	0.00	0	0	11,601	353,597
FY98	0	0.00	0	0.00	0	0.00	0	0	11,431	365,028
FY99	2	16.99	0	0.00	0	0.00	0	0	11,775	376,803
LIFETIME CY63-FY99	27	7.17	1	0.27	20	5.31	7	12	376,803	
5 YR AVG	1.2	8.69	0.0	0.00	0.4	2.90	0.4	0.6	13,810.2	
10 YR AVG	1.0	6.36	0.0	0.00	0.6	3.82	0.4	0.5	15,719.7	

B-1 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	1	3.74	1	3.74	0	0.00	0	0	26,705	84,279
FY91	2	8.56	0	0.00	0	0.00	0	0	23,355	107,634
FY92	3	11.12	0	0.00	0	0.00	0	0	26,970	134,604
FY93	1	3.31	1	3.31	1	3.31	2	4	30,179	164,783
FY94	0	0.00	1	3.40	0	0.00	0	0	29,383	194,166
FY95	0	0.00	3	10.80	0	0.00	0	0	27,781	221,947
FY96	0	0.00	1	3.79	0	0.00	0	0	26,371	248,318
FY97	1	4.03	3	12.10	1	4.03	2	4	24,803	273,121
FY98	1	4.21	2	8.42	1	4.21	0	0	23,744	296,865
FY99	0	0.00	0	0.00	0	0.00	0	0	28,764	325,629
LIFETIME CY84-FY99	12	3.69	17	5.22	6	1.84	6	11	325,629	
5YR AVG	0.4	1.52	1.8	6.85	0.4	1.52	0.4	0.8	26,292.6	
10 YR AVG	0.9	3.36	1.2	4.48	0.3	1.12	0.4	0.8	26,805.5	

B-2 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	0,060	0,060
FY91	0	0.00	0	0.00	0	0.00	0	0	0,225	0,285
FY92	0	0.00	0	0.00	0	0.00	0	0	0,378	0,663
FY93	0	0.00	0	0.00	0	0.00	0	0	0,455	1,118
FY94	0	0.00	0	0.00	0	0.00	0	0	0,976	2,094
FY95	0	0.00	0	0.00	0	0.00	0	0	2,415	4,509
FY96	0	0.00	0	0.00	0	0.00	0	0	3,248	7,757
FY97	0	0.00	0	0.00	0	0.00	0	0	3,743	11,491
FY98	0	0.00	0	0.00	0	0.00	0	0	3,078	14,569
FY99	0	0.00	1	22.68	0	0.00	0	0	4,410	18,979
LIFETIME FY90-FY99	0	0.00	1	5.27	0	0.00	0	0	18,979	
5 YR AVG	0.0	0.00	0.2	5.92	0.0	0.00	0.0	0.0	3,377	

B-52 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	91,037	7,128,143
FY91	1	1.09	0	0.00	1	1.09	0	3	91,454	7,219,597
FY92	0	0.00	0	0.00	0	0.00	0	0	69,056	7,288,653
FY93	0	0.00	1	1.88	0	0.98	0	0	53,293	7,341,946
FY94	1	3.11	1	3.11	1	3.11	4	0	32,146	7,374,092
FY95	1	4.13	1	4.13	0	0.00	0	0	24,223	7,398,315
FY96	0	0.00	0	0.00	0	0.00	0	0	25,506	7,423,821
FY97	0	0.00	1	4.29	0	0.00	0	0	23,297	7,447,118
FY98	0	0.00	0	0.00	0	0.00	0	0	22,852	7,470,308
FY99	0	0.00	0	0.00	0	0.00	0	0	24,423	7,494,393
LIFETIME CY55-FY99	97	1.29	165	2.20	76	1.01	100	311	7,494,393	
5 YR AVG	0.2	0.83	0.4	1.66	0.0	0.00	0.0	0.0	24,060.2	
10 YR AVG	0.3	0.66	0.4	0.87	0.2	0.44	0.4	0.3	45,728.7	

FY99 hours and cumulative hours forecasted for Aug/Sep 99.

C-5 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	1	1.13	0	0.00	1	1.13	3	13	88,390	1,077,984
FY91	0	0.00	1	0.60	0	0.00	0	0	166,676	1,244,660
FY92	0	0.00	1	1.51	0	0.00	0	0	66,324	1,310,984
FY93	0	0.00	2	2.55	0	0.00	0	0	78,319	1,389,303
FY94	0	0.00	4	5.49	0	0.00	0	0	72,899	1,462,202
FY95	0	0.00	1	1.55	0	0.00	0	0	64,608	1,526,810
FY96	0	0.00	0	0.00	0	0.00	0	0	67,499	1,594,309
FY97	0	0.00	1	1.58	0	0.00	0	0	63,120	1,657,429
FY98	0	0.00	0	0.00	0	0.00	0	0	64,501	1,721,930
FY99	0	0.00	0	0.00	0	0.00	0	0	60,149	1,782,079
LIFETIME CY68-FY99	15	0.84	37	2.08	4	0.22	5	168	1,782,079	
5 YR AVG	0.0	0.00	0.4	0.63	0.0	0.00	0.0	0.0	63,975.4	
10 YR AVG	0.1	0.13	1.0	1.26	0.1	0.13	0.3	1.3	79,248.5	

C-9 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	28,610	590,862
FY91	0	0.00	0	0.00	0	0.00	0	0	26,728	617,590
FY92	0	0.00	0	0.00	0	0.00	0	0	27,260	644,850
FY93	0	0.00	0	0.00	0	0.00	0	0	26,072	670,922
FY94	0	0.00	0	0.00	0	0.00	0	0	25,087	696,009
FY95	0	0.00	1	3.83	0	0.00	0	0	26,119	722,128
FY96	0	0.00	0	0.00	0	0.00	0	0	24,602	746,730
FY97	0	0.00	0	0.00	0	0.00	0	0	23,260	769,990
FY98	0	0.00	0	0.00	0	0.00	0	0	21,361	791,351
FY99	1	3.79	0	0.00	0	0.00	0	0	26,381	817,732
LIFETIME CY68-FY99	3	0.37	2	0.24	1	0.12	3	3	817,732	
5 YR AVG	0.2	0.82	0.2	0.82	0.0	0.00	0.0	0.0	24,344.6	
10 YR AVG	0.1	0.39	0.1	0.39	0.0	0.00	0.0	0.0	25,548.0	

KC-10 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	51,490	270,976
FY91	1	1.46	1	1.46	0	0.00	0	0	68,668	339,644
FY92	1	2.31	1	2.31	0	0.00	0	0	43,253	382,897
FY93	0	0.00	0	0.00	0	0.00	0	0	54,266	437,163
FY94	0	0.00	0	0.00	0	0.00	0	0	52,289	489,452
FY95	0	0.00	0	0.00	0	0.00	0	0	43,381	532,833
FY96	2	3.87	0	0.00	0	0.00	0	0	51,725	584,558
FY97	0	0.00	0	0.00	0	0.00	0	0	50,181	634,739
FY98	0	0.00	0	0.00	0	0.00	0	0	48,809	683,548
FY99	0	0.00	0	0.00	0	0.00	0	0	46,614	730,162
LIFETIME CY81-FY99	4	0.55	5	0.68	0	0.00	0	0	730,162	
5 YR AVG	0.4	0.83	0.0	0.00	0.0	0.00	0.0	0.0	48,142.0	
10 YR AVG	0.4	0.78	0.2	0.39	0.0	0.00	0.0	0.0	51,067.6	

C-12 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	34,928	244,758
FY91	0	0.00	0	0.00	0	0.00	0	0	34,944	279,702
FY92	0	0.00	0	0.00	0	0.00	0	0	28,893	308,595
FY93	0	0.00	0	0.00	0	0.00	0	0	27,099	335,694
FY94	0	0.00	0	0.00	0	0.00	0	0	16,500	352,195
FY95	0	0.00	0	0.00	0	0.00	0	0	21,461	373,655
FY96	0	0.00	0	0.00	0	0.00	0	0	4,740	378,395
FY97	0	0.00	0	0.00	0	0.00	0	0	4,728	383,123
FY98	0	0.00	0	0.00	0	0.00	0	0	5,666	388,789
FY99	0	0.00	0	0.00	0	0.00	0	0	5,442	394,231
LIFETIME CY75-FY99	2	0.51	1	0.21	1	0.25	2	6	394,231	
5 YR AVG	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0	8,407.4	
10 YR AVG	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	18,440.1	

C-17 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	8	8
FY92	0	0.00	0	0.00	0	0.00	0	0	,539	,547
FY93	0	0.00	0	0.00	0	0.00	0	0	1,252	1,799
FY94	0	0.00	0	0.00	0	0.00	0	0	4,454	6,253
FY95	0	0.00	0	0.00	0	0.00	0	0	12,968	19,221
FY96	1	4.75	1	4.75	0	0.00	0	0	21,050	40,271
FY97	1	3.78	1	3.78	0	0.00	0	0	26,486	66,757
FY98	1	2.40	0	0.00	0	0.00	0	0	57,633	124,390
FY99	0	0.00	0	0.00	0	0.00	0	0	57,980	182,370
LIFETIME FY91-FY99	3	1.65	2	1.10	0	0.00	0	0	182,370	
5 YR AVG	0.6	1.70	0.4	1.14	0.0	0.00	0.0	0.0	35,223.4	

C-20 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	8,495	37,611
FY91	0	0.00	0	0.00	0	0.00	0	0	8,244	45,855
FY92	0	0.00	0	0.00	0	0.00	0	0	6,994	52,849
FY93	0	0.00	0	0.00	0	0.00	0	0	6,046	58,895
FY94	0	0.00	0	0.00	0	0.00	0	0	6,617	65,512
FY95	0	0.00	0	0.00	0	0.00	0	0	6,472	71,984
FY96	0	0.00	0	0.00	0	0.00	0	0	6,403	78,387
FY97	0	0.00	0	0.00	0	0.00	0	0	6,380	84,266
FY98	0	0.00	0	0.00	0	0.00	0	0	7,251	92,018
FY99	0	0.00	0	0.00	0	0.00	0	0	7,205	99,223
LIFETIME CY83-FY99	0	0.00	0	0.00	0	0.00	0	0	99,223	
5 YR AVG	0	0.00	0.0	0.00	0.0	0.00	0.0	0.0	6,742	
10 YR AVG	0	0.00	0.0	0.00	0.0	0.00	0.0	0.0	7,011	

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	54,535	321,530
FY91	0	0.00	0	0.00	0	0.00	0	0	54,923	376,453
FY92	0	0.00	0	0.00	0	0.00	0	0	47,603	424,056
FY93	0	0.00	0	0.00	0	0.00	0	0	48,421	472,477
FY94	0	0.00	0	0.00	0	0.00	0	0	47,336	519,813
FY95	1	2.13	0	0.00	1	2.13	2	7	47,020	566,833
FY96	0	0.00	0	0.00	0	0.00	0	0	46,239	613,072
FY97	0	0.00	0	0.00	0	0.00	0	0	44,743	659,815
FY98	0	0.00	0	0.00	0	0.00	0	0	45,231	705,046
FY99	0	0.00	0	0.00	0	0.00	0	0	48,390	753,436
LIFETIME CY84-FY99	2	0.27	0	0.00	2	0.27	4	9	753,436	
5 YR AVG	0.2	0.43	0.0	0.00	0.2	0.43	0.4	1.4	46,724.6	
10 YR AVG	0.1	0.21	0.0	0.00	0.1	0.21	0.2	0.7	48,644.1	

C-21 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	325,201	12,252,166
FY91	0	0.00	0	0.00	0	0.00	0	0	401,615	12,653,781
FY92	2	0.63	0	0.00	2	0.63	8	24	315,952	12,969,733
FY93	1	0.33	0	0.00	1	0.33	2	6	300,157	13,269,890
FY94	1	0.36	0	0.00	1	0.36	0	8	279,923	13,549,813
FY95	1	0.35	1	0.35	1	0.35	2	6	282,864	13,832,677
FY96	1	0.34	1	0.34	1	0.34	2	9	294,075	14,126,752
FY97	2	0.70	2	0.70	2	0.70	2	13	283,997	14,410,749
FY98	0	0.00	0	0.00	0	0.00	0	0	282,876	14,693,625
FY99	0	0.00	0	0.00	0	0.00	0	0	294,373	14,987,998
LIFETIME CY55-FY99	142	0.95	143	0.95	83	0.55	134	613	14,987,998	
5 YR AVG	0.8	0.28	0.8	0.28	0.8	0.28	1.2	5.6	287,637.0	
10 YR AVG	0.8	0.26	0.5	0.16	0.8	0.26	1.6	6.6	306,103.3	

C-130 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	1	0.37	0	0.00	1	0.37	2	4	270,624	9,671,901
FY91	1	0.34	0	0.00	0	0.00	0	0	298,070	9,969,971
FY92	1	0.30	0	0.00	1	0.39	0	0	255,073	10,225,044
FY93	0	0.00	1	0.00	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	0.00	0	0.00	0	0	219,880	10,909,841
FY96	0	0.00	1	0.00	0	0.00	0	0	215,105	11,124,946
FY97	0	0.00	3	0.00	0	0.00	0	0	212,055	11,337,001
FY98	1	0.52	0	0.00	0	0.00	0	0	192,302	11,529,303
FY99	1	0.52	0	0.00	1	0.52	2	4	190,508	11,719,811
LIFETIME CY57-FY99	79	0.67	120	1.02	64	0.55	134	629	11,719,811	
5 YR AVG	0.4	0.19	1.0	0.49	0.2	0.10	0.4	0.8	205,970.0	
10 YR AVG	0.5	0.22	0.6	0.26	0.3	0.13	0.4	0.8	231,853.4	

C-135 HISTORY

C-141 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	304,106	8,778,256
FY91	0	0.00	0	0.00	0	0.00	0	0	442,406	9,220,662
FY92	0	0.00	0	0.00	0	0.00	0	0	226,312	9,446,974
FY93	1	0.49	0	0.00	2	0.98	4	13	203,264	9,650,238
FY94	0	0.00	0	0.00	1	0.78	0	0	127,938	9,778,176
FY95	0	0.00	0	0.00	0	0.00	0	0	157,059	9,935,235
FY96	0	0.00	0	0.00	0	0.00	0	0	146,417	10,081,652
FY97	1	0.83	1	0.83	1	0.83	2	9	121,043	10,202,695
FY98	1	0.97	0	0.00	0	0.00	0	0	102,917	10,305,612
FY99	0	0.00	0	0.00	0	0.00	0	0	108,599	10,414,211
LIFETIME CY64-FY99	34	0.33	29	0.28	16	0.15	34	161	10,414,211	
5 YR AVG	0.4	0.31	0.2	0.16	0.2	0.16	0.4	1.8	127,207.0	
10 YR AVG	0.3	0.15	0.1	0.05	0.4	0.21	0.6	2.2	194,006.1	

E-3 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	26,141	303,055
FY91	0	0.00	0	0.00	0	0.00	0	0	32,343	335,398
FY92	0	0.00	0	0.00	0	0.00	0	0	33,329	368,727
FY93	0	0.00	0	0.00	0	0.00	0	0	27,782	396,509
FY94	0	0.00	0	0.00	0	0.00	0	0	24,381	420,890
FY95	1	3.90	0	0.00	1	3.90	2	22	25,612	446,502
FY96	0	0.00	0	0.00	0	0.00	0	0	25,430	471,932
FY97	0	0.00	0	0.00	0	0.00	0	0	21,752	493,684
FY98	0	0.00	0	0.00	0	0.00	0	0	20,960	514,644
FY99	0	0.00	0	0.00	0	0.00	0	0	24,764	539,408
LIFETIME CY77-FY99	1	0.19	2	0.37	1	0.19	2	22	539,408	
5YR AVG	0.2	0.84	0.0	0.00	0.2	0.84	0.4	4.4	23,703.6	
10 YR AVG	0.1	0.38	0.0	0.00	0.1	0.38	0.2	2.2	26,249.4	

E-4 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	1,908	27,995
FY91	0	0.00	0	0.00	0	0.00	0	0	1,822	29,817
FY92	0	0.00	1	58.28	0	0.00	0	0	1,716	31,533
FY93	0	0.00	1	74.96	0	0.00	0	0	1,334	32,867
FY94	0	0.00	0	0.00	0	0.00	0	0	1,587	34,454
FY95	0	0.00	0	0.00	0	0.00	0	0	1,697	36,151
FY96	0	0.00	0	0.00	0	0.00	0	0	1,401	37,552
FY97	0	0.00	0	0.00	0	0.00	0	0	1,310	38,862
FY98	0	0.00	0	0.00	0	0.00	0	0	1,362	40,224
FY99	0	0.00	0	0.00	0	0.00	0	0	1,820	42,044
LIFETIME CY75-FY99	1	2.38	2	4.76	0	0.00	0	0	42,044	
5 YR AVG	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0	1,518.0	
10YR AVG	0.0	0.00	0.2	12.53	0.0	0.00	0.0	0.0	1,595.7	

F-15 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	7	3.08	6	2.64	7	3.08	4	5	227,617	2,155,126
FY91	3	1.09	2	0.72	3	1.09	0	0	276,393	2,431,519
FY92	5	2.26	2	0.91	5	2.26	2	3	220,866	2,652,385
FY93	3	1.38	5	2.30	3	1.38	0	0	217,547	2,869,932
FY94	4	1.90	3	1.43	4	1.90	1	1	210,241	3,080,173
FY95	4	1.95	5	2.42	3	1.45	1	2	206,649	3,286,822
FY96	4	1.99	2	1.00	3	1.49	0	0	200,766	3,487,588
FY97	3	1.56	5	2.60	2	1.04	0	0	192.073	3,679,661
FY98	3	1.59	5	2.66	2	1.06	0	0	186,205	3,867,866
FY99	4	2.18	5	2.72	6	3.27	1	2	183,620	4,051,486
LIFETIME CY72-FY99	101	2.49	150	3.70	97	2.39	35	42	4,051,486	
5 YR AVG	3.6	1.81	4.4	2.26	3.2	1.65	0.4	0.8	194,262.6	
10 YR AVG	4.0	1.90	4.0	1.88	3.8	1.79	0.9	1.3	212,397.7	

F-16 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	13	3.19	4	0.98	14	0.00	4	7	408,078	2,389,270
FY91	21	4.55	1	0.22	21	1.09	5	5	461,451	2,850,721
FY92	18	4.04	1	0.22	18	0.00	8	9	445,201	3,295,922
FY93	18	4.15	2	0.46	18	0.98	4	5	433,960	3,729,882
FY94	17	4.00	2	0.50	15	3.11	3	27	400,484	4,130,366
FY95	9	2.33	2	0.52	9	0.00	1	1	386,445	4,516,811
FY96	8	2.14	5	1.34	7	0.00	0	1	374,530	4,891,341
FY97	11	3.05	1	0.28	11	3.05	1	1	360,738	5,252,079
FY98	14	3.89	1	0.28	12	3.33	4	6	360,245	5,612,324
FY99	18	5.12	2	0.57	16	4.55	2	2	351,751	5,964,075
LIFETIME CY75-FY99	264	4.43	35	0.59	250	4.19	68	103	5,964,075	
5 YR AVG	12.0	3.27	2.2	0.60	11.0	3.00	1.6	2.2	366,741.8	
10 YR AVG	14.6	3.67	2.1	0.53	14.1	3.54	3.2	6.4	398,288.3	

F-117 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY91	0	0.00	0	0.00	0	0.00	0	0	17,875	17,875
FY92	1	8.71	0	0.00	1	8.71	0	0	11,481	29,356
FY93	0	0.00	2	15.95	0	0.00	0	0	12,538	41,894
FY94	0	0.00	0	0.00	0	0.00	0	0	12,136	54,030
FY95	2	15.62	0	0.00	1	7.81	1	1	12,804	66,834
FY96	0	0.00	1	7.59	0	0.00	0	0	13,171	80,005
FY97	3	23.69	0	0.00	1	7.90	0	0	12,661	92,666
FY98	0	0.00	0	0.00	0	0.00	0	0	12,470	105,136
FY99	1	7.25	1	7.25	0	0.00	0	0	13,788	118,924
LIFETIME FY91-FY99	7	5.89	4	3.36	3	2.52	1	1	118,924	
5 YR AVG	1.2	9.25	0.4	3.08	0.4	3.08	0.2	0.2	12,978.8	

H-1 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	30,704	520,202
FY91	1	3.32	1	3.32	1	3.32	1	2	30,087	550,289
FY92	2	7.21	0	0.00	2	7.21	3	7	27,729	578,018
FY93	0	0.00	0	0.00	0	0.00	0	0	25,945	603,963
FY94	1	4.15	1	4.15	1	4.15	0	0	24,099	628,062
FY95	1	4.60	0	0.00	1	4.60	0	0	21,761	649,823
FY96	1	4.73	0	0.00	1	4.73	0	0	21,141	670,964
FY97	0	0.00	0	0.00	0	0.00	0	0	20,716	691,680
FY98	1	5.05	0	0.00	1	5.05	0	0	19,787	695,567
FY99	0	0.00	0	0.00	0	0.00	0	0	19,574	731,041
LIFETIME CY71-FY99	15	2.05	6	0.82	14	1.92	9	24	731,041	
5 YR AVG	0.6	2.91	0.0	0.00	0.6	2.91	0.0	0.0	20,595.8	
10 YR AVG	0.7	2.90	0.2	0.83	0.7	2.90	0.4	0.9	24,154.3	

H-53 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	12,223	315,187
FY91	0	0.00	0	0.00	0	0.00	0	0	11,594	326,781
FY92	0	0.00	0	0.00	0	0.00	0	0	12,238	339,019
FY93	0	0.00	0	0.00	0	0.00	0	0	12,019	351,038
FY94	0	0.00	0	0.00	0	0.00	0	0	12,106	363,144
FY95	1	8.43	0	0.00	1	8.43	0	0	11,857	375,001
FY96	1	7.44	0	0.00	0	0.00	0	0	13,436	388,415
FY97	0	0.00	0	0.00	0	0.00	0	0	12,996	401,433
FY98	0	0.00	0	0.00	0	0.00	0	0	13,926	415,359
FY99	1	6.27	1	6.27	1	6.27	0	1	15,940	431,299
LIFETIME CY66-FY99	27	6.26	16	3.71	20	4.64	24	81	431,299	
5 YR AVG	0.6	4.40	0.2	1.47	0.4	2.93	0.0	0.2	13,631.0	
10 YR AVG	0.3	2.34	0.2	1.56	0.2	1.56	0.0	0.1	12,833.5	

H-60 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	7,849	34,245
FY91	1	6.85	0	0.00	0	0.00	0	0	14,594	48,839
FY92	1	5.15	0	0.00	1	5.15	0	1	19,401	68,240
FY93	1	4.37	0	0.00	1	4.37	1	12	22,871	91,111
FY94	2	8.25	1	4.13	1	4.13	0	0	24,229	115,340
FY95	1	3.75	1	3.75	1	3.75	2	5	26,666	142,006
FY96	0	0.00	0	0.00	0	0.00	0	0	27,809	169,815
FY97	0	0.00	0	0.00	0	0.00	0	0	26,009	195,824
FY98	1	3.84	0	0.00	2	7.69	4	12	26,014	221,838
FY99	0	0.00	0	0.00	0	0.00	0	0	29,343	251,181
LIFETIME CY82-FY99	8	3.18	2	0.80	7	2.79	9	34	251,181	
5 YR AVG	0.4	1.47	0.2	0.74	0.6	2.21	1.2	3.4	27,168.2	
10 YR AVG	0.7	3.11	0.2	0.89	0.6	2.67	0.7	3.0	22,478.5	

T-1 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY92	0	0.00	0	0.00	0	0.00	0	0	0,001	0,001
FY93	0	0.00	0	0.00	0	0.00	0	0	18,063	18,064
FY94	0	0.00	0	0.00	0	0.00	0	0	32,304	50,368
FY95	0	0.00	0	0.00	0	0.00	0	0	41,055	91,423
FY96	0	0.00	0	0.00	0	0.00	0	0	48,186	139,609
FY97	0	0.00	0	0.00	0	0.00	0	0	58,420	198,029
FY98	0	0.00	0	0.00	0	0.00	0	0	78,618	276,647
FY99	0	0.00	0	0.00	0	0.00	0	0	90,018	366,665
LIFETIME FY92-FY99	0	0.00	0	0.00	0	0.00	0	0	366,665	
5 YR AVG	0	0.00	0	0.00	0	0.00	0	0	63,259.4	

T-3 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY94	0	0.00	0	0.00	0	0.00	0	0	2,663	2,663
FY95	1	4.34	0	0.00	1	4.34	1	2	23,062	25,725
FY96	1	3.30	0	0.00	1	3.30	1	2	30,337	56,062
FY97	1	3.70	0	0.00	1	3.70	1	2	27,044	83,107
FY98	0	0.00	0	0.00	0	0.00	0	0	0,001	83,108
FY99	0	0.00	0	0.00	0	0.00	0	0	8,422	91,530
LIFETIME FY94-FY99	3	3.28	0	0.00	3	3.28	3	6	91,530	
5 YR AVG	0.6	3.38	0.0	0.00	0.6	3.38	0.6	1.2	17,773.4	

T-37 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	306,885	10,650,389
FY91	0	0.00	0	0.00	0	0.00	0	0	279,593	10,929,982
FY92	2	0.85	0	0.00	3	1.28	2	2	234,830	11,164,812
FY93	1	0.56	0	0.00	1	0.56	0	0	179,933	11,344,745
FY94	0	0.00	0	0.00	0	0.00	0	0	151,651	11,496,396
FY95	1	0.74	0	0.00	1	0.74	0	0	134,425	11,630,821
FY96	0	0.00	0	0.00	0	0.00	0	0	144,079	11,774,230
FY97	1	0.62	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	178,505	12,297,171
LIFETIME CY56-FY99	133	1.08	31	0.25	131	1.07	26	75	12,297,171	
5 YR AVG	0.4	0.25	0.0	0.00	0.4	0.25	0.0	0.0	160,155.0	
10 YR AVG	0.5	0.26	0.0	0.00	0.6	0.31	0.2	0.2	195,366.7	

FY99 hours and cumulative hours forecasted for Aug/Sep 99.

T-38 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	2	0.55	2	0.55	2	0.55	0	0	361,878	10,616,209
FY91	1	0.30	0	0.00	1	0.30	0	2	337.134	10,953,343
FY92	1	0.38	0	0.00	0	0.00	1	1	265,369	11,218,712
FY93	3	1.33	0	0.00	3	1.33	0	0	225,105	11,443,817
FY94	0	0.00	0	0.00	0	0.00	0	0	194,161	11,637,978
FY95	1	0.63	0	0.00	1	0.63	0	0	158,422	11,796,400
FY96	1	0.75	0	0.00	1	0.75	0	0	133,959	11,930,359
FY97	0	0.00	0	0.00	0	0.00	0	0	135,011	12,065,370
FY98	0	0.00	1	0.71	1	0.71	0	0	141,448	12,206,818
FY99	0	0.00	0	0.00	0	0.00	0	0	130,540	12,337,358
LIFETIME CY60-FY99	189	1.53	90	0.73	183	1.48	75	134	12,337,358	
5 YR AVG	0.4	0.29	0.2	0.14	0.6	0.43	0.0	0.0	139,876.0	
10 YR AVG	0.9	0.43	0.3	0.14	0.9	0.43	0.1	0.3	208,302.7	

T-41 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	30,742	450,172
FY91	0	0.00	0	0.00	0	0.00	0	0	24,172	474,344
FY92	0	0.00	0	0.00	0	0.00	0	0	26,293	500,637
FY93	0	0.00	0	0.00	0	0.00	0	0	23,755	524,392
FY94	0	0.00	0	0.00	0	0.00	0	0	17,881	542,273
FY95	0	0.00	0	0.00	0	0.00	0	0	0,578	542,851
FY96	0	0.00	0	0.00	0	0.00	0	0	0,671	543,522
FY97	0	0.00	0	0.00	0	0.00	0	0	0,622	544,144
FY98	0	0.00	0	0.00	0	0.00	0	0	0,834	544,978
FY99	0	0.00	0	0.00	0	0.00	0	0	0,750	545,728
LIFETIME CY64-FY99	3	0.55	2	0.37	3	0.55	1	2	545,728	
5 YR AVG	0	0.00	0	0.00	0.0	0.00	0	0	0,691	
10 YR AVG	0	0.00	0	0.00	0.0	0.00	0	0	12,630	

T-43 HISTORY

YEAR	CLASS A #	CLASS A RATE	CLASS B #	CLASS B RATE	DESTROYED A/C	DESTROYED RATE	FATAL PILOT	ALL	HOURS	CUM HRS
FY90	0	0.00	0	0.00	0	0.00	0	0	14,370	255,967
FY91	0	0.00	0	0.00	0	0.00	0	0	13,296	269,263
FY92	0	0.00	0	0.00	0	0.00	0	0	11,005	280,268
FY93	0	0.00	0	0.00	0	0.00	0	0	9,179	289,447
FY94	0	0.00	0	0.00	0	0.00	0	0	7,069	296,516
FY95	0	0.00	0	0.00	0	0.00	0	0	7,917	304,433
FY96	1	14.28	0	0.00	1	14.28	2	35	7,003	311,436
FY97	0	0.00	0	0.00	0	0.00	0	0	6,552	317,988
FY98	0	0.00	0	0.00	0	0.00	0	0	5,265	323,253
FY99	0	0.00	0	0.00	0	0.00	0	0	5,858	329,111
LIFETIME CY74-FY99	1	0.30	6	1.82	1	0.30	2	35	329,111	
5 YR AVG	0.2	3.07	0.0	0.00	0.2	3.07	0.4	7.0	6,519.0	
10 YR AVG	0.1	1.14	0.0	0.99	0.1	1.14	0.2	3.5	8,751.4	

F-15

USAF Photo by MSgt Perry J. Heimer

MAJ KURT J. SALADANA (CAF)
HQ AFSC/SEFF

FY99 saw six Eagles destroyed in four Class A mishaps. With the exception of an F-15E controlled-flight-into-terrain (CFIT) mishap that cost the lives of both crewmembers, the other mishaps had no fatalities. They were also all midairs. Total cost to the taxpayer was $206,806,639. That much money could almost purchase a squadron of F-16s.

Total cost from midairs alone was $168,772,248. All of the aircrews involved in FY99's mishaps were experienced. Although the pilot and WSO in the Strike Eagle mishap had relatively few hours in the F-15E, both had flown the F-111 operationally, performing a similar mission.

So, why did these mishaps occur when thousands of other sorties flew in FY99 without loss of life or property? In the old days, when the US Air Force lost hundreds of aircraft per year, aircrews talked about luck. Does luck still play a role? If you happen to get taken out by a meteorite, or the only bird flying in a particular chunk of sky on a particular day, most people are going to buy the "luck" angle. If you smack into someone else's aircraft, one to whom you were just talking, and on a clear day, luck probably didn't have much to do with it.

All of FY99's Class A F-15 midair collisions were daytime VFR mishaps. No one planned on hitting someone else and the collisions weren't the result of bad luck. So why did these aircraft hit each other?

Accidents are almost always the result of mistakes. But trying to nail down who made the mistake isn't always easy, nor would it necessarily serve the goal of flight safety and prevent future accidents. If we know why a mistake was made, we can try to find a fix so that the same mistake isn't made again. In some cases, the mistakes were made during an aircraft's design or construction phase. Frequently these errors were simply the result of technology that existed at the time. As computers become ever more powerful, aircraft design becomes more precise and, as a result, something that made sense 20 years ago is often incomprehensible today. In these instances, the problem usually isn't discovered until years later and a fix isn't feasible because of the cost. Instead, everyone concerned is warned of the problem and procedures are designed, implemented, and practiced to eliminate, or at least reduce, the chance of a recurrence. When mistakes are made during maintenance, they're usually the result of a breakdown in habit patterns. If someone is performing a common or routine task, and that person is interrupted or for some reason must change the way he or she normally executes that task, the chances of missing a step increase dramatically. This is why on very rare occasions, even though the Air Force has a thorough system of maintenance and inspection, cotter pins get left out, nuts aren't properly torqued, or wires aren't properly connected.

In flying operations, routine cockpit taskings are more prone to habit pattern breakdown than sequences that are being practiced or concentrated upon. For instance, on an aerial gunnery mission, if interrupted by a radio transmission, the pilot is more likely to miss a step during a climb or level-off check than he or she is to miss a step during the set-up and run at the target. What is more likely to occur, while concentrating on hitting the target, is an error related to focusing too much on one part of a task and missing other inputs.

This is normally the case when a mishap occurs during BFM, ACM, or DACT. It isn't unusual for an aircraft to depart controlled flight in a 1 V 1 engagement because the pilot's fangs are out and he or she is focused almost entirely on getting the shot and misses an AOA reading, fuel imbalance, or departure tone. The same is true for midairs, only the potential increases with the complexity of the engagement: The more aircraft in the engagement, the greater the chance of hitting one of them. A metal-to-metal pass in a 1 V 1 is usually the result of loss of sight, but in a "more than 1 V more than 1," a collision is normally due to a loss of Situational Awareness (SA).

The Air Force developed Rules of Engagement to prevent midairs. During 1 V 1 engagements, the ROEs appear foolproof, providing the players adhere to them strictly, especially regarding loss of sight. As hours are reduced and training becomes a more precious commodity, it becomes harder and harder to give up the training value of a sortie or an engagement. Nobody wants to call "Knock it off" unless they really have to, and it isn't unusual to lose sight of the other aircraft for a second or two. And certainly nobody wants to call "Blind" in anticipation of the dreaded "Continue" call in an all-too-smug tone of voice from the other aircraft. Who hasn't applied the old "One potato, two potato" rule before making the "Blind" call while trying to acquire the other fighter (and it has to be right where you are looking, it was just there)? Focusing on getting the most out of an engagement by staying in the fight and excluding the immediate application of ROEs is little different from concentrating on getting a shot and departing the aircraft—unless, of course, the result is a midair.

With multiple aircraft engagements, the pilot ends up dividing his or her attention to radar, visual lookout, tactical formation station-keeping, radio inputs, and all of the aircraft flight parameters. As the workload increases, it becomes more difficult to track everything and attention tends to focus on fewer inputs, usually those which the brain says are the most critical. In real or simulated air combat, getting the shot, monitoring for threats, and keeping track of lead or wingmen become top priorities. Because this is probably the most demanding scenario for a fighter pilot, it is also the one most likely to produce a midair.

How do we prevent midairs? We probably can't prevent all of them, but we can reduce the risk, particularly in training. Follow the ROEs. Don't get into the habit of delaying warning calls because SA and common sense tell you the other aircraft must be in a particular chunk of sky and can't possibly be a threat. During multiple aircraft versus multiple aircraft engagements, don't lose SA on your lead. It's better to stay in your own block and tied to lead than it is to be tally at the merge and not know where lead is. You might not always get the shot, but your chances of debriefing some valuable lessons learned and getting the shot on the next sortie are going to be a lot better than if your squadron is down two aircraft because of a midair.

The Eagle community was relatively "lucky" in FY99. There were two fatalities, but that number could easily have been eight, or even more. The F-15 is the best air superiority aircraft in the world. The US Air Force can ill afford the loss of this asset, or the real reason the Eagle is the best air superiority fighter in the world—its skilled aircrews. Fly Safe! ✈

USAF Photo

USAF Photo by A1C Greg L. Davis

KC-10 and all kinds of -135s

LT COL BRUCE LUJAN
HQ AFSC/SEFF

Fiscal Year 1999 has been a busy one for those of us involved in mishap investigations and their follow-up actions. The Air Force wound up with a rate of 1.40 Class A Mishaps per 100,000 flying hours, with 30 flight Class As and 25 destroyed aircraft. It was the Air Force's worst year since FY95. This issue includes articles and trends from a fair number of aircraft similar to ours. After you're done reading about your particular weapon system, please read the other weapon system articles and learn what you can from them, too.

The -135 Mishaps

Before our Class A in FY98, we had gone five fiscal years (FY93-FY97) without a flight Class A in the -135. In the FY98 mishap, the right main gear on an OC-135B collapsed during landing. A stress corrosion crack had apparently worked its way through a main landing gear drag strut, the strut failed during landing, the main landing gear collapsed into the fuselage, the aircraft settled onto the No. 3 and 4 engines, and the No. 3 engine caught fire. The aircraft slid to a stop on the runway and all passengers and crew egressed without injury.

The last time we had a -135 destroyed in a flight mishap was FY92, when an EC-135J crew landed with a tailwind on a wet runway at Pope AFB. The mishap aircraft (MA) failed to stop, departed the overrun, hit a ditch, and was damaged beyond repair. The good news there? The crew was able to egress safely. The last time the -135 community experienced fatalities in a flight mishap was FY90, when a KC-135A exploded, crashed, and burned following a turn to base for the ILS approach into Loring AFB.

FY99's sole -135 Class A flight mishap was the KC-135E that crashed at Geilenkirchen Air Base, Germany. Here's the releasable narrative.

"Following an air refueling mission, the MA flew an ILS approach to a planned full-stop landing on Runway 27. Weather was VMC with light rain and drizzle, and time of day was night. During the landing phase of the approach, the mishap crew called that they were going around. No further radio calls were made. MA crashed into a near-flat, wooded area northwest of the departure end of the runway. All four crewmembers were fatally injured. MA was destroyed upon impact and debris scattered over only a small area."

The manufacturer and the entire -135 community are keeping a close eye on stabilizer trim components and flight control systems to keep our aging aircraft safe.

There were no Class B flight mishaps, but we have plenty to talk about in Class C, HAP, FOD, and Physiological mishaps, with a total of 32. (That total does include one Class C mishap that happened 28 Sep 98 and didn't make last year's summary.) Of those 32, 20 were Logistics-related, four were Maintenance-related, five were Operations-related, and three fell into the "Miscellaneous" category.

Of the three Class Cs in the Miscellaneous category, one was a birdstrike and one was a lightning strike. The third one involved a No. 4 engine pod scrape that happened when the aircraft entered an unexpected, severe rainstorm with gusting winds in the flare and the crew lost all outside visual references after touchdown.

In the Operations category, we had an uneventful physiological mishap when the pilot flying experienced an inner ear imbalance and wisely decided to let the other pilot fly. The remaining four Operations-related Class Cs occurred during air refueling. Three resulted in ice shield damage when E-3A, F-15, and F-117 receivers exceeded inner boom limits. The last one involved damage to a boom nozzle following a brute force disconnect with a KC-10 receiver.

In the Maintenance category, there were three Class Cs and a HAP. The HAP was reported after a roller on a covelip door exited the track and allowed the covelip door to drop low enough to contact the fore flap. When the flaps were retracted, the leading edge of the flap and the covelip door were crushed. Among the Class Cs was an RC-135W engine shutdown due to a thrust reverser that activated during flight. Another Class C involved a hydraulic system failure and engine fire following the chaffing and rupture of an engine hydraulic line. The last one was an RC-135 stall caused by water that froze in the pitot-static system and caused erroneous airspeed indications. Three cheers for the copilot that took aggressive stall-recovery actions!

Now for the 20 in the Logistics category. One was a Class X FOD mishap, three were physiologicals that occurred when the aircraft failed to pressurize during climbout, seven were HAPs, and nine were Class Cs.

The HAPs included a cracked flex tube that allowed cabin air to enter the altitude computer and produce erroneous altitude readings in the reset mode. Next, a hydraulic system lost pressure when chafing and electrical arcing punched a hole in an engine hydraulic line. In the third HAP, a KC-135E unit reported the premature failure of GTCP-180L APU fuel boost pumps. Fourth, on two of six Pacer CRAG-modified aircraft at one base, the new glare shields interfered with yoke travel. The last three were flight control-related. In one of them, the yoke could be moved approximately 20 degrees left or right of center freely, with no aircraft response. Past 20 degrees, there was binding and the aircraft would lurch to the commanded bank. In another incident, neither pilot could trim the aircraft in the nose-up direction using the electric stabilizer trim. In the last flight control-related HAP, some leaking hydraulic actuators caused the aircraft to roll right significantly when the flaps were lowered.

Finally, the nine Logistics-related Class Cs covered a wide variety of things that went wrong. First, we had a boom nozzle hang up after refueling on a B-1 refueling receptacle skid plate that had a bowed-up aft edge. It required a controlled-tension disconnect and resulted in some blown hydraulic lines. The second Class C happened when hydraulic fumes coming through the bleed air ducts caused a crew to abort at high speed and overheat the brakes. The hydraulic fluid got there because of incomplete guidance on repair actions. The third Class C also resulted from inadequate guidance. This time, it was on covelip door latch dimensions. A covelip door remained in the path of the retracting flap and it was crushed. The fourth involved a faulty main landing gear wheel bearing that failed during takeoff. The fifth involved failure of a rudder power control unit with the autopilot on, resulting in an abrupt pitch down and a roll to the right. The sixth happened when an inboard fore flap failed, departed the aircraft, and damaged a spoiler assembly and covelip door. The seventh involved damage to the lower nose section when the tread separated from a nose gear tire. The eighth was an "E" model that had an engine fuel manifold rupture followed by a fire. And the last one involved an RC-135S that had the right main landing gear brakes overheat for an undetermined reason after two successive low-speed aborts.

That's quite a wide variety of things to be alert for as members of the tanker community. Now, more than ever, as we continue to fly jets that are older than most of us, I'm glad we've got smart people on our team working hard to keep them safe!

The KC-10 Mishaps

Generally speaking, the KC-10 safety record is awesome, and we have lots to be thankful for. You've never suffered a flight-related fatality or aircraft loss. The last KC-10 Class A mishap was in FY96. That says lots of great things about the operators, maintainers, supervisors, and directives you've got that work together to help you get the job done safely.

There were no Class A or B mishaps again this year and I had to dig through the Class C, HAP, FOD, and Physiological mishaps to have anything to write about. There was a total of 16 reportable mishaps/events in FY99. Of those, seven were Logistics-related, four were Operations-related, and five were in the Miscellaneous category.

All five Miscellaneous mishaps involved birdstrikes. While the birds hit different parts of the aircraft, four of the five birdstrikes occurred near McGuire AFB. It doesn't take a rocket scientist to realize that you need to be alert for birds when you fly there.

Mishaps in the Operations category included one physiological and three Class C refueling mishaps. The physiological involved a flight engineer who experienced an ear block during descent and wound up with a ruptured ear drum. The refueling Class Cs included one where the KC-10 was receiving fuel from a KC-135R in an anchor area when they experienced an uncontrolled brute force disconnect. Next, we had a US Navy E-6B that contacted the boom ice shield, and an air refueling basket that separated from the hose following a contact by an F-18 that produced a sine wave.

The seven mishaps in the Logistics category included four refueling mishaps, two engine mishaps, and one blown tire. Among the refueling mishaps, three involved the wing air refueling pods (WARP) failing to retract after refueling, and one involved the centerline drogue failing to respond. There were two instances of the WARP ram air turbine seizing that resulted in landings with the hose in trail. In the third WARP mishap, the hose would rewind partially, then deploy to full trail again. The centerline hose mishap occurred when the reel response feature failed to retract the slack in the hose after contact, a sine wave developed, and the F-14 receiver went home with our basket. The two engine mishaps included one FOD that led to compressor stalls, and a 14th stage bleed air manifold failure that caused a fire light and resulted in engine shutdown. Finally, during landing on a dry runway, the No. 9 and 10 wheel brakes locked up for unknown reasons. The No. 9 tire blew, and the unraveling tread damaged hydraulic components.

Again, the view of your community from here is a good one. You turned in another year you can be proud of. Keep up the good work. ✈

USAF Photo by SSgt Steve Thurow

MAJ PAT KOSTRZEWA
HQ AFSC/SEFF

The Year In Review

Overall, FY99 was an excellent year for safety in the B-1, B-2, and B-52 fleets. There were no Class A flight mishaps and only one Class B flight mishap. As always, there were a few mishaps involving some "outside-of-the-box" thinking, but these mishaps were less than 10 percent of the total. Achieving this while participating in Operation Desert Fox and Operation Allied Force makes it all the more impressive. A breakdown of the Class B and C flight mishaps is listed below.

B-1 (15 Total)

Birdstrikes	5
Lightning Strikes	2
Engine-Related	2
Landing Gear Damage	2
Tanker Boom Damage	1
Bomb Bay Door Damage	1
Hydraulic Failures	1
Windscreen Failures	1

B-2 (One Total)

Lightning Strike (Class B)

B-52 (Nine Total)

Birdstrikes	7
Engine-Related	1
Bomb Bay Door Damage	1

Lessons Learned

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

- DTG 200225Z Jan 99 (B-1 Hydraulic Failure)
- DTG 200142Z Sep 99 (B-1 Landing Mishap)
- DTG 121409Z May 99 (B-1 Engine Mishap)
- DTG 201401Z Aug 99 (B-2 Lightning Strike)

FOD

In the FOD category mishaps, all three bombers had increases. The B-1 had a total of 12 FOD mishaps, the B-52 had three, and the B-2 had one. The total cost for the 16 FOD mishaps was nearly $2 million. There was no real trend, but this isn't uncommon when dealing with FOD mishaps. They're difficult to investigate, and the result is often a "best guess."

The bottom line is that the prevention of FOD mishaps is *everyone's* responsibility because the costs of FOD mishaps (repair dollars, man-hours, sortie cancellations, etc.) are *everyone's* problem.

The Future

As FY00 begins and the Expeditionary Aerospace Force becomes reality, there will be new challenges to the way bombers operate and deploy. This past year has proven that you have the critical elements of an effective mishap prevention program in place. Continue to use them, exercise common sense, and fight complacency. If you do these things, then next year at this time you'll be reading an equally ho-hum article about what a quiet year it has been. ✈

ENGINE REVIEW

FY99 ENGINE-RELATED MISHAPS

USAF Photo by MSgt Perry J. Heimer

BILL BRADFORD
MAJ STEVE ROSE
BOB BLOOMFIELD
RICH GREENWOOD
HQ AFSC/SEFE

You may notice this year's article on engine-related mishaps looks a little different. However, the primary purpose—mishap prevention—remains unchanged. Ideally, as you make your way through the article, you'll ask yourself, "Is my organization relying on the same practices that eventually led others to experience a mishap?" If so, be sure to read the final segment on "What You Can Do" for tips on preventing mishaps before they ever have a chance of getting started. We're glad to report that besides ongoing Component Improvement Program (CIP) efforts to make our engines safer and more reliable, it seems there is a renewed effort to accelerate the pace safer hardware and other solutions make it into the field.

Now let's talk about the different layout of this year's article. First, you might notice the mishap statistics primarily address destroyed aircraft due to engine-related failures. Second, the organization and in-depth discussions center around engine models, versus airframes. We chose this format because the introduction of the new Class J mishap category makes comparisons to historical Class A and B mishap statistics less meaningful. Additionally, it also lends itself to discussion about the other problems afflicting an engine model, regardless if these problems resulted in high-dollar mishaps. Finally, any mishap-specific information found in this article was extracted from non-privileged sources.

Class J Reporting

Chapter 13, "Engine-Confined Incidents," in the 1 Oct 99 version of AFI 91-204, *Safety Investigations and Reports*, is new, and describes reporting of engine-confined, or "Class J Incidents." (*Effective Jan 00, the term "Class J Incident" will be changed to "Class J* Mishap.*" Ed.*) A Class J mishap has occurred when an engine failure results in $10,000 or more internal damage to the engine, *and* damage external to the engine is less than $10,000. Class J mishaps do not affect MAJCOM mishap rates. However, total damage costs must still be calculated and included in the final message report. In FY99, there were 27 Class J mishaps reported with total damages exceeding $11.5 million. Wing-level organizations will normally investigate their own Class J mishaps unless directed otherwise by higher authority. Nevertheless, if your organization suffers a high-dollar value Class J mishap (greater than $200,000), you are strongly advised to call the HQ AF Safety Center (AFSC) Technical Assistance Hot Line (DSN 246-5867) and get yourself some qualified technical help to assist you in determining the root cause of your Class J. For all Class J mishaps, be sure to forward a Deficiency Report on suspect parts to the appropriate Air Logistics Center. Normally, Class J mishaps are reported using aircraft Class C mishap reporting proce-

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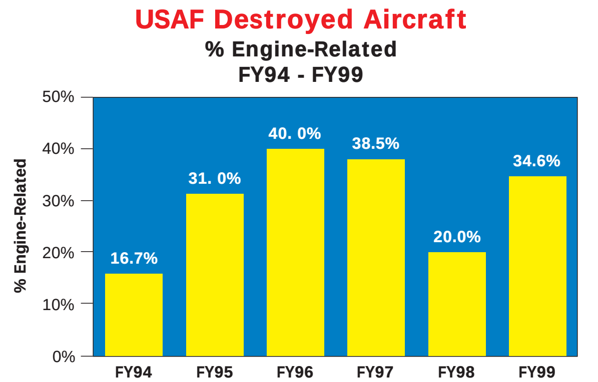


Figure 1

dures and message formats, although MAJCOMs or the HQ AFSC may require additional reporting if it is deemed necessary due to the seriousness or possible consequences of the mishap. Also, by the time you read this, all FOD incidents will be reported as Class J FOD mishaps, so long as they meet the minimum reporting criteria and if damage external to the engine is less than $10,000.

FY99 Overview—A Look at the Numbers

Last year we reported FY98 was the Air Force's safest year ever. Wondering how well the engine community fared in FY99? Well then, let's take a look. Figure 1 shows the percentage of all destroyed aircraft mishaps that were engine-related for the last six years. In FY98, engine-related failures accounted for 20% (four of 20) of all destroyed aircraft. For FY99, such failures represented 35% (nine of 26) of all destroyed aircraft. So doing the math, one sees that while the number of destroyed aircraft increased 30%, the engine-related losses increased 125%. Not a healthy trend at all! As shown in Figure 2, there are other categories besides the engine-related slice that make up the FY99 "Destroyed Aircraft" pie. For

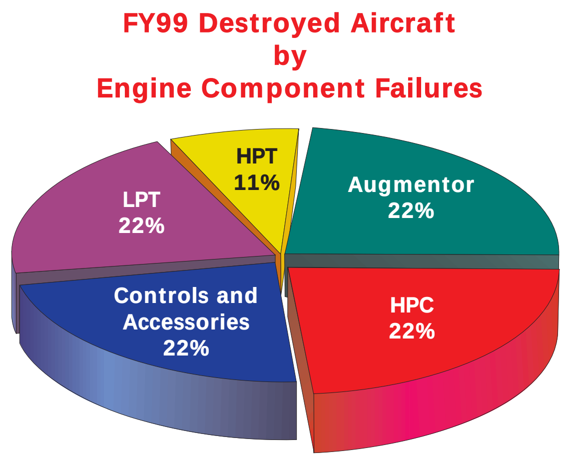
Note: Some mishaps have more than one category

Figure 2

example, in first place and accounting for 52% are those aircraft losses deemed to be Ops-related.

Let's peel this onion back to get a better look into the factors contributing to this year's engine-related mishaps resulting in destroyed aircraft. Pulling back the skin and outer layers, we find the failures to be evenly distributed among five major sections of the engine (see Figure 3). It's interesting to note that neither of the remaining major engine sections (the fan and the combustor) accounted for any of these mishaps. That we didn't lose a single aircraft this past year due to fan or combustor section failure is a major accomplishment. This achievement can only be due to our maintainers' increased awareness and their attention to detail, especially during those ever-important inlet inspections.

Continuing to peel back layers, we are able to get down to the core and expose the contributing factors.



9 Total Engine-Related Destroyed Aircraft

Figure 3

Doing so, we find that "Logistics" played a factor in almost every destroyed aircraft mishap involving engine failures in FY99. As shown in Figure 4, the Logistics category can be sliced and diced until we get down to the reasons why each component failed in-flight. Keep in mind that usually it takes the interaction of several factors, each representing a single link, that act together to form the chain of events necessary to sustain a mishap. For example, while waiting to incorporate a hardware modification to address a known design deficiency, additional mishaps may occur if the interim inspections or other control measures used to reduce our risk exposure are flawed, ineffective or otherwise inadequate.

So what distinguishes one factor from another? For this article, a deficiency in "Design" occurs when the engineers get it wrong. For example, poor modeling of the stresses and thermal environment the component must operate within, or errors with the mission usage and associated life calculations applicable during the time or development, may result in a deficient design. A

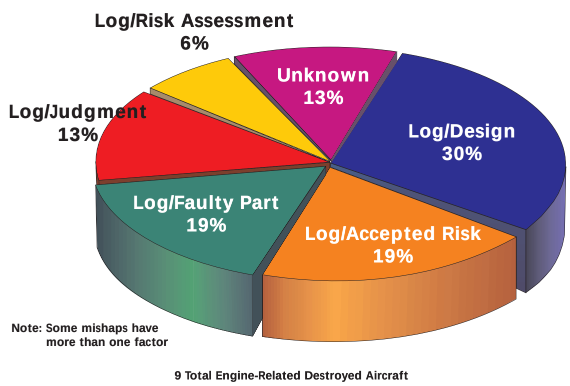


Figure 4

"Faulty Part" is one which doesn't conform to drawing specifications due to manufacturing or other processes going awry. An "Inadequate Risk Assessment" occurs when those performing them fail to fully consider potentially serious failure modes and their effects. "Accepted Risk" is a factor when, for example, retrofit schedules and interim risk control measures fail to prevent additional mishaps. "Publications" can play a factor if the guidance contained within them proves inadequate. "Judgment" errors involve inappropriate decisions or poor information assessment vital to the decision-making process. Naturally, when these factors are allowed to link up, our mishap rates go up.

Fighter Mishap Rates: F-15 and F-16

Before we delve into the particular problems each engine model is having, let's look at the recent engine-related mishap rates for our fighters. Table 1 shows how we did this year compared to last year. The good news here is that we didn't lose a single F-15 due to an engine malfunction this year. Way to go, folks!

Now let's see how the F-16 fared. Unfortunately, in FY99 our F-16 engine-related mishaps rate went the wrong way on us. As Table 2 shows, we lost three times as many F-16s for engine failures this year as we did in FY98. When you factor in flight hours, the underlying rate more than doubled. Obviously, single-engine aircraft are much more vulnerable to engine failures, but nevertheless, this rate increase is disturbing.

Table 1

F-15 Engine-Related Destroyed Aircraft Statistics

	FY98		FY99	
Engine	Aircraft Losses	FY98 Rate	Aircraft Losses	FY99 Rate
F100-PW-100	1	0.47	0	0.00
F100-PW-220	0	0.00	0	0.00
F100-PW-229	0	**	0	**
All Engines	1	0.26	0	0

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

Table 2

F-16 Engine-Related Destroyed Aircraft Statistics

	FY98		FY99	
Engine	Aircraft Losses	FY98 Rate	Aircraft Losses	FY99 Rate
F100-PW-200	0	0.00	0	0.00
F100-PW-220	0	0.00	5	3.98
F100-PW-229	0	**	0	**
F110-GE-100	2	1.34	3	2.04
F110-GE-129	1	1.60	1	1.55
All Engines	3	0.79	9	1.64

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

Mishaps By Engine Model

Now that we're finished with all the statistics, it's time to look at the problems afflicting some of our engine models. We'll discuss those problems that led to destroyed aircraft and also touch on some others that are potentially hazardous. While reading the following, you'll undoubtedly recognize some of these mishaps and problems.

F100-PW-220

There were five engine-related aircraft losses in the F-16 F100-PW-220-powered fleet in FY99. The following is a brief synopsis of the events.

• DEEC Anomaly

On return to base from a local training sortie, an F100-PW-220-powered F-16C suffered an engine control system problem. Due to an internal converter board malfunction, the Digital Electronic Engine Control (DEEC) auto-transferred from primary (PRI) to secondary (SEC) operation mode. Eight seconds later there was an uncommanded transfer back to PRI followed by an engine die-out. The pilot successfully ejected and the aircraft crashed and was destroyed. The exact cause of the transfer back to PRI is still under review. A recommendation has been made to change the aircrew manual. If approved, it would direct the pilot to manually select SEC via the cockpit switch following all SEC auto-transfers to ensure the DEEC and main fuel control stay in the same mode.

• Augmentor Nozzle Liberation

Even though augmentor nozzle liberation was previously identified as an area of concern, an unanticipated series of events resulted in two F-16 Class A mishaps in FY99.

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USAF Photo by SSgt Steve Thurow

When an engine loses the augmentor nozzle, it no longer has the back-pressure required for normal operation, and several things happen. First, the pilot notices a reduction of thrust as the exhaust gas, no longer controlled by the nozzle, dumps out the back of the engine. Normally, this lack of back-pressure would result in an overspeed of the Low Pressure Turbine (LPT) assembly. However the DEEC senses the impending overspeed and reduces fuel flow to compensate. This results in a further reduction in thrust, and the aircraft can no longer maintain level flight. In an F-16, the pilot action for this low-thrust condition includes a manual transfer to SEC. While the aircraft will now have enough thrust to maintain level flight below 5000 ft MSL in most configurations, the lack of back-pressure and resultant high airflow drive the 4th stage turbine blades to a flutter condition. Also, the loss of overspeed protection usually afforded by the DEEC in PRI results in an overspeed of the LPT. If allowed to continue, the flutter and overspeed result in a fatigue fracture at the root of 4th stage turbine blades.

Many variables determine whether the engine will have enough thrust to sustain flight and how long the engine will operate before 4th stage turbine blades fracture. Thrust available depends primarily on altitude and what parts of the augmentor were lost. At lower altitudes, more thrust is available. If just the augmentor nozzle is lost and the augmentor liner remains, more thrust is available and rotor speeds are lower because the liner throat acts as a nozzle. If the augmentor nozzle and liner are lost, there is less thrust and higher rotor speeds can occur. Weight, configuration, and airspeed determine thrust required. Obviously, the more stores that can be jettisoned, the better.

To summarize, when faced with a nozzle liberation, the best course of action usually includes transferring to SEC, jettisoning all stores, getting as low as practicable (but not lower than 1000 ft above minimum ejection altitude), using the minimum throttle necessary to maintain 250 knots, and heading for the closest divert field.

Both the Air Force and Pratt & Whitney are aggressively working corrective actions for this problem. They include:

- Changing the flight manual to reflect the above procedures.
- Revising augmentor duct inspection procedures and reducing their intervals, to better detect cracks before they link up.
- A DEEC logic change to allow more thrust in PRI than in SEC, but without causing damage to the LPT blades.
- Ground and flight testing to identify conditions that initiate augmentor duct cracking.
- Procuring a new, robust, chem-milled augmentor duct with installations having started in September 1999.

• 3rd Stage Turbine Blade Tip Shroud Curl

Two F-16 Class A mishaps this FY were attributed to 3rd stage turbine blade tip shroud liberations, another previously identified issue. A redesigned blade with improved stress margin has been available for installation since late 1997 as part of the Reliability Enhancement Program (REP) turbine upgrade. Incorporation of the REP turbine into our F-16s is being accelerated.

Early versions of the 3rd stage turbine blades in the F100-PW-220 fleet (and to a lesser degree the -100 and -200 engines) are subject to creep-induced stress rupture at the tip from excessive time at high temperature. Since the current mission mix of the F-15 and F-16 fleets calls for more hot-time than initially planned for, the blade tips are subjected to creep stress for time periods greatly exceeding the original design specification. High Pressure Turbine (HPT) wear can also increase the outer diameter temperature profile to the 3rd stage blades, thus increasing their curl rate. Blade times are tracked by a parameter called HS3 time, which is time spent above 915°C. The Engine Diagnostic Unit (EDU) tracks HS3 time. The amount of HS3 time per engine flight-hour varies from mission to mission. To compensate for variations in HS3 time per engine flight-hour, a borescope inspection of the 3rd stage turbine blade tips was required each 10 HS3 hours for the F-16 and each 15 HS3 hours for the F-15. The inspection's purpose is to measure the amount of "curl," or mismatch, between adjacent blade tips.

In these two FY99 Class A mishaps, the 3rd stage turbine blades had been inspected, but still fractured within the 10 HS3 hour window. Also, several F-15 Class J tip shroud fractures have recently occurred within their 15 HS3 hour inspection window. In order to further mitigate the risk of 3rd stage turbine blade fractures, we've done the following:

- Reduced the inspection interval and curl limits.
- Directed inspection of HPT blades for wear whenever access permits.
- Increased emphasis on borescope inspection techniques.
- Prioritized installation of redesigned blades to higher-risk engines and aircraft.

Hard work pays off! Reliability Enhancement Program hardware changes to the F100-PW-220, coupled with intensely focused inspections by maintainers, has been very successful in reducing mishaps associated with 3rd stage turbine disk lug fractures, 4th stage turbine disk fractures, and 3rd stage turbine blade tip fractures. Obviously, the long-term fix is to accelerate the fleet-wide incorporation of the REP hardware.

F100-PW-229

The F100-PW-229 continues its reputation as one of the safest fighter engines in the fleet. We haven't lost a single USAF aircraft because of an F100-PW-229 engine failure. There are however, some issues that still require vigilance to maintain this record.

• PTO Duplex Bearings

A batch of 10 gearbox Power Take-Off (PTO) shaft duplex bearings was identified as being susceptible to premature spalling, most likely due to manufacturing anomalies. The suspect bearings have been identified and removed from service. Assembly and installation procedures have also been modified to eliminate any possible contributing factors. A more robust redesign of the PTO shaft bearing is under way which will also increase chip mobility and provide for early detection of any future, premature bearing distress. As with all bearing and oil system issues, proper chip detector inspections and JOAP analysis are the field's best defense against bearing failures.

JT8D

A JT8D-powered C-9 Nightingale was on a local training sortie in the radar pattern. After a touch-and-go, with the engines stabilized at takeoff thrust, the No. 2 engine suffered a 1st stage fan blade failure. The resulting vibration caused the engine oil cooler fuel inlet connector to crack, releasing fuel into the engine compartment. This fuel then ignited and resulted in an engine compartment fire. The crew shut down the engine, flew a single-engine approach, landed, and egressed the aircraft. The fracture origin on the fan blade was traced to a FOD nick on the leading edge of the blade. There is evidence the crack existed for a significant length of time before the mishap sortie. It's unclear if a more rigorous inlet inspection would have prevented this mishap.

TF33 Engine

There were no Class A mishaps in the B-52, C-135, E-3 or C-141 fleets in FY99 that were attributed to the TF33 engine. However, in the last three quarters there have been nine reports (three confirmed) of external fuel check valve tube fatigue cracks that led to fuel leaks, thrust loss, and in-flight shutdowns in the TF33-P-103 (B-52H) fleet. The current bill-of-material tube is chafing between the tube connector and valve housing. The tube then cracks and begins to leak fuel. These fuel leaks have the potential to cause engine flameouts and fires. A redesigned tube is currently available and efforts are being made to accelerate its incorporation into the fleet.

F117 Engine

A C-17 aircraft lost power on the No. 4 engine during climbout from a touch-and-go landing. Subsequent investigation found that a 1st stage turbine blade had fractured due to thermal mechanical fatigue—a known problem with this particular blade. A new Advanced Technology Blade (ATB) has been developed as a replacement and has been installed in all but three of the fleet's 266 engines.

F110-GE-100

There were three engine-related Class A mishaps in F110-GE-100-powered F-16 aircraft this year.

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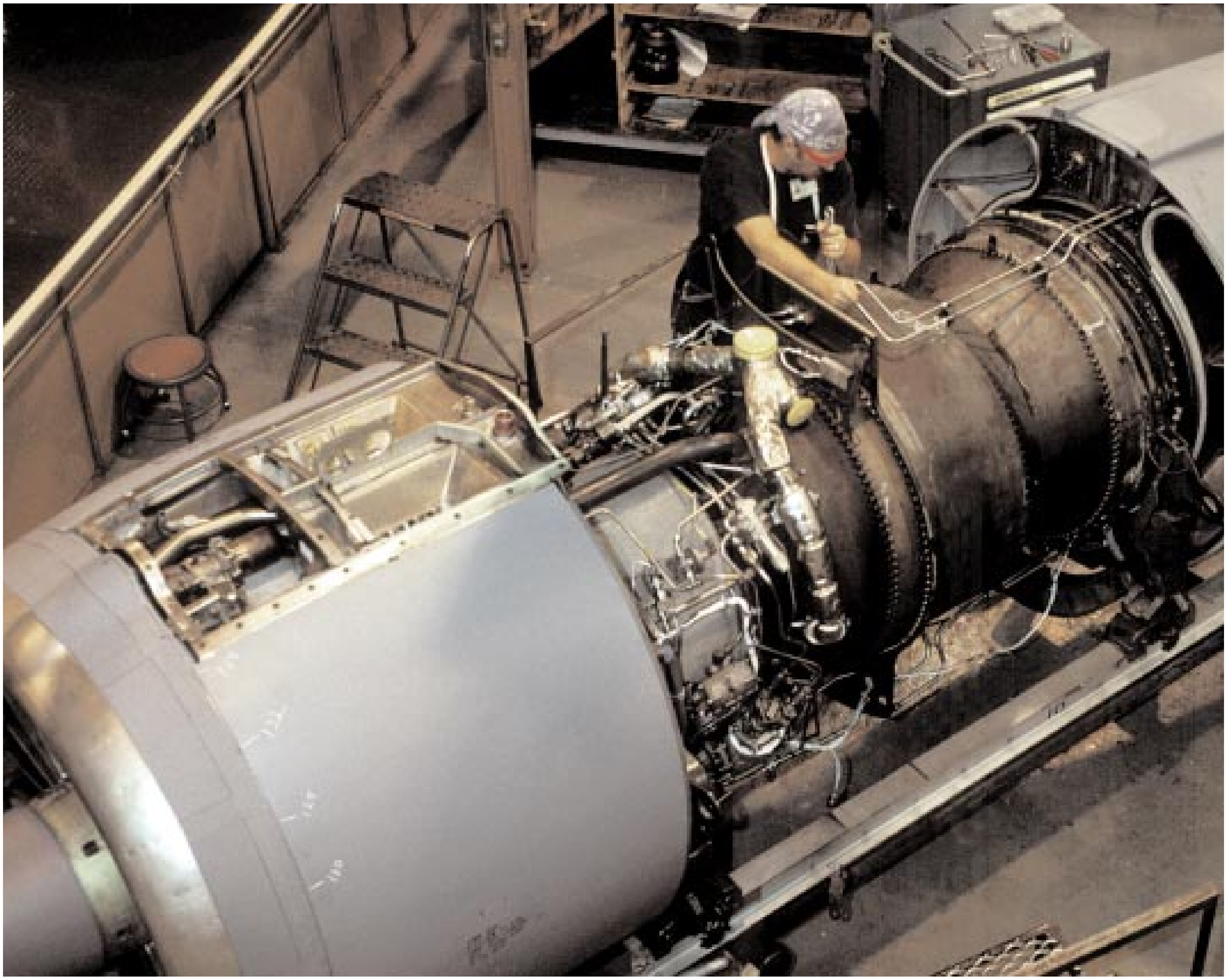

USAF Photo by MSgt Perry J. Heimer

• CDP Seal

An aircraft experienced a catastrophic engine failure while performing a low-altitude weapons delivery. The mishap pilot was unable to restart the engine and ejected safely from the aircraft. The cause of this accident was an incorrectly refurbished Compressor Discharge Pressure (CDP) air seal. The CDP seal is a required change item during the 6000 TAC inspection. During the refurbishment process, a tech order-required metal bond coating wasn't applied to the teeth of the CDP seal. This metal bond coating allows the abrasive top coating to adhere to the CDP seal. Because the bond coating wasn't applied, the top coating came off during sustained engine operation. A TCTO was issued to verify bond coating application and successfully prevented another engine having approximately the same time on its defective CDP seal from causing a mishap.

• HPC

In the second mishap, the crew felt a severe "thump" and an immediate deceleration. The engine experienced a compressor stall, and the pilot initiated emergency procedures. After three unsuccessful attempts to restart the engine, the pilot commanded a dual sequenced ejection. The primary cause of this mishap was High Cycle Fatigue (HCF) failure and subsequent liberation of a 1st stage High Pressure Compressor (HPC) blade, resulting in a non-recoverable in-flight shutdown. Substantial evidence shows the root cause of the blade liberation was a failure to detect the HCF crack before it progressed to failure. The ultrasonic inspection designed to detect and prevent this failure mode was unsuccessful because the crack originated outside the current inspection region. Several possibilities for improved detection are being investigated.

• HPT

The third mishap occurred when the pilot felt an explosion from the tail of the aircraft and experienced a loss of thrust. His wingman simultaneously witnessed a large fireball from the mishap aircraft's engine. The pilot turned toward the nearest emergency field and attempted two airstarts without success. Realizing that he wouldn't be able to reach the airfield, the pilot steered the aircraft away from populated areas and ejected. The F-16 crashed in a pasture, skidded approximately 120 yards, and came to rest at the edge of a county road. A majority of the aircraft remained intact and the engine was found to be in relatively good condition. Preliminary engine analysis revealed two HPT blades had liberated and damaged the remaining blades as well as the HPT nozzle trailing edges. The lower tang of a third HPT blade was visibly cracked and the upper tangs on three adjacent disk posts were liberated. The fracture surfaces displayed characteristics of fatigue. Applicable parts of the engine have been sent to General Electric's Evendale facility for metallurgical analysis. The exact cause of this mishap is still under investigation.

There are other areas of concern that are being worked, but fortunately, they didn't cause any Class A mishaps this past year. For Example, GE Aircraft Engines and OC-ALC are working to find solutions to the following problems:

• T4B Pyrometer

T4B pyrometer reliability continues to be a concern. Field service evaluation of an "I-level" tester used to detect pyrometer cold shifts is currently under way. A cold-shifted pyrometer can allow an engine to run hotter than the fuel schedule normally permits. Meanwhile, efforts to redesign the pyrometer are also under way.

• No. 4 Bearing

The resolution of No. 4 bearing failures is probably the highest current priority. A test aircraft was flown with a "flawed" No. 4 bearing installed, with the engine instrumented in an attempt to detect an impending failure. The bearing was subjected to abnormal conditions to induce failure, and it eventually developed an outer race spall that was detected. Several modifications are being considered to improve failure detection. While these improvements are being studied, increased attention to the following maintenance practices will go a long way in reducing the likelihood of a No. 4 bearing failure:

- Strict adherence to time limits and published procedures during LPT removal and installation to prevent bearing damage.
- Using a dynamometer during removal of the LPT package, and setting the proper pre-load to prevent bearing damage.
- Adherence to proper handling and storage procedures after the bearing has been removed.

• MCD

A spin-off of the No. 4 bearing problem is a study of the Master Chip Detector (MCD). A field service evaluation of Scanning Electron Microscope/Electron Dispersion X-Ray (SEM/EDX) equipment has been ongoing for some time, and a second location will soon begin using this technology. The SEM/EDX allows the local unit to measure and identify composition of any material found on the MCD. This includes particles not readily visible to the naked eye. If this field evaluation goes well, expect a push to get this equipment for remaining units. Hopefully, early detection of impending bearing failures will be greatly improved.

F110-GE-129

There was one engine-related Class A mishap involving an F110-GE-129 engine. The mishap aircraft took off and experienced a rapid and significant loss of thrust within four seconds after takeoff. The pilot selected afterburner but the engine didn't respond, so he ejected approximately 15 seconds after takeoff at 160 feet AGL. Immediately following ejection, the engine regained full power and the unpiloted aircraft flew for another thirty seconds before impacting the ground at military power. The loss of thrust was caused by a sequence of events starting with the AC generator assembly. At some time, the clamp load holding the generator rotor against the gear shaft backed off. This reduction in clamping pressure enabled the rotor to wear the tri-lobe on the gear shaft. Over time, the tri-lobe became so worn from the rotor rubbing it that the rotor moved freely on the gear shaft. The Digital Engine Control (DEC), which monitors the electrical output from the generator, sensed that the engine was slowing down when in fact it was running at 100%. The DEC logic requested an increase in fuel to increase engine speed. The engine began to overspeed due to the extra fuel being supplied. The Main Engine Control (MEC) sensed an overspeed and momentarily shut off fuel to the engine. RPM and thrust immediately decreased due to fuel starvation. When fuel pressure on the fuel shut-off valve decreased, a mechanical spring reopened the valve, allowing fuel flow to resume and the engine to recover to military power. TCTOs 2J-F110-741 and 2J-F110129-608 have been issued to inspect the AC generator for excessive wear. Be aware that erratic behavior involving sudden jumps of the RPM indicator needle may in fact be a sign that the generator rotor is slipping and catching on its shaft. If you observe such a condition, be sure to report it and troubleshoot it accordingly, before writing off the problem as a loose or sticky RPM indicator needle.

F404-GE-F1D2

An F-117 aircraft experienced a fire on takeoff roll shortly after brake release. The pilot heard a loud bang followed by radio calls from the tower confirming a fire. The pilot aborted the takeoff, successfully egressed the

continued on next page

aircraft, and the fire department extinguished the fire. Upon further investigation, it was determined that the Forward Cooling Plate (FCP) had suffered an uncontained failure. A redesigned FCP has already been introduced and is being installed on an attrition basis. Service life of the older FCPs has been shortened to reduce the risk of another failure.

F101-GE-102

There were no Class A mishaps attributed to the B-1 engine this year. Fan blade durability has been significantly improved, but one area needs a lot of work. You guessed it—FOD! Of the eleven engine-related mishaps reported this fiscal year, ten were FOD-related. Items ingested included fasteners, screws, flashlights, mirrors, ice, and other metallic and non-metallic objects. We could have reduced this engine's mishap rate by more than 80% simply by eliminating the man-made FOD.

TF34-GE-100A

There were no Class A engine-related mishaps in the A-10 community this year. The single largest failure-item (four occurrences) seen in mishap reports was the oil pump driveshaft.

F118-GE-100

Only two engine-related Class C mishaps were reported in the B-2 fleet, and they were both due to ice ingestion. Incorporation of long-dovetail stage one compressor blades at the 2500 flight hour interval will further improve this engine's reliability.

F118-GE-101

There were no engine-related mishaps reported by the U-2 community this year. A TCTO to introduce a new-design main scavenge oil tube and bracket was issued, and incorporation is nearing completion.

J85-GE-5

There were no engine-related Class A mishaps reported in the T-38 fleet this year. The number one safety improvement in work for this engine is a new-design compressor rotor which is slated for introduction in the fourth quarter of 2000. The two big drivers of our less severe mishaps are flameouts for various reasons, and birdstrikes. You "aviators" have got to watch out for each other up there.

T64/T700

There were no engine-related Class A mishaps reported in the helicopter community this year. However, we do need to work harder to reduce FOD events. Of the five reported T64 mishaps, four were FODs. The engines were reported to have ingested one red rag, one nose gearbox cowling rod, and two unidentified metal objects.

TF39/F103/F108

The GE-powered tanker and cargo fleet had a good year, with no engine-related Class A mishaps. There were only five events reported all year, and they included one compressor stall, two bleed manifold ruptures, and two birdstrikes.

Mishap Reporting, Deficiency Reporting, and Crosstell Discipline

Proper mishap reporting and the communication of potential hazards are essential elements of the mishap prevention process. The Air Force relies on each of us to faithfully follow the formal guidance and procedures outlined in AFI 91-204 and T.O. 00-35D-54, *USAF Deficiency Reporting and Investigating System*, to make this happen. Failing to do so only hampers the processes used to initiate and track the status of investigations, to develop corrective actions, and to communicate this information to those who need it most.

There are far too many examples where mishaps were mis-classified, reflected damage costs much lower than actually incurred by the USAF, or worse yet, weren't investigated with the urgency and diligence they actually deserved. Worst of all, some weren't even reported. This lapse doesn't just apply to actual mishaps. It also applies to High Accident Potential (HAP) incidents discovered by one organization but never passed on to the rest of us via crosstell. Eventually, such activity becomes a point of embarrassment when it comes out during the investigation and briefing of a more serious mishap involving the same factors. Additionally, the quality of the report, i.e., the investigation, findings, and recommendations, for many of our Class B (and lower) mishaps aren't up to Air Force standards. Poor quality reports benefit no one and may even prevent the proper corrective actions from being taken, enabling future mishaps of the same type to occur. The same can be said when investigations fail to produce worthwhile recommendations. This happens more often than you might think. In one case, despite the investigator including a rather pointed finding that a particular practice was inexcusable, no corrective action was recommended. Okay, enough "ivory tower" lecture on reporting discipline. Just remember: Unless a problem is reported, tracked, and investigated, there's little reason to hope it will go away.

What You Can Do

Let's take the opportunity to reflect back on recent mishaps and identify specific actions YOU can take to reduce our engine-related mishaps and make the Air Force safer as we close out the millennium. Remember that it's not just the limited assets you may save—it's also the safety of our people we're talking about here! Besides building on those lessons learned and safe practices that continue to prove themselves, here are some other points to consider.

Continue to use tech data (paper or electronic) even if you think you already know the procedures. Information in these books changes frequently, and the speed with which these changes appear will most likely accelerate as the current backlog of tech order changes is cleared.

While we're on this subject, let's all do a better job of

USAF Photo by SrA Jeff Allen

documenting the teardown, buildup, and other maintenance status of our engines. We've lost too many aircraft in the past because of parts that weren't installed or a procedure that wasn't completed simply because folks lost track of where they were in the process. Ask yourself: "Do we use bookmarks or a checklist method to document status, or are we getting by on memory and verbal communication?"

Use the formal mishap and deficiency reporting procedures to ensure the root causes of potentially hazardous problems are quickly identified, and to speed the corrective action process. This is extremely important for our single-engine aircraft because today's flameout or successful dead-stick landing can easily turn into tomorrow's destroyed aircraft (or worse) mishap.

As always, we want to stress the importance of performing thorough inlet and fan blade inspections. Although we didn't lose any aircraft due to FOD-induced fan blade failures this past year, we still tore up some pretty expensive engines in the air and on the ground. We won't go into the lengthy list of mishaps involving FOD—there are far too many to mention here. Let it suffice to say that most of them didn't involve rocks or pebbles being sucked off the tarmac and down an inlet. *Hint: We're spending too much money replacing mangled flashlights, mirrors, tools, and other hardware.* FOD walks and good shop practices, like inventory control of parts and tools, offer the biggest bang for the buck when it comes to reducing our engine maintenance costs and improving safety.

Continue to be vigilant in your inspections and day-to-day activities while awaiting replacement or modified hardware to make it into the jet. Last year we mentioned help was on its way. This year we can report that it looks like an extra $100 million is going to be spent on accelerating installation of retrofit parts and taking other corrective actions in response to problems currently plaguing the fighter engine world.

For all you Loggies out there, Figure 4 categorizes this year's mishaps and points to areas needing more attention. With increased awareness and emphasis focused on correcting our known weaknesses, we can make FY00 a safer flying year.

Finally, we would be remiss if we neglected to point out that *field-level engine maintenance was not causal in any of our FY99 aircraft losses!* Way to go, troops! This is a substantial reduction compared to historical field-level maintenance-induced aircraft losses. Keep up the great work! ✈

MIDAIR COLLISIONS

FY99 MIDAIR-RELATED MISHAPS

MAJ DAVE BURRIS
HQ AFSC/SEFF

Seven midairs, seven aircraft, $204.1 million in FY99. At first glance, one might assume that some losses were attributable to the Kosovo operation since we crammed so many aircraft daily in so small an airspace. One might also wish to blame ATC or uncontrolled VFR aircraft. It is true that there were 64 reported near midair collisions, mostly as a result of uncontrolled VFR aircraft and ATC mistakes. But the fact is none of the reported mishaps occurred in the Kosovo theater or as a result of VFR aircraft or ATC errors. All occurred on fighter training or demonstration sorties. A brief description of each follows:

10 Oct 98 A flight of four F-16s departed Luke AFB on 10-second, single-ship takeoffs. During the early afternoon departure, number three and number four collided. The pilot of number four ejected successfully and received only minor injuries. Number three sustained damage to the horizontal stabilizer, but was able to recover.

21 Nov 98 The Thunderbirds were conducting an airshow and the slot aircraft in the diamond formation collided with the right wing aircraft. The collision went undetected and the airshow was completed. Only minor damage to the wingtips was sustained.

28 Jan 99 A dissimilar tactical intercept training sortie of two F-15Cs against three F-16Cs was in progress. During the first intercept in the early afternoon, the two F-15Cs collided and both pilots ejected successfully (easy kills for the Vipers).

15 Jun 99 A flight of five F-15s acting as Blue OCA for a planned strike package consisting of two F-15Es, one B-1 and a B-52. Five F-16s were Red DCA. Following several air-to-air engagements, the strike package approached the target area. Two of the F-15 pilots (MP1 and MP2) set up a reset CAP in the North, approximately 10 NM SE of the Red Air regeneration point. MP1 and MP2 committed in a two-ship line abreast tactical formation against two regenerating F-16s. MP2 engaged one F-16 beyond visual range and called a kill. The other F-16 performed a drag maneuver as MP1 followed in trail. MP2 maintained a line abreast position on the right side of MP1 and visually acquired a third adversary in formation with the dead F-16. Both F-16s passed between MP1 and MP2. MP2 began an aggressive left-hand conversion. MP1 obtained a tally on an F-16, dropped the dragging F-16, and began an aggressive right-hand conversion. After approximately 120 degrees of turn, the radome section of MP2's aircraft impacted the nozzle area of MP1's aircraft. Both pilots ejected successfully (those sneaky Vipers did it again).

11 Aug 99 A flight of four F-16s completed a surface

USAF Photo by Sgt Mike Reinhardt

attack training sortie and initiated recovery via straight-in approaches as separate elements. Recovery order was one, two, four and three. Numbers two and four collided one-and-a-half nautical miles short of the approach end of the runway. The pilot of number two ejected successfully, and number four was able to maintain aircraft control, took a trip around the pattern, and landed.

19 Aug 99 A flight of two F-15As were on a Continuation Basic Fighter Maneuvers (BFM) mission as a pre-Weapons Instructor Course spin-up sortie for number two. Mission plan included multiple BFM engagements and in-flight refueling, followed by more BFM. On the first BFM set-up after refueling, the two aircraft collided approximately one minute after the "fight's on" call. Number two ejected successfully, and number one was able to recover safely.

27 Aug 99 Two flights totaling ten F-15Cs were on an en-route formation sortie, and during weather and communications difficulties number three and number four of a six-ship collided. The collision, originally thought to be a "close call," went undetected until one pilot scanned his aircraft prior to landing and discovered damage to one of his wings. Further inspection revealed damage to the horizontal stabilizer of the other aircraft. Both pilots recovered successfully.

If you're thinking the pilots involved in these mishaps must have been inexperienced, you're wrong! The average flying time of the 17 pilots involved in the seven midair collisions is over 2100 hours, and only three had less than 1600 hours. If it was the new guys, we might easily find blame in inadequate training or guidance, but this is not the case.

So, if it's not the new guys or system malfunctions, what seems to be the problem? Are training rules inadequate? Training rules are there to help deconflict, but not to hinder training, and therefore do not protect aviators from midair collisions. The fighter's mission routinely provides opportunity for two or more jets to run into each other, and it's solely the flyer's responsibility to clear his / her flight path.

Essentially, we have adequate guidance, Code 1 aircraft, and highly experienced pilots running into each other. This leads to discussions of Human Factors. Many of the problems noted are a result of complacency or discipline. Flyers are not maintaining visual contact while in formation and are not following established procedures when visual contact is lost. There are many recent cases of delayed "blind" calls or inappropriate blind procedures, and this should be an area of emphasis for training missions.

This trend is absolutely unacceptable. Yes, war-fighters routinely accept greater risks to maintain a combat edge, but both complacency and lack of discipline are not acceptable risks. ✈

WHAT'S WRONG WITH JANUARY? REVISITED

MAJ PAT KOSTRZEWA
HQ AFSC/SEFF

Let's review the numbers. One January Challenge, five Class A mishaps, four fatalities, four different weapon systems, four different MAJCOMs, six destroyed aircraft, over $150 million worth of combat capability gone...one terrible month.

Despite the high ops tempo and manning issues, none of the mishap investigations identified these as factors. The 30/60/90 day lookbacks were all average to above-average.

So what's the common denominator? Well, two of the mishaps were clearly Human Factors mishaps and two of the remaining three had Human Factors influences. Let me review some of the points from my December 1998 "What's Wrong With January?" article and comment on January 1999's results.

"January is the highest mishap rate month and the beginning of a string of high mishap rate months..."

• January has indeed been the worst month of 1999. In fact, there have only been three months in the entire decade—Jan 92, Feb 94, May 95—that were worse.

"We have more mishaps attributed to Operations in January..."

• In January 1999, causal categories for mishaps were overwhelmingly attributed to "Operations." The leading sub-categories of Operations were "Judgment" and "Accepted Risk."

"The problem is not just the first sortie back. The mishaps are spread evenly throughout the month."

• January 1999 Class A mishaps occurred on the 7th, 13th, 20th, 21st and 28th.

"Weather plays a minimal role in January mishaps."

• Only one finding was attributed to weather in January 1999.

Last year's article outlined the problem, so this year I'm going to share my thoughts, or "rules," for avoiding Human Factors mishaps. These thoughts are based on my experience working on Class A mishap Safety Investigation Boards, reading hundreds of safety messages and articles, talking to FSOs, and the mishap briefings I've attended. I don't claim any of these as my original thoughts; I freely admit to not always following them; I don't plan on putting them on a laminated card for you to carry around; and I don't mean for them to sound condescending. If one of the quotes below sounds like you, don't take offense. The quotes are the same things we read again and again in mishap reports and are not taken from any specific mishap.

As we look for ways to address Human Factors mishaps, maybe a look at the low-hanging fruit is a good place to start. I can honestly say that if these rules were applied to every sortie, then many of the Human Factors mishaps I've read about would never have occurred. These rules apply to Ops and Maintenance, individuals and supervisors alike. The beauty of them is their simplicity.

The Rules

Practice The Basics

• BOLDFACE, BOLDFACE, BOLDFACE. Don't just write it, practice it. The Dash-1...know it.

• Basic pilot responsibilities like clearing, deconflicting, configuration checks, communicating...do them. If you don't practice them, pretty soon they won't be the basics to you. Some might think this doesn't apply to them because they're experienced. Recent mishaps show the experienced person has been just as likely to botch the basics.

Use Common Sense

• This is so basic, I really didn't want to write it. However, the sad fact is that too many times, mishaps occur because people ignore what their common sense is telling them.

Know Your Limitations

• Admit to yourself what events are your weakest. Evaluate your fellow crewmembers or flight mates. Set reasonable limits and don't exceed them.

Know When The Risks Are Too Great For The Rewards

• Don't say, "It can't happen to me," because it can and will if you give it enough chances. The cool points you may get by pressing too far to get that extra engagement or touch-and-go will surely be exceeded by the scorn you receive when the odds catch up to you.

Make The Tough Calls

• When placed in charge, be in charge. Things like "I told him to limit his Gs" or "I asked him how he felt" are weak excuses for not having the guts to terminate a mission.

Be A Professional Everyday, Every Mission

• I don't want to offend, but the truth is that we have some mishaps that are just plain silly and point to lack of professionalism. Excuses like "The book doesn't say I can't do it" may hold up in a strictly legal sense, but they are really just a poor excuse for someone who wasn't being a professional. Learn from professional briefs and debriefs. If you can't admit your mistakes and learn from them, you don't belong in the cockpit or on the team.

As you return to flying in January, you'll hear about "January Challenge 2000" from your Commanders and Safety Officers. It's not just about January. January Challenge 2000 is a reminder of what we've done in the past and the price we've paid for it. A reminder that we are human and that as humans, we make mistakes. The challenge is to play by the rules and fly safe. ✈

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And In Closing...

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1. Approaching January 1999, I issued the first ever “January Challenge” to combat our January flight mishap trend. As we completed that month, the results were disappointing. We experienced five Class A mishaps in January, making it our worst month since May 1995. The post-holiday period continues to be high-risk—Human Factors played a role in four of the five mishaps.

2. We must continue to work to eliminate the negative January trend and continue to reduce flight mishap rates and fatalities. Despite budgetary constraints, we are stressing the implementation of three technological initiatives: engine upgrades/reliability improvements; an automatic ground collision avoidance system (AGCAS) for the F-16; and navigation safety upgrades for passenger/airlift/tanker aircraft. Air Force leadership at all levels must aggressively address those mishaps attributed to human error (over 80 percent). We must rely on tested Operational Risk Management principles and empower commanders responsible for implementing them. And finally, as I have stated before, I will support your judgment in making the necessary “Knock It Off” call when you sense the risk involved exceeds the expected return. FLY SAFE!

3. General Ryan sends.

USAF Class A Mishaps

Final FY99 Flight Mishap Totals (Oct 98 - Sep 99)
30 Class A Mishaps
9 Fatalities
25 Aircraft Destroyed

FY00 Flight Mishaps (Oct 99 - Nov 99)	FY99 Flight Mishaps (Oct 98 - Nov 98)
3 Class A Mishaps	6 Class A Mishaps
0 Fatalities	3 Fatalities
2 Aircraft Destroyed	5 Aircraft Destroyed

03 Oct	♣	While conducting a SAR mission, a UH-1N went down.
17 Nov	♣	Two F-16Cs flying a night vision goggle upgrade sortie collided during a VID intercept. One pilot ejected and was recovered uninjured. The other pilot returned safely to base.
22 Nov		An OA-10A departed the departure end of the runway. The pilot ejected successfully.

- ***Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.***
- ***"♣" denotes a destroyed aircraft.***
- ***Current as of 1 Dec 99.***

WITH TECH DATA...

OR WITHOUT...

ANY QUESTIONS ?