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2008 Year In Review

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contents

U.S. AIR FORCE

Cover: U.S. Air Force photo by Senior Airman Donald Action
Rear Cover: U.S. Air Force photo by Capt. Jeremy Angel

Correction: In the December 2008 edition of ***Flying Safety Magazine***, we misspelled Maj. Todd "T-Bone" Tobergte's surname in the byline of his article, "Not Having Solid Fundamentals Can Kill You." We regret the error.

MESSAGE FROM THE CHIEF of SAFETY

I am excited to take this opportunity to launch this year's annual review issue. As your new Air Force Chief of Safety, I understand the opportunity we have to help all Airmen save lives and preserve priceless combat assets. This is important at all levels, from the Chief of Staff to our youngest Airmen.

How did we do as aviators in FY08? After going two full fiscal years with only three total aviation-related fatalities, in FY08 we lost 13 fellow Airmen. For the first time, we lost one of each of our heavy bombers … a B-1, a B-52, and a B-2 … making FY08 the most expensive mishap year in Air Force history. The Air Force experienced 27 Class A aviation flight mishaps in FY08, one fewer than in FY07. We also destroyed 15 manned aircraft, one more than in FY07. What happened?

For starters, the human element contributed to 80 percent of our 15 destroyed aircraft and all 13 aviation fatalities. Key things we saw in human factors include misperception of the environment, risk-assessment choices, channelized attention, and skill-based errors. Unmanned aircraft weren't immune: human factors contributed to more than three-quarters of our UAV mishaps.

The news wasn't all bad. The MAJCOM safety teams carried forward an aggressive campaign against bird/wildlife strike hazards, slashing BASH-related Class A mishaps from six in FY07 to zero this year. Maintenance-related mishap costs plummeted from $76 million in FY07 to just under $2 million in FY08. That's outstanding! Nonetheless, we still have work to do in aviation safety, and we at Air Force Safety are committed to supporting commanders and aviators in the field.

Safety is the commander's program. Commanders must lead a "back-to-basics" approach if we're going to make a difference in aviation safety. I mean "lead" by direct commander involvement in the day-to-day risk-management culture. Now is the time for commanders to take safety lessons from FY08's mishaps (published throughout this magazine), and set the conditions for safer aviation operations. At Air Force Safety, we believe Airmen must go "back to basics" on mission prep and systems knowledge. Stick to your guidance, procedures, training rules, and ROE discipline. Our ORM, CRM, MRM, and FOD-prevention programs will help provide bedrocks for success in 2009. Commanders and Airmen alike must challenge each other to know their equipment, personal, and operations limits, and chair-fly different methods of maintaining and improving SA and CRM.

We're in a position to beat our aviation safety record from FY06, our safest year ever, with only one fatality and eight destroyed aircraft. We can do it! I challenge each commander and every Airman to be the best wingmen they can be, in the air and on the ground. Stick to the basics. Recognize the risks and hazards; manage them smartly.

I pledge to do my part to arm commanders with the tools to break the aviation-mishap chain. Air Force Safety stands ready to support commanders' efforts with trends, lessons learned, SAVs, and anything else you need. Let's make 2009 the safest year ever in Air Force aviation! ★★

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BASH

U.S. Air Force photo by Master Sgt. Lance Cheung

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Everyone needs a good year every now and then, and 2008 was a very good year when viewed from the perspective of bird/wildlife aircraft strike statistics. Not since 1997 has U.S. Air Force experienced a year without any Class A mishaps resulting from strikes with birds or other wildlife. There were six in FY07. When flight hours are finally calculated for 2008, and the number of hours is no more than or slightly less than last year's total, as it now appears, some may conclude that's the reason behind low strike numbers. However, this one metric alone should not be used to draw correlations about strike rates, as it doesn't reflect the amount of time aircraft spend below 3,000 feet AGL, where birds are likely to be encountered. Another consideration might be that as this article goes to print, a number of AFSAS strike reports remain open, and when closed, will bring some strike categories up a bit. To shed more light on this year's good fortune, it's a safe bet that final strike numbers will remain less than or will not significantly exceed FY07's totals in any one area.

For more perspective of the magnitude of the difference in numbers, consider there was $25 million damage in FY07, as opposed to $9.7 million in FY08. Class B mishaps decreased from 16 in FY07 down to 12; Class C mishaps decreased from 97 to 87 during the same period. When all strikes are finally tallied, including Class E's, the overall number of bird strikes will not be significantly different from last year. However, we learned some great lessons during the FY08 campaign.

The BASH Campaign raised Air Force awareness and re-established the focus on BASH plan fundamentals during individual staff assistance visits at 20 bases. The Campaign also refocused attention on existing tools by making them more accessible to aircrews. Individual Avian Hazard Advisory System customized unit Web pages were increased from 30 to 61 — more than 100 percent! The Safety Center also exploited information dissemination by revising the portal and public BASH Web sites.

It's tough to single out any one reason for lower BASH rates, but we certainly hope the BASH Campaign helped. One need only look back through the last 24 years of strike data to learn that for some inexplicable reason, there has been a significant dip in strike statistics every six years. One or any combination of variables may cause these hiccups to occur, from mission profile, weather events, data-collection consistency, or just plain old statistical odds — what some would call "luck."

Variability should come as no surprise within the realm of aircraft wildlife hazards, as there is

one common thread running through this area of expertise: the word "wild." In the BASH context, one can assume "wild" and "unpredictable" are synonymous and will always play some part in fluctuating numbers. No matter how well we manage, at any given moment, a bird or deer can find itself in direct conflict with an aircraft, without tower confirmation. One such event and there go the statistics, so it's never wise to "count your chickens" too soon. This is precisely why dealing with wildlife hazards requires constant vigilance and not resting on one's laurels following a successful year.

With so much variability within BASH, are there any lessons learned that may be relied upon to keep damaging strikes moving in the right direction? Absolutely. It's no secret that a "back-to-basics" approach is always a good starting point.

Successful BASH programs rely on some basic tenets; the first is to employ an integrated approach. While this may seem like a vague concept, it's actually quite simple; just start at the beginning.

The first step is to look at your installation statistics and identify any clusters of data that may be apparent. Data groups where pertinent clusters could occur include: what is being struck (aircraft and birds), where strikes happen, what phase of flight is most involved in strikes, what time of day do strikes occur, and which months total the greatest numbers.

Armed with this information, the problem may be brought into focus, allowing for a directed response. For example, if strike numbers are greatest on takeoff, one can assume birds are either on or near the airport. If the birds are small, perching species, such as doves or blackbirds, an inspection of airfield turf conditions should be accomplished. If strikes occur in the climb phase of flight and the species being struck are large raptors, direct BASH staff to survey perimeter areas to ascertain bird conditions or identify any attractions that may cause soaring birds to linger in the area. If strikes occur in the morning or evening, adjusting flight times may be appropriate.

The second step is huge: take action! If the data points to any of the situations described above, take steps to break the chain of events causing strikes. This is where the integration aspect of pest management comes into play. Here, the person charged with implementation becomes the most important part of the program. Whether the installation contracts with a government agency, private contractor, or handles the problem "in house," a competent response is essential. If problem species have to deal with persistent adverse conditions that come from unfriendly habitat conditions, pyrotechnic harassment, border collies, falcons, or even depredation, they will eventually find another place to call home.

The third step involves taking accurate notes and documenting everything learned about the problem and any successes or failures in arriving at a solution. This is important because operations tempo means that rotations are inevitable. Good documentation ensures successes from one tour can live on to another and can be further enhanced for even better results. Reporting all strikes, submitting strike remains for identification, and maintaining in-depth continuity books are simple ways to accomplish this step.

Airfield bird and other wildlife control can be difficult and sometimes downright frustrating due to varying results, but continues to be a normal part of everyday airfield operations. Assuring success is rarely a guarantee, but failing to deal with these problems is not an option. With a little luck, persistent response, and implementation of an integrated program, long-term success can be accomplished.

U.S. Air Force photo by Master Sgt. John E. Lasky

Bombers

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Courtesy Photo

FY08 marked the most challenging year for bomber aviation safety in recent memory, including the first-ever loss of a B-2A. The USAF hadn't lost three heavy bombers to aviation mishaps in a single year since FY89. More importantly, the bomber community suffered six fatalities in FY08, the most since 1983, and it came perilously close to losing six more aircrew due to aviation mishaps. These mishaps and the loss of valuable aircrew and resources were preventable, and the continuing challenge lies in turning the lessons learned from these mishaps into timely and proactive risk mitigation and mishap prevention.

Class A and B Mishaps

The bomber community experienced six Class A mishaps in FY08: four B-1B Class A's, one B-2A Class A, and one B-52H Class A. In comparison, the bomber community experienced only one Class A mishap (B-1B) in FY07. One of each bomber weapons system was lost in FY08, with all six fatalities resulting from the loss of the B-52H. The previous 10-year average for bomber Class A's was 1.2, with no fatalities.

There were 11 FY08 Class B bomber mishaps, down from 18 in FY07. While the reduction of Class B mishaps is traditionally a good-news story in aviation safety, this year's reduction was tainted by the dramatic rise in Class A mishaps, the highest bomber Class A total since 1969 (nine B-52 Class A's).

As a whole, FY08 bomber aviation Class A and B mishaps had common themes. Propulsion-related causes accounted for one Class A and four Class B's; all B-1Bs. Technical order non-compliance, failure to adhere to ROE, and ineffective CRM were the root causes in the majority of the remaining Class A and B mishaps. Preventable human error was also a significant factor in almost all bomber Class A and B mishaps in FY08.

Class C Mishaps and Class E Events

The bomber community recorded 27 Class C mishaps in FY08, down one mishap from FY07. Twelve mishaps were propulsion-related, seven of which involved FOD. Damage due to bird strikes was down throughout the bomber community from FY07. With several material-failure issues mixed in, the cross-section of bomber Class C mishaps also included technical order compliance and human-error factors. Supervision and training were at the heart of most of these mishaps.

There were 231 BASH-related bomber Class E events out of 334 reported in the AFSAS database for FY08, a modest improvement over the 248 out of 359 total Class E events reported in FY07. The sheer number of reported events is both a testament to improved BASH reporting and an elevated caution on the hazard that birds represent to bomber operations. One bird strike on a critical control surface, cockpit

B-1

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	4	17.85	9	40.16	1	4.46	0	22,406.10
5-YR AVG.	2.4	10.69	11.6	49.86	0.2	0.89	0	23,161
10-YR AVG.	1.6	6.99	9	38.3	0.2	0.83	0	23,518.40
LIFETIME FY84-FY08	25	4.68	102	19.07	8	1.5	11	534,746

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

B-2

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	18.34	0	0	1	18.34	0	5,451
5-YR AVG.	0.2	3.67	0.8	12.46	0.2	3.67	0	6,512.80
10-YR AVG.	0.2	3.28	0.56	10.31	0.2	1.83	0	6,298.70
LIFETIME FY90-FY08	2	2.05	9	10.93	1	1.15	0	82,353.60

window, or engine can easily result in a Class E becoming an expensive Class B or Class A. Operating bombers in avian environments is a risk-management issue requiring the appropriate level of supervision and leadership involvement. Flexibility in mission planning and execution will continue to be a key factor in balancing the mission against the potential for loss of valuable resources and continued mission capability.

Good News in FY08

Despite the first-ever loss of an aircraft, the B-2A continues to have a remarkable safety record for such a complex weapons system. In 18 years, the B-2A has experienced only two Class A mishaps (one aviation and one ground/industrial) and seven Class B mishaps. That is the best overall safety record for the same period among all three bomber weapons systems and almost all other USAF aircraft. Strong, safety-focused leadership and a highly effective system safety organization have been keys to the B-2A's remarkable record.

Effectively mitigating a spoiler-hinge hazard and improving engine safety were highlights for the B-1B community in FY08. Strong partnerships in safety and leadership at all levels pulled together to advance the combat capability of the weapons system, while addressing known and emerging hazards.

The B-52 community continues to pursue a rigorous aircraft structural integrity program, and conducts frequent and effective product-improvement working groups. Despite the first loss of a B-52 in 14 years and the resultant fatalities, the B-52 continues to have a comparatively successful aviation safety record. Flexibility, adaptability, and strong leadership have been hallmarks of all B-52 programs and operations throughout its history, and these assets will be needed to address the safety challenges highlighted in FY08.

Bombers in FY09

The focus for the bomber community in FY09 mirrors the overall USAF aviation-safety strategy: a back-to-basics approach in training, systems knowledge, compliance with technical orders and ROE, and improved hazard identification and risk mitigation. All three bomber weapons systems will benefit by readdressing the known material and human-error hazards with sound mitigation strategies. Vigilant and involved leadership in safety will create the synergistic effect of safe operations and successful mission accomplishment. Bombers represent a precious, irreplaceable capability for the USAF and for the nation — making safe and effective stewardship a must.

B-52

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	5.34	2	10.13	1	5.34	5	18,739.40
5-YR AVG.	0.6	2.66	3.2	14.29	0.2	1.07	1	22,292
10-YR AVG.	0.4	1.7	3.7	16.73	0.1	0.53	0.5	23,777
LIFETIME FY55-FY08	99	1.28	189	2.45	77	1	104	7,708,672

U. S. Air Force photo by Senior Master Sgt. John Rohrer

U.S. Air Force photo by Senior Airman Larry E Reid Jr.

C-130

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Another year has come to an end, and the prevailing question in the Herc world is, "What happened in Baghdad?" Take a stroll down to your local safety office to have a look at AFSAS No. 561778, an interesting and informative read. I think most in the community will be surprised as to what really went down outside Baghdad, and all the rumors that have been flying around the squadrons will finally be put to rest. We can chew on this for many days, but no matter what the naysayers think, the bottom line is that 38 people are walking and talking today, and it's not due to dumb luck.

If you're still not a believer, we have confirmed three additional events since the Baghdad mishap. While the results were different, the flight deck indications that the crews saw were almost identical. The biggest difference between these situations was that the crew dogs were armed with new dash-1 procedures and the knowledge that things can quickly go from bad to worse. The more recent event crews all said that without this new information/knowledge, the outcome of their flight would have been significantly different. Their quick response and timely actions saved the day, so heed the dash-1, because we know it has saved three crews and three aircraft so far.

Let's take a look at the remainder of the mishaps and trends over the past year in the B through E mishap categories. We had 21 Class B mishaps in

C-130

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	0.39	21	8.18	0	0	1	256,519.40
5-YR AVG.	1	0.34	15.6	5.44	0.4	0.7	2	286,686
10-YR AVG.	1.1	3.84	13.9	4.78	0.5	0.17	1.7	290,951
LIFETIME FY55-FY08	152	0.86	242	1.37	88	0.5	639	17,603,414

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

FY08, with 83 percent attributed to motors and birds. While the overall total of C-130 mishaps has increased, the most frequent categories (powerplant and bird strikes) have not changed over the past three years, remaining steady at around 85-87 percent. If we reduce or remove the FOD incidents from the total this year, the total number of mishaps would be 10, which is below the five- and 10-year averages.

The Class C and E mishap summary could read almost the same as the Class B summary, with 74 percent and 85 percent, respectively, of incidents coming from the same two categories: Powerplant and Bird Strikes. The individual breakdown by class is as follows: Powerplant — Class B (35), Class E (673); Bird Strikes — Class B (26), Class E (1139). As noted, the biggest issues with the Herc are still engines and bird strikes, with about 75 percent of the total C-130 mishap cost directly tied to these areas, outside the cost of the one Class A mishap.

The one category with the highest dollar amount is birds. It has a total cost of more than $2.9 million, with not all of the costing dollars entered yet; it could go as high as $3.6 million. So, remember your migratory routes, the rules for sunrise/sunset operations, and also pay attention to your BASH briefings, as this is one area that could be significantly reduced by just being aware of your surroundings.

Although the motors are getting older and the frequency with which we have in-flight shutdowns is increasing, I see signs of the community getting complacent with minor mishap reporting and dash-1 emergency procedures. There have been numerous cases in which crews have had an IFS and have not declared an airborne emergency. It has also been discovered that crews are not reporting engine anomalies and are taking aircraft that otherwise would have been returned to maintenance when engine discrepancies were less commonplace. Give maintenance a chance. How can they fix it if we don't report it?

Of the 727 engine-related mishaps, 98 (about 14 percent) can be directly attributed to AC essential electrics, the TD system, corrosion in the relays, and brownout conditions. Is this a symptom of the age of the motors, or a factor of the quality of the maintenance reporting? Only future quality reports and analysis will tell. The Air Force Safety Center and the program office are working risk-mitigation measures to address the cause of these events. Hey, bag wearer, help us to identify leading indicators by being diligent in reporting potential safety hazards. This data is vital to proper trending and early detection. Be mindful that if the motors are running and electrics go bad, "Take the Electrics Out of the System." Remember, "Mech Gov and TDs to NULL" will decrease the PK factor!

Other important areas should be noted, including HAPs, HATRs, gear, brakes and lightning strikes. HAPs and HATRs have seen a 17 percent increase over FY07, with a 31 percent increase from FY06. These include RCA violations, departures without clearance, taking off and landing on the wrong runway or taxiway, and taxiing into stationary objects. While no specific area can be singled out as the leading contributor to this increase, the overall increase speaks volumes. If we're not careful, it won't be long before one or more of these are elevated into the Class A or B range.

Don't become complacent! Look after the engines, keep your eyes outside, and follow the book. Be attentive when flying in the AOR. It's not an excuse to take shortcuts and push the mission for mission's sake. With the continued high ops tempo and the demanding missions, you must take care of the details, as it's the smallest of things that usually add up to bite you when you least expect it.

If things don't seem right, they probably aren't. Always be on guard, strive to be safe, and fly another day. Remain vigilant in all you do — you don't want to be the topic of next year's article!

U.S. Air Force photo by Tech. Sgt. Justin D. Pyle

F-15

U.S. Air Force photo by Staff Sgt. Aaron Allmon

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It's certainly been an eventful year for the Eagle fleet. At first glance, it might appear that FY08 safety stats for both the U.S. Air Force as a whole and the F-15 specifically were not that bad. Overall, USAF numbers for Class A mishaps were about the same as the previous year.

The Eagle fleet improved in both number of Class A mishaps and rates (from 6/3.76 in FY07 to 4/2.78 in FY08). We took a significant step back in terms of fatalities and destroyed aircraft. This directly affects combat capability and is not easily replaced. Another alarming trend for the Eagle community is we're still well above the 10-year average (5.1 Class A mishaps, for a rate of 2.87). It's not normal to experience a significant fleet grounding, and you deserve kudos for keeping focus during that unfortunate time. There are many things we can learn and build upon as we look forward to the upcoming year.

Class A Mishaps

The Eagle fleet experienced four Class A mishaps during FY08. In these, we experienced the loss of five total aircraft and, tragically, two fatalities.

F-15

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	4	2.78	5	3.47	5	3.47	2	143,963.70
5-YR AVG.	4	2.4	11.4	6.78	2.6	1.55	0.4	166,899
10-YR AVG.	5.1	2.87	15.4	8.65	2.6	1.46	0.8	177,609
LIFETIME FY72-FY08	137	2.42	255	4.52	117	2.07	47	5,641,183

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

An F-15C experienced a catastrophic structural failure and breakup after a longeron failure. Problems were traced back to original manufacturing of the longeron and led to a fleet grounding. Numerous efforts are underway to make sure this doesn't happen again.

We had two F-15Ds that couldn't be recovered from out-of-control situations in-flight. Out of the three ejections in these two mishaps, two were successful. The D-model, especially with external tanks, has proven to be temperamental in high AOA environments. The takeaway: know how your configuration might affect planned maneuvers and know when it's time to give the jet back to the taxpayers.

Two F-15Cs experienced a midair collision during HABFM, resulting in one fatality and one successful ejection. Normally our midairs occur during benign phases of flight between members of the same formation; however, our last two happened during the fight. Remember to keep your noodle on a swivel and always have an "out" plan.

Class B Mishaps

One area of improvement was in Class B mishaps. The Eagle fleet experienced five Class B mishaps in FY08 (compared with 13 the year before). We continue to see FOD as a trend item. Any time loose fasteners find their way into an engine, the dollar costs are going to rise. One Class B was attributed to a bird strike (a far cry better than the three Class A bird strikes we experienced last year). The other trend is mishaps involving hydraulics/brakes. We're seeing more of these pop up across the board. Don't let your guard down until you're walking away from the jet.

Other Mishaps/Events

We experienced 63 Class C and more than 220 Class E mishaps during FY08. Not a lot new under the sun, but there were some noticeable trends. There were nearly 130 reported bird strikes, on par with the last few years. Weather-related mishaps (including electrostatic discharges) were up, as were the aforementioned hydraulic/brakes/gear-related mishaps. FOD continues to wreak havoc, as well. Departures/flight control-related problems are still creeping up, especially for the A-D models. For those of you flying in the AOR, HATRs remain one of your main threats.

Hazards/Mitigation Efforts

A lot of efforts are underway to improve everything, such as bird avoidance, elimination of FOD sources, and departure resistance. Just realize these take dollars and time. We all know the dollars don't come so easily anymore, and our jets are getting older. Still, the best mitigation comes from those in the field. By simply keeping the focus, following guidance, knowing where problems can occur, and having a game plan to deal with them, we can improve greatly on our stats across the board that directly enhance our ability to take the fight to the enemy. How else can you help? If you see problems in the field, especially those that appear to happen over and over again, tell somebody about it. Go to your flight safety officer or chief of safety. When was the last time somebody at your wing attended a Systems Safety Group conference? There are plenty of opportunities to voice your concerns and weigh in on what's being planned for the fleet.

What will we be doing for you this year? You can anticipate us continuing to stress ejection decisions and adherence to rules and regulations. We're also going to be fully engaged with efforts to figure out why our jets keep departing controlled flight. If we see trends, we'll be getting the word out. Remember, you may see the trends before we do, so help us help you. Stay sharp and happy hunting.

U.S. Air Force photo by Airman 1st Class Melissa A. Padilla

U.S. Air Force photo by Staff Sgt. Andrew Dunaway II

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Aviation safety stats for the U.S. Air Force as a whole didn't change appreciably between FY07 and FY08. We experienced nearly the same number of Class A's (28 and 27, respectively) and identical mishap rates (1.37 mishaps/100,000 flying hours). The biggest problem area was that we destroyed more aircraft and had significantly more fatalities over the previous year. The Raptor community did not contribute to those negative trends. That's not to say it didn't regress in some areas. It would be hard to improve on the previous year's Class A rate of zero. It's not surprising given today's dollar costs that it's easy to surpass the $1 million threshold that defines a Class A. The good news is the community experienced only one for the year. The bad news is Class B/C/E mishaps rose. This is not surprising for a new weapons system, but those mishaps may be indicators of more serious ones in the future. We can certainly learn from them.

Class A/B

With only one Class A mishap, the Raptor fleet had a rate of 5.56. This may be "eye-popping" to some, but it's not surprising given the still relatively low hours being flown. That's still less than the lifetime average of 8.63. The one Class A was caused by an engine sucking up some intake coating. That will obviously cross the $1 million threshold in a hurry.

The Raptor experienced three times as many Class B's as in FY07. That may sound dramatic, but we're actually talking just three Class B mishaps. One was a bird strike on takeoff, and two others involved fuel problems that caused engine damage (one a main fuel control problem, the other fuel contamination). It's a good thing to have two engines.

Other Mishaps and Events

The Raptor community experienced a slight increase in Class C and E mishaps from the previous year. Not surprising, the more we fly. Bird strikes contributed to well more than half of these numbers. Apparently LO works. There have also been a fair number of in-flight engine shutdowns for various reasons. As the skies become more congested with both piloted and unmanned aircraft, it's no surprise that HATRs are up. Don't forget to use those two sensors that sit on either side of your nose.

F-22

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	5.56	3	16.69	0	0	0	17,976
5-YR AVG.	1.2	32.7	2.4	56.42	0.2	5.77	0	9,222
10-YR AVG.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LIFETIME FY02-FY08	4	8.63	11	23.73	1	2.16	0	46,350

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

Hazards/Mitigation Efforts

The Raptor will continue to see modifications over the years, many based on safety recommendations. While that's certainly a good thing, the best ways to mitigate mishaps will almost always rest on the shoulders of those turning the wrenches and sitting in the cockpit. The more hours you fly, the more opportunities you have for bad things to happen. Have a game plan for dealing with the unexpected, and ensure those in the flight know what's expected from them. When things start going to hell, make sure you have an "out" plan. That may be as simple as knowing when to get out of the jet. Let's not do the enemy's job for them.

As for what you can expect from us, we're going to keep harping on you about ejection decisions and adherence to training rules. Please know this isn't like your Mom having to keep telling you to clean your room. There is a reason for our concerns. We'll let you know of any adverse trends we see, but we're relying on you for help. Stay engaged, stay safe, and happy hunting.

U.S. Air Force photo by Tech. Sgt. Ben Bloker

A-10

U.S. Air Force photo by Master Sgt. Robert Wieland

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The A-10 community experienced one Class A mishap in FY08 (vs. 0 in FY07), which fortunately did not include a fatality or the loss of a jet. This resulted in an FY08 Class A rate of 1.18 as compared to the 10-year average of 1.32 mishaps per 100,000 hours. The mishap mission was a four-ship flight-lead upgrade close air support sortie to conduct medium-altitude CAS with a joint terminal attack controller and was uneventful until execution of the low tactical recovery. During the turn to final, an engine failed and the pilot shut it down and flew a single-engine straight-in approach. It was determined the No. 2 engine suffered an uncontained engine failure in flight, when portions of the engine broke and exited through the engine casing.

For Class B mishaps, FY08 was not a good year, with the unusually high number (20 vs. eight in FY07) for a rate of 23.69 vs. the 10-year average of 7.03. All but three were engine-related, with the largest share caused by high-pressure turbine blade failures. Two mishaps involved a failure/malfunction of the mighty GAU-8 gun and resulted in relatively uneventful gear-up landings. One was clearly an avoidable mishap. The remaining Class B occurred when a Hog sustained hail damage during combat operations due to unforeseen weather conditions.

The HPT blade failures all occurred in flight and resulted in nonrecoverable in-flight shutdowns. Engineers from the system program office and manufacturer worked diligently to identify the failure mechanism involved and implement mitigation measures. The fixes include replacing HPT blades with a newer design. Fleetwide retrofit should be complete in January 2011.

Class C's dropped to 42 from last year's 49, and included 15 bird strikes, 10 gun malfunctions, eight slat failures, and nine various others (engine/air refueling/APU/nose wheel). Gun malfunctions and slat failures remain the non-BASH trendsetters, but beware of the other incidents that could set the next trend, or worse, the next Class A.

Non-BASH Class E's (up to $20,000) remained the same as last year's 56, with no major trends. I

want to stress the importance of Class E reporting, particularly HAPs. These reports are used to help the safety and SPO communities keep an eye on things. They are also one of the best ways for operators and maintainers to get the word out when something out of the ordinary happens. See your local safety officer or NCO to file a report for you.

A total of 179 BASH incidents were reported this year, including 15 Class C's, 164 E's, but no A's or B's — pretty much the same as last year (182), with the exception of the Class B. Unscheduled BFM with these guys seems unavoidable much of the time, so make sure you're using the tools available (BAM/AHAS/PIREPs) to the max extent possible to make informed risk-management decisions. Do you know the local BASH threats and their threat rings?

If you still have any doubts about whether the Hog is starting to show its age, then look no further than our most recent safety concern involving the presence of fatigue cracks in the lower skins of many jets. The cracks were discovered on jets going through depot maintenance, which led to fleetwide inspections and subsequent extensive groundings. All Hog drivers have been affected. Yet, don't despair; repair procedures have already been developed and tested, and are being fielded at multiple locations. Repair teams or repaired jets should arrive at your location in the not-too-distant future if they haven't already. These field repairs will prevent additional wing skin damage until permanent ones can be made at the depot.

Updates on this and many other Hog safety issues, such as HPT blade failures and landing-gear troubles, are briefed annually at the A-10 System Safety Group conference at Hill AFB, Utah. The next A-10 SSG is tentatively scheduled for March 2009. Forward any issues you would like to brief or have addressed to your flight safety officer so he or she can pass it to the Safety Center or SPO.

FY08 turned out to be a mixed year for safety, with the high point being no lost lives or jets in the Hog community — often a credit to the pilot's ability to safely get a sick jet home — though some critical issues have either continued to be factors or shown up unexpectedly. We aren't very effective at predicting when a jet is about to break, but we can prepare ourselves based on what we've seen. Do what you can to keep up with trends and know when and where you'll most likely get bit. Using timely and appropriate risk management can help keep the odds in your favor. Keep up the great work.

U.S. Air Force photo by Staff Sgt. Brian Ferguson

A-10

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	1.18	20	23.69	2	2.37	0	84,421.10
5-YR AVG.	1	1.24	8.6	10.75	0.8	0.98	0.2	78,441
10-YR AVG.	1.5	1.32	8.0	7.03	1.2	1.54	0.5	77,129
LIFETIME FY72-FY08	102	2.19	122	2.62	103	2.21	58	4,655,358.10

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

F-16

U.S. Air Force photo by Master Sgt. Scott Wagers

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The F-16 community made some great strides in keeping the number of Class A mishaps down in FY08, with less than one-third the number of FY07. Hats off to all involved. You'll notice from the summaries, however, that these mishaps were not material-related failures, but involved operator-specific human factors. Here's a summary of our Class A and B mishaps.

U.S. Air Force-wide F-16 units experienced three Class A mishaps in FY08, representing a significant decrease versus the 10 that occurred in FY07. The number of Class A mishaps has not been this low since FY04 when there were only two. The resulting FY08 Class A rate was 1.05, compared with the 10-year average of 2.76 mishaps per 100,000 hours.

The first Class A occurred during a night defensive engagement against a four-ship while on NVGs in an over-water area. According to the AIB report, the mishap pilot executed a beam maneuver and descended rapidly in a steep left bank and nose-low attitude. During the maneuver, the MP lost a discernible horizon and became spatially disoriented to the extent that he was unable to recover the aircraft despite multiple attempts. The MP successfully ejected and sustained only minor injuries.

The AIB president determined the cause of the mishap was the MP's failure to recognize and recover from spatial disorientation in a timely manner, due to an inadequate instrument cross-check. The night over-water environment, use of NVGs, and weather conditions limited the visible horizon and substantially influenced the mishap.

The second Class A occurred during a two-ship high-aspect BFM training sortie during simulated air-to-air combat maneuvering. According to the AIB report,

the mishap aircraft entered a briefed high speed-turning maneuver characterized by high G forces when it stopped maneuvering and began descending, with a flight path consistent with the aircraft no longer being controlled by the pilot. Fourteen seconds later, the aircraft struck the ground at more than 600 knots, with no attempt by the pilot to eject. The AIB determined the cause of the mishap was a G-induced loss of consciousness experienced by the mishap pilot, caused by his failure to perform an effective anti-G straining maneuver. It was also found that neither the condition of the aircraft nor the MP's physical or mental condition, supervision, or training contributed to the accident.

The final Class A mishap of FY08 occurred during the approach/landing portion of a dual-training sortie after completion of surface-attack training. The AIB report stated the mishap pilot had executed three uneventful approaches and landed with the landing gear fully extended for a touch-and-go landing. After touchdown, however, the MP raised the gear handle before applying full power for takeoff, resulting in the landing gear retracting with the aircraft still on the ground. The aircraft slid on its belly about 500 feet before stopping, after which the mishap crew emergency ground-egressed without injury. The aircraft sustained about $2.6 million in damage.

The AIB president found the cause of the mishap to be the MP moving the landing gear handle to the "up" position before applying full throttle, which caused the aircraft to settle to the runway due to insufficient speed and lift to attain and maintain flight. Multiple human factors were contributory to the MP's cognitive task oversaturation, including procedural error, limited experience/proficiency, distraction, and fatigue.

The F-16 fleet reported five Class B mishaps ($200,000 up to $1 million) in FY08, versus two in FY07, for a rate of 1.75, slightly higher than the 10-year average of 1.17. The first mishap occurred during landing roll, when a CATM-88 missile departed from the LAU-118 launcher and sustained damage from contact with the runway. The second mishap occurred during ground operations and involved FOD damage from tools to the engine before flight. Mishap No. 3 also occurred during ground operations before flight, when a material failure caused a compressor stall and serious engine damage. Both of these ground mishaps could have resulted in a lost aircraft and/or pilot, with only relatively minor changes in the timing of events. The final Class B occurred shortly after takeoff when the engine ingested a mourning dove. Initial indications to the pilot consisted of smoke in the cockpit and a barely audible high-pitched buzzing sound. Fortunately, the pilot was able to fly to high key and execute an uneventful SFO pattern and landing.

Notable trends in this year's 58 Class C's ($20,000 up to $200,000) include about a dozen hard touchdowns or otherwise improper landings, and numerous damaged missiles due to flight through inclement weather. Leave yourself some margin for error and ensure you're using the most accurate references for AoA during landing. Also, be on the lookout for old or incorrect brake-control software, which wreaks havoc through a variety of brake malfunctions.

A couple of other issues being closely scrutinized by safety, the SPO, and the manufacturer are also

F-16

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	3	1.05	5	1.75	2	0.7	3	285,502.80
5-YR AVG.	6.6	2.08	5.8	1.83	4.2	1.32	1	316,875
10-YR AVG.	9.2	2.76	8	2.4	7.4	2.22	1.7	333,536
LIFETIME FY75-FY08	334	3.72	72	0.8	307	3.42	118	8,970,731

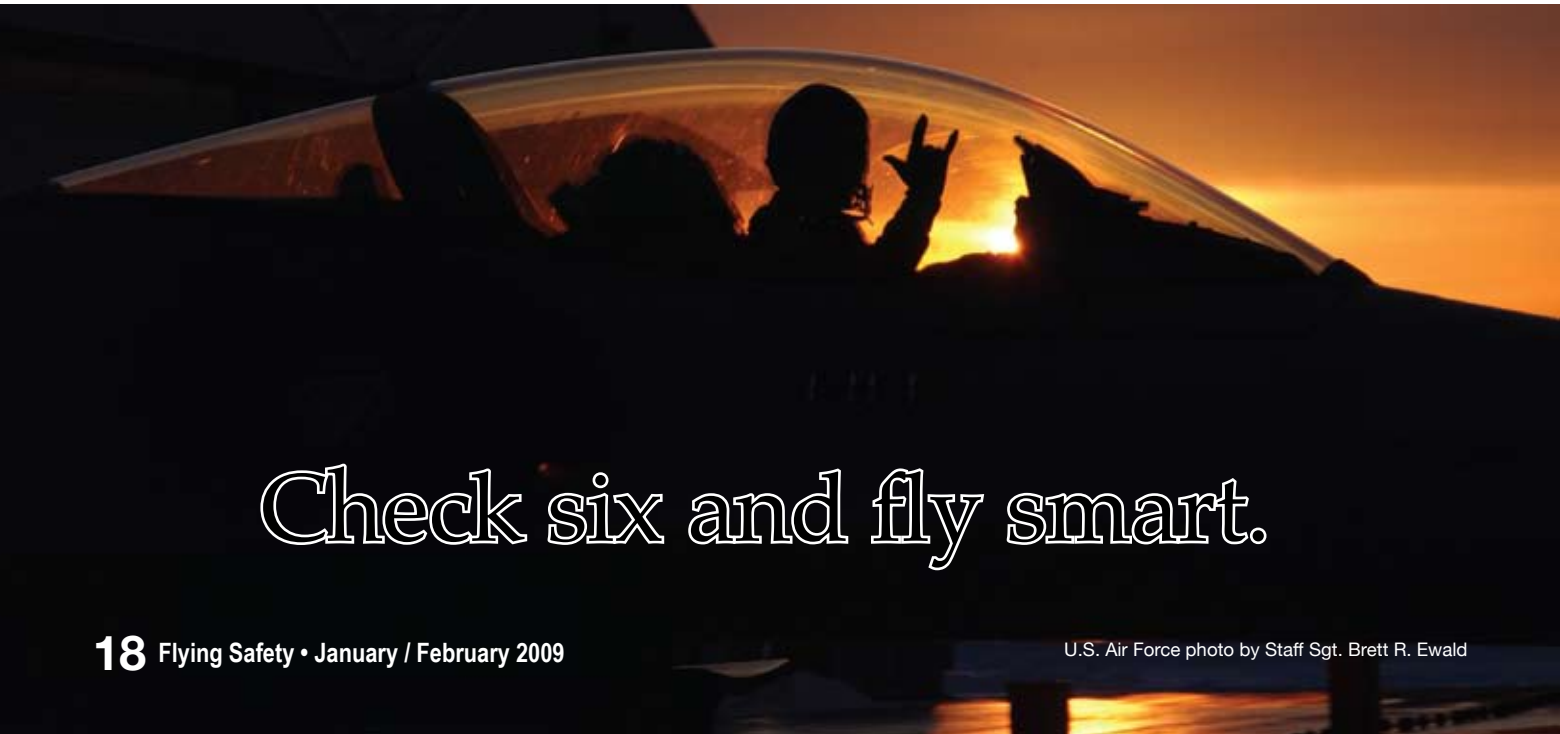
Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

worthy of mention here. While no jets were lost this year to departures from controlled flight, the potential still exists with the numbers that are being reported (about 17 this year). This issue is being monitored for the worldwide F-16 community in hopes of garnering more data to determine the causes. Capturing complete and accurate data is vital to understanding and mitigating this hazard, so do what you can to ensure all occurrences are properly documented and up-channeled. Also, pilots must remain cognizant of their operating envelopes, their aircraft configuration (including flight-control system type — analog or digital), and their emergency procedures. Just as the F-16 remains one of the premier air-to-air fighters and is normally a nimble and docile aircraft in a maneuvering environment, all aircrew need to be aware that it can still turn and bite you if it's overaggressively handled in the slow-speed, high-AOA environment.

This leads me to the other high-visibility issue of ejections delayed below established minimums. Yes, this has been highlighted before, but it remains a hazard as the USAF lost a pilot and almost a second, "but for the grace of … ," in a recent mishap where this was clearly the case. The seats being highly reliable likely weighs into the decision process, along with the thought they may be able to save the jet, in some cases. A noted misconception about the seat being able to upright itself may add to this condition. Two of the five F-16 ejections that occurred in FY07 were below ejection minimums, with one dangerously below. Changing a person's behavior for when they are confronted with the reality of ejecting is pretty tough, but it's got to happen. Leadership needs to reinforce the requirement to adhere to the minimums in the dash-1 and ensure simulator and other training pushes the point home.

U.S. Air Force photo by Master Sgt. Rob Trubia

Overall, it appears FY08 turned out to be a much better year than FY07 in terms of sheer mishap numbers, though the single fatality certainly casts a dark shadow and makes you question our progress. What can you do? Invest some time learning about the ever-present human factors threats that dominate the overwhelming majority of mishaps. Fatigue, spatial disorientation (especially on NVGs), and G-LOC aren't new elements to mishaps. With flight hours being cut, and the follow-on effects likely being lost proficiency no matter what the bean logs show, the need to continue to do things smarter via risk management and with these types of hazards in mind will become even more important. Check six and fly smart.



Check six and fly smart.

U.S. Air Force photo by Staff Sgt. Brett R. Ewald

Strategic Airlift

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While both the C-5 and the C-17 communities made it through FY08 without a single Class A mishap (best FY since FY03, and FY01, respectively), neither community was quite so lucky with respect to Class B and Class C mishaps. Both experienced a significant number of engine, material, and component failures that are all being closely monitored by their respective System Safety Groups and the Safety Center.

The C-5 community experienced the worst Class B year in its history and the C-17 tripled its Class B rate.

What happened? Both communities experienced trends in engine and BASH-related mishaps. The C-5 also suffered from material and mechanical failures, while the C-17 suffered a significant number of human factors–driven mishaps. The most notable resulted in significant injury to the co-pilot, when he slipped off a frost-covered fuselage during a preflight wing inspection. This injury could have been prevented if the crewmember had worn a restraint harness. Most other injuries resulted from people contacting sharp aircraft surfaces. Also of particular interest for the C-17 were the eight helicopters damaged during loading/unloading, the seven ground operations / taxi mishaps, and the 35 reported HATRs.

I encourage all wing representatives to voice their concerns at the next System Safety Group conference at Robins AFB, Ga., in March for the C-5, and for the C-17 at Wright-Patterson AFB, Ohio, in May, with the fall conference at the Boeing plant in Long Beach, Calif., in November. The SSG is an excellent opportunity to learn what's going on in the fleet and to express your concerns to the entire community so corrective action can be taken. Your reports and investigations have helped identify 49 medium- and high-risk safety hazards in the C-17 that are now being monitored. Similarly, efforts are afoot to implement risk-mitigation measures for all 14 medium- and high-risk system safety hazards currently tracked.

Safety Concerns:

As our operations tempo continues to remain high, and probably will for the next several years, it's critical that everyone remains focused on the tasks at hand, no matter how "routine" they may seem. With this in mind, in FY09, the Safety Center will pay particular attention to checklist discipline, HATRs, aircrew and maintenance injuries, as well as previously identified safety hazards. To help address these items, the Safety Center is working with AMC, AFFSA, and AFCENT to help ensure appropriate risk-mitigation measures are identified and implemented. I also encourage everyone on the line to make an extra effort to ensure we minimize risk and operate safely.

Unfortunately, while FY08 saw a decrease in CRM-related mishaps, it also saw an increase in checklist-discipline problems. As such, I encourage all aircrew to "return to basics." By this I mean renew your efforts to think about what you learned during qualification training. For example, pilots, ensure you're proficient flying all types of instrument approaches with both the

U.S. Air Force photo by Tech. Sgt. Shane A. Cuomo

Mishap Highlights

C-5	A	B	C	D	E
Engine		4	7		49
BASH			5		128
Gear / Tires		1	6		2
Material Failure (hole in wing)		1			
Flap / Slat			3		1
Uncommanded Flight-Control Input					8
Physiological					10
Injuries			4	5	1
** Total Flight Mishaps*		6	22		211

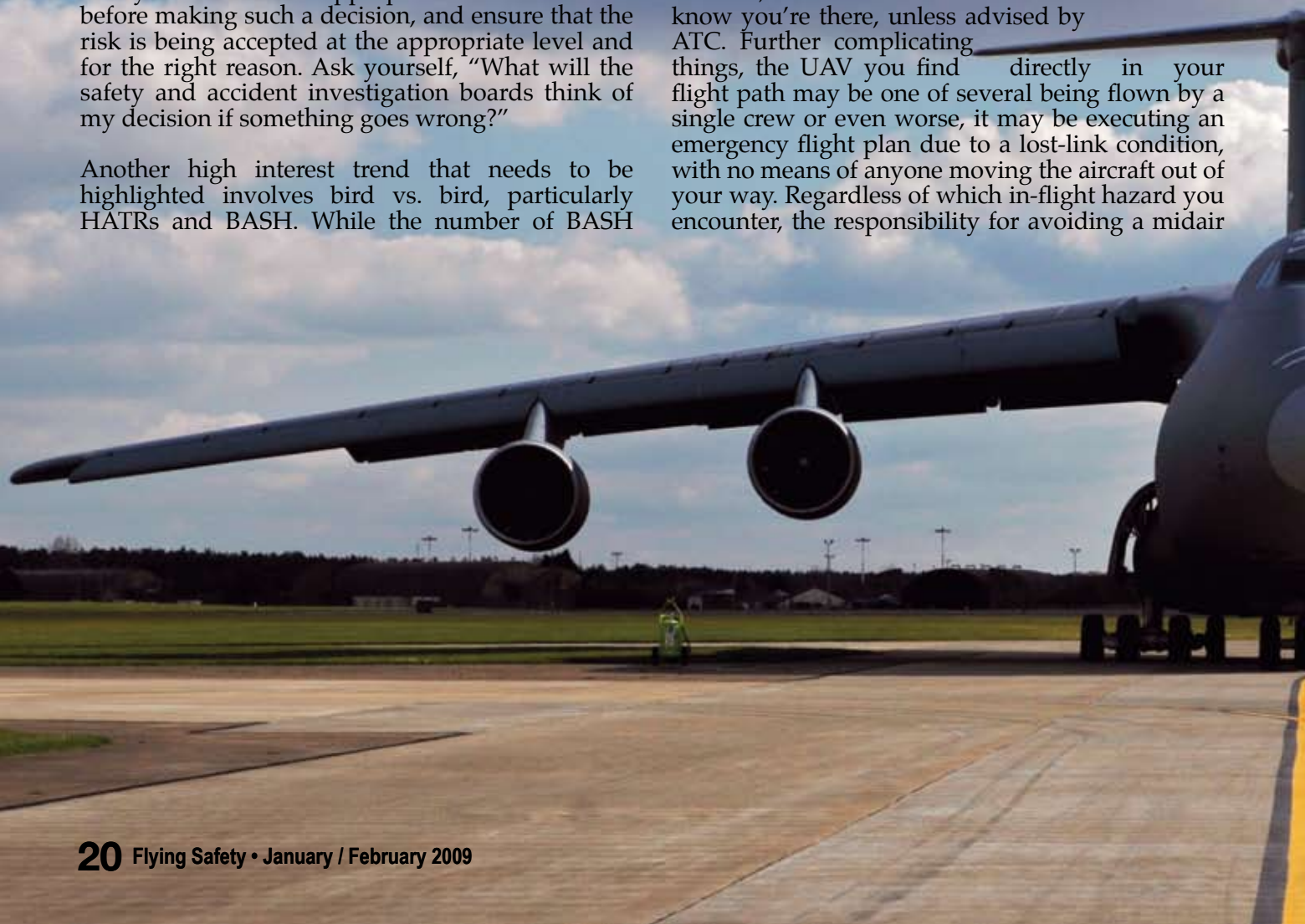
C-17	A	B	C	D	E
Engine		7	20		24
BASH			12		603
Gear / Tires			2		2
Ground Ops			3		4
HATR					35
Uncommanded Flight-Control Input			1		2
Physiological		0	3		8
Injuries		1	1	9	1
Total Flight Mishaps		7	46		692

* Includes mishaps beyond categories listed.

primary and standby instruments. Additionally, use extreme caution while taxiing, to maintain proper wingtip clearance. Engineers and loadmasters, continue to focus on following checklist procedures; avoid working from memory or improvising. Although we may be operating in a war zone, it's important to remember that checklists are written for a reason; many of the notes, warnings, and cautions are in there as a result of previous mishaps. Although deviations from checklist procedures may be valid on the extremely rare occasion, make sure that you've done an appropriate risk assessment before making such a decision, and ensure that the risk is being accepted at the appropriate level and for the right reason. Ask yourself, "What will the safety and accident investigation boards think of my decision if something goes wrong?"

Another high interest trend that needs to be highlighted involves bird vs. bird, particularly HATRs and BASH. While the number of BASH events involving strategic airlift aircraft actually decreased in FY08, this is not a problem that will go away. Remain vigilant and use all available tools to avoid flying in high-hazard areas or at high-risk times.

Another hazard that won't be going away is the growing number of UAVs operating in the same airspace as manned aircraft. Aircrew need to remember that UAVs have very limited means of seeing other traffic, such as two very limited cameras, and chances are that the crew doesn't know you're there, unless advised by ATC. Further complicating things, the UAV you find directly in your flight path may be one of several being flown by a single crew or even worse, it may be executing an emergency flight plan due to a lost-link condition, with no means of anyone moving the aircraft out of your way. Regardless of which in-flight hazard you encounter, the responsibility for avoiding a midair



U.S. Air Force photo by Airman Perry Aston

C-5

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	6	13.35	0	0	0	44,916.50
5-YR AVG.	1.8	0.54	4.2	2.25	0.2	0.11	0	186,842
10-YR AVG.	1	0.57	4.2	2.38	0.1	0.06	0	176,712
LIFETIME FY68-FY08	23	0.97	62	2.62	5	0.21	168	2,370,086

C-17

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	7	3.83	0	0	0	182,635
5-YR AVG.	2.8	1.75	6	3.65	0	0	0.2	167,585
10-YR AVG.	1.8	1.18	6.2	5.27	0	0	0.1	130,667
LIFETIME FY91-FY08	18	1.28	46	3.28	0	0	1	1,403,874

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

falls on your shoulders. Take evasive maneuvers if required, and then report it. This is being watched closely, but if the problem isn't reported every time it occurs, appropriate risk-mitigation measures cannot be implemented.

Lastly, it's everyone's responsibility to identify potential safety issues and to make those concerns known at the appropriate level. If you see something that is a hazard or may present a future safety threat, voice your concerns to your safety staff so they can track it and take appropriate action to mitigate the hazard. Only by reporting it can we identify trends across multiple installations or communities and take widespread corrective action.

Recce

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Fiscal Year 2008 was a good year for reconnaissance aircraft. There was only one Class A mishap (E-8), two Class B mishaps (both E-3), and 27 Class C mishaps. Most of the Class E mishaps were due to BASH, smoke and fumes, physiological incidents, and FOD.

U-2

The U-2 had an extraordinary FY08, with no reported Class A or B mishaps. The latest reported Class A mishap was in May 2007, and the latest reported Class B mishap was in October 2004. These numbers are even more impressive when you realize the U-2's cumulative hours flown has increased every year. Increased exposure with fewer mishaps is a good trend.

The Class C trend has remained steady. The U-2 experienced five Class C mishaps in FY08, consistent with the five-year average of about five Class C mishaps a year. Analysis of the Class C mishaps does not show any appreciable trend. From FY04-08, 11 of the 26 Class C mishaps were aircraft ground operations, and the other 15 were either flight or flight-related. Of interest, there has been only one aircraft ground operations Class C mishap since July 2005.

All but one of the 20 U-2 Class E physiological events reported since FY04 have been decompression sickness. The reported cases decreased in FY08 when compared with FY07 and FY06. There was only one reported DCS case in FY08. In FY07, there were eight, and in FY06, there were six reported.

Wildlife has been nearly as hazardous to the U-2 as DCS. There were 21 BASH events reported in the last five years, with four in FY08. Birds are not always the unlucky ones, as a rabbit was hit on landing in FY07. The remaining Class E events were spread out and do not show a significant trend.

As these platforms continue to age, especially in the HD/LD role, being able to trend early indicators remains important. Take the time to know what to report (ask your FSO) and take the time to report those things. Building the database with sufficient info is integral to successfully identifying and mitigating hazards through safety and sustainment efforts. Continue taking care of these mature platforms … because we ain't getting any new ones any time soon!

E-4

No Class A's in FY07 or FY08 for the E-4. The last Class A was in 2005, when an aircraft struck a goose in the traffic pattern. There have also been no Class B E-4 mishaps in the past two years. The last Class B (engine blade damage) was again in FY05. The 10-year average is about one Class B mishap every other year.

U.S. Air Force photo by Master Sgt. Dave Nolan

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

U-2

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	15,468.20
5-YR AVG.	0.4	2.75	0.4	2.75	0.2	1.37	0.2	14,560
10-YR AVG.	0.6	4.48	0.2	1.49	0.2	1.49	0.1	13,402
LIFETIME FY63-FY08	31	6.22	2	0.4	22	4.41	13	497,816

E-4

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	1,649.70
5-YR AVG.	0.4	24.89	0.6	37.31	0	0	0	1,695
10-YR AVG.	0.3	18.93	0.6	38.94	0	0	0	1,591
LIFETIME FY94-FY08	5	8.96	8	14.33	0	0	0	55,806

There was only one Class C E-4 mishap in FY08. An aircraft struck several birds, damaging the leading edge flaps. FY07 also had a Class C for the E-4, an engine mishap. The 10-year average is a little over one Class C mishap per year.

The E-4 had 20 Class E events in FY08, up two from FY07. All the FY07/08 E-4 Class E incidents were BASH-related. The 10-year average is just under 19, with almost 97 percent caused by BASH, with no other noted trends.

E-8

There was one Class A mishap in FY08 for the E-8, a hard landing. The only previous E-8 Class A mishap was in 2000. That incident was caused by hydraulic fluid, damaging aircraft systems. There were no Class B mishaps in FY08, but the latest one (engine FOD) just happened in FY07.

There were seven Class C mishaps in FY08, up from five in FY07. Four were propulsion-related, two were spoiler malfunctions, and one was a

E-8

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	7.72	0	0	0	0	0	12,952.50
5-YR AVG.	0.2	1.54	0.6	5.26	0	0	0	11,527
10-YR AVG.	0.2	3.57	0.4	5.43	0	0	0	8,575
LIFETIME FY91-FY08	2	2.1	4	4.2	0	0	0	95,195

RC-135

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	15,210.10
5-YR AVG.	0	0	0.6	4.28	0	0	0	14,016
10-YR AVG.	0	0	0.4	3.25	0	0	0	12,335
Data Since FY93	0	0	4	2	0	0	0	200,074

Note: RC-135 hours are combined with all C-135 hours.

U.S. Air Force photo by Tech. Sgt. Keith Brown

gear/tire mishap. The 10-year average is a little more than four per year, so the last two years show a small spike.

Class E events were also up. In FY07, there were 54 E-8 Class Es. In FY08, the number jumped to 84. The BASH trend remains steady, at 44 percent and 43 percent of the total E-8 Class E incidents for FY07 and FY08, respectively. Other Class E trends for the E-8 are smoke and fumes, and physiological incidents.

RC-135

There were no RC-135 Class A or B mishaps in FY07 or FY08. The last Class B was in FY05, when a near-midair forced the RC-135 to perform an evasive maneuver close to the ground, and subsequently struck the runway with the No. 1 engine.

Class C mishaps declined. In FY08, there was only one Class C mishap, a brake fire, compared to FY07's four. Those incidents include two brake malfunctions and two bird strikes.

Class E events were also down. We still hit 30 birds in FY08, up from the 24 Class E bird strikes from FY07. But the total Class E events went down from 70 to 60 — a positive trend. In addition to BASH, there were 15 smoke and fume incidents, four engine problems, two pressurization mishaps, and two flight-control malfunctions reported in FY08.

E-3 Sentry

The E-3 has had no Class A mishaps in FY08 or FY07. The last (and only) Class A mishap on record was in 1995, when an entire E-3 crew lost their lives after striking a flock of geese immediately after takeoff. Despite the major accident, the E-3 community has a .14 lifetime Class A mishap rate. In FY08, the two Class B mishaps were engine-related.

FY08 brought 14 Class C mishaps. Propulsion was the culprit in six of them, three were caused by bird strikes, two were for gear/tire malfunctions, two were air cycle machine problems, and one was a bleed air incident. Comparatively, there were only seven Class C mishaps in FY07, with no significant trends noted. The 10-year E-3 Class C average is less than five annual mishaps.

For E-3 Class E events, FY08 was very similar to FY07. There were 88 incidents this year versus 87 from FY07. We had more BASH incidents in FY08, up from 21 to 35. There were fewer smoke and fume problems in FY08, down to 23 from 31 the previous year. The only other FY08 Class E event trend is FOD to engines.

E-3

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	2	10.62	0	0	0	18,842.80
5-YR AVG.	0	0	1.8	10	0	0	0	18,032
10-YR AVG.	0	0	1.3	6.46	0	0	0	20,117
LIFETIME FY77-FY08	1	0.14	14	1.96	1	0.14	24	714,619

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

Trainers

U.S. Air Force photo by Senior Airman Matthew C. Simpson

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T-1

The T-1 experienced its first Class A mishap in five years in FY08. During a microburst on final approach, the aircraft sustained major damage after the crew encountered an excessive downdraft. It was only the second Class A mishap in T-1 history.

The last Class B T-1 incident was in June 2004 for an impressive .63 lifetime Class B mishap rate.

There were four Class C mishaps in FY08, up one from FY07. Last year, the Class C mishaps were caused by improper towing, hail damage, and an engine-bearing malfunction. This year, we had an anti-skid malfunction, a tire failure, and two major bird strikes.

In Class E events, FY08 saw far fewer than FY07. There were 187 Class E incidents in FY07 compared with 130 last year. BASH continues to be the trend, with FY07 posting 81 percent, versus 79 percent of the Class E total in FY08. Other Class E trends include trim malfunctions, and smoke and fumes in the cockpit.

Most of the hazards point to bird avoidance, weather, and traffic-pattern activities as prime focus areas — nothing new for the T-1. These improvements will help crews mitigate serious weather-related incidents and reduce future Class A mishaps.

T-6

The T-6 fleet had a rough year in FY08. After three years without a Class A and only five Class B mishaps in five years, U.S. Air Force T-6s experienced a Class A midair and three Class B's. Twelve Class C mishaps were also an increase,

T-1

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	1.2	0	0	1	1.12	0	89,506.20
5-YR AVG.	0.2	0.22	0.2	0.22	0.2	0.22	0	99,300
10-YR AVG.	0.2	0.21	0.8	0.79	0.1	0.11	0	99,819
LIFETIME FY92-FY08	2	0.16	8	0.63	1	0.08	0	1,275,669

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

hitting the highest level since FY05.

According to the Accident Investigation Board report, the Class A resulted from the failure of two crews on UPT syllabus sorties to clear their flight path in the vicinity of VFR entry. Both aircraft were destroyed, but all four aircrew successfully ejected without injury.

All three Class B mishaps involved the engine. An additional five Class C mishaps involved the engine, pointing to the continued need for vigilance and contingency plans when flying a single-engine trainer. AETC, the program office, and the manufacturer are exploring options to increase engine reliability. Two mishaps and two Class E events were instigated by a pilot improperly positioning the PCL — one pilot moved it out of the "start ready" position, leading to an overtemp, while three others inadvertently shut down the engine, one on a touch-and-go. Inadvertent shutdowns are a continuing trend in the T-6, and one caused a Class A destroyed aircraft.

Most Class E events cause little or no damage to the aircraft, but they are often predictors of future mishaps. The T-6 experienced 143 Class E's in FY08, down slightly from the 154 in FY07. Eighty-eight of those were bird strikes, down 14 percent from last year. Another positive trend was a decrease in HATRs from four to three, only one of which was an airborne event.

The T-6 community has a robust safety program, which ranges from the flyers and maintainers at the local level; to AETC, the lead MAJCOM; to the AFMC system program office; to the manufacturer. Representatives from all these organizations and their counterparts in the U.S. Navy form a System Safety Group, which meets annually to review and prioritize safety concerns, and implement fixes. Your wing flight safety officer probably attends these SSGs. If you have concerns or ideas, pass them to your FSO.

T-37

The mighty Tweet fleet has drawn down to 62 aircraft, all at Sheppard AFB, Texas. The problems with the T-6 engine may delay their final trip to Davis-Monthan. Only one T-37 incident exceeded the $20,000 threshold for a reportable mishap — a bird in the engine of an aircraft on landing roll caused a Class C. The T-37 also had 18 Class E bird strikes and 29 other Class E events. The only trend in the Class E's was nine physiological events caused by either G-LOC or hypoxia.

T-38

The T-38 community suffered two Class A mishaps this year that claimed the lives of two IPs and two student pilots. According to the AIB report, the first mishap occurred when the aircraft crashed on takeoff due to a broken aileron actuator servo lever. The failure caused the aircraft to roll rapidly after liftoff and crash. The second mishap occurred at another training base after an engine failed during a touch-and-go landing. Both crew members were fatally injured. These mishaps resulted in a FY08 Class A rate of 1.9 mishaps per 100,000 flying hours.

Two Class B T-38 mishaps also occurred during

T-6

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	1	0.73	3	2.18	2	1.45	0	137,839.7
5-YR AVG.	0.4	0.45	1.2	1.27	0.6	0.6	0.4	104,334
10-YR AVG.	0.3	0.5	0.8	1.33	0.4	0.66	0.2	60,338
LIFETIME FY00-FY08	4	0.66	7	1.16	4	0.66	2	603,380

T-37

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0.00	0	38,693.9
5-YR AVG.	0.2	0.17	0	0	0.2	0.00	0	93,324
10-YR AVG.	0.5	0.29	0	0	0.5	0.00	0.3	143,953
LIFETIME FY56-FY08	138	1.02	31	0.23	136	0.00	78	13,563,921

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

U.S. Air Force photo by Staff Sgt. Andy Dunaway

FY08, producing a rate of 1.9 as compared with the 10-year average of 0.97. The first Class B mishap occurred when a bird was ingested in an engine during takeoff, while the second occurred when an aircraft departed the runway during a rolling takeoff. No injuries were sustained in either mishap, though they easily could have been much worse.

The number of Class C mishaps in FY08 was down significantly, from 70 in FY07 to 51 in FY08. Though most were still engine mishaps and bird strikes, the number of engine-related mishaps was cut almost in half. Bird strikes were down 20 percent (136 vs. 172 in FY07) along with non-BASH Class E's.

The annual T-38 System Safety Group meeting in the first week of November provided valuable updates and discussion of the following high-interest issues:

- T-38 aileron actuator servo levers are being replaced with newly manufactured hardware and will be replaced every 900 hours. Aircraft are grounded until the new servo levers have been installed.
- The new ejection seat should begin to be retrofitted in February, following more component testing and certification.
- Retrofit of an anti-skid brake system is anticipated to begin sometime in 2011.

Engine updates:

- PMP compressor stall data collection still underway, with additional testing planned in first quarter of 2009, though acquisition of some new components has already begun.
- Updated main fuel control components should be fielded in April 2010.
- The high incidence of stuck exhaust nozzles is being addressed through multiple avenues to resolve many factors. Initial results have been positive, with less than 10 reported stuck nozzles from January 2007 through October 2008.

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

T-38

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	2	1.9	2	1.9	2	1.9	4	105,278.5
5-YR AVG.	1.4	1.14	2	1.63	1.2	0.98	0.8	122,595
10-YR AVG.	2.2	1.65	1.3	0.97	1.1	0.82	0.6	133,618
LIFETIME FY60-FY08	140	1.03	33	0.24	138	1.01	80	13,630,506

T-43

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	3,268.8
5-YR AVG.	0	0	0	0	0	0	0	3,953
10-YR AVG.	0	0	0	0	0	0	0	4,313
LIFETIME FY74-FY08	1	0.27	6	1.63	1	0.27	35	367,970

Tankers

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No new trends have emerged on the tanker fleet. METCO delamination will continue to challenge the F-108 engine until all the engines have run through the repair cycle. As the engines age, expect to see other "wear-and-tear" indicators. EGT exceeding limits or just running hot are likely indicators that components need attention. Timely attention may mean the difference between routine and costly unscheduled maintenance, so make sure you're documenting properly with the required 781 entries. In conjunction with AMC, we reviewed how we report engine mishaps and are waiving some reporting requirements to increase process efficiency, which should save time for safety warriors at all levels.

With the KC-10, you're likely to have an engine problem, if anything. However, most of the FY08 events were driven from a good engine, trying to digest metal instead of air and fuel. The good news is that there were no catastrophic failures from these engine-related mishaps, and proper tech order procedures prevail when problems arise.

Whatever the issue, when it comes to maintenance, I'm a big fan of the "Info Note" for the non-event event. The one where technically it's not broken, but you had the jet for four straight sorties and

KC-10

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	4	5.67	2	2.83	0	0	0	70,606.9
5-YR AVG.	2	3.05	3.6	5.63	0	0	0	64,491
10-YR AVG.	1.5	2.45	3.1	5.13	0	0	0	61,556
LIFETIME FY81-FY08	17	1.31	27	2.09	0	0	0	1,293,992

something's just not right. Write it up as an info note and have a talk with the specialist. You might just learn something in the process and could provide the missing early warning that saves a vital component.

Other issues? It would be nice if the KC-10 drogue and KC-135 MPRS systems were more dependable, but at least these aren't major safety hazards. Sure, the occasional F-18 driver may become excited by basket separation as he suddenly has to contend with a large hose slapping around his cockpit area. That's nothing to spill your box lunches over — you just gained 3 percent in fuel savings! Just kidding, Navy guys — and no, you can't keep the baskets.

One could argue that birds are the most imminent hazard for FY09, so get your BASH on this fall. As with any risk, the best mitigation tool is between your ears. We wish risk mitigation was taught at grade school, but it isn't, so buck up. With all the competing interests that assault an aircrew before flight, we must culture the ability to wade through issues and separate the chaff.

Air-refueling mishaps were at record lows in FY08. Continue the great work. Toe the common-sense line, make the tough calls, and serve as good examples.

KC-135

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	3	1.38	11	5.08	0	0	0	216,509.8
5-YR AVG.	0.8	0.36	12.4	5.58	0	0	0	222,412
10-YR AVG.	0.8	0.38	8.7	4.17	0.1	0.05	0.4	208,506
LIFETIME FY57-FY08	85	0.62	196	1.42	64	0.46	134	13,779,467

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

U.S. Air Force photo

UAS

U.S. Air Force photo by Master Sgt. Scott Reed

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At first glance, it may not seem like a great year for the Unmanned Aircraft Systems community, but the tremendous growth of UAS ops masks the true story.

FY08 featured 12 Class A UAS mishaps: 10 Predators and two Reapers. The Predator also had four Class B mishaps. Although the raw numbers seem high, when converted to a rate, they show improvement over previous years. At 6.76 Class A mishaps per 100,000 hours, the Predator had its third best year ever (zero in FY98 and 6.31 last year). With a rate of 13.21, the Reaper had its best year ever.

The Global Hawk did not have any Class A, B, or C mishaps this year. Well done! The last Class B was in 2005 and the last Class A was in 2002.

Most Class C mishaps and Class E events, were engine-related. A significant number were also due to landing, taxiing, and BASH events. Several had to do with logistical or maintenance factors, such as missing fasteners or fuel caps discovered after flight.

As everyone who has anything to do with the Predator and Reaper knows, the biggest hazard crews faced was the landing. Historically, more than 22 percent of all UAS mishaps have occurred during the landing phase. Typical causes for these mishaps were flying the approach fast, steep, and not having situational awareness of the height above the runway. Many SIBs have recommended putting a radar or laser altimeter on the aircraft, as well as a weight-on-wheels sensor. Once these systems are fielded, landing mishaps should be reduced. In the meantime, an early decision to go around will prevent most of the mishaps.

Another area of interest for all unmanned systems is the ability to operate safely with and around manned aircraft. The recent Global Hawk ORM assessment done for the FAA highlights hazards that require mitigation before we can truly operate safely side by side in the same airspace. Some of these hazards are:

- Traffic conflicts at divert fields
- Traffic conflict with another aircraft while airborne
- Unintended or unanticipated altitude and/or course deviation
- Inability to comply with CFRs for routing and altitude when contingency modes are active
- Inability to respond to time-sensitive ATC instructions

Some of the recommendations to mitigate these hazards are:

- Procedures to separate UAVs from manned aircraft
- Flight-planning guidance for contingency logic (automated UAV recovery software)

MQ-1

Year	Class A		Class B		Destroyed		Hours
	No.	Rate	No.	Rate	A/C	Rate	
FY08	10	6.76	4	2.7	9	6.08	148,001.2
5-YR AVG.	5.8	9.7	1	1.02	4.4	6.76	74,830
10-YR AVG.	4.2	7.94	0.7	2.93	3.4	6.28	43,871
LIFETIME FY93-FY08	44	9.78	7	1.56	36	8	449,949

RQ-4

Year	Class A		Class B		Destroyed		Hours
	No.	Rate	No.	Rate	A/C	Rate	
FY08	0	0	0	0	0	0	6,633.7
5-YR AVG.	0	0	0.2	7	0	0	3,717
10-YR AVG.	0.4	72.57	0.1	3.5	0.3	50.38	2,213
LIFETIME FY99-FY08	4	18.07	1	4.52	3	13.55	22,134.90

MQ-9

Year	Class A		Class B		Destroyed		Hours
	No.	Rate	No.	Rate	A/C	Rate	
FY08	2	13.21	0	0	1	6.61	15,138.20
5-YR AVG.	0.4	9.2	0	0	0.2	3.32	5,667
10-YR AVG.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LIFETIME FY03-FY08	2	7.03	0	0	1	3.52	28,436

- Installing and using TCAS
- Redesigning key software
- Redesigning human/computer interface to minimize erroneous user commands

Through the coming months, we will continue striving to make unmanned systems safer. A concerted effort is underway to implement recommendations from mishap investigations. We're also working to streamline the investigation process for the unique challenges posed by these systems. Under the direction of the Air Force Chief of Safety, we'll continue to work with MAJCOMs/NAFs/wings and program offices through the Air Force UAS task force to ensure safety is entrenched in the UAS flight plan.

As we continue to expand the UAS community, there will be some growing pains; however, I expect to see the safety trend continue to improve.

U.S. Air Force photo by Tech. Sgt. Erik Gudmundson

U.S. Air Force photo by Staff Sgt. Andy Dunaway

Helos

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FY08 was a small step back for U.S. Air Force helicopter mishap prevention. However, more importantly, our community again experienced no fatalities or serious injuries during the fiscal year. USAF helicopters experienced two Class A mishaps, four Class B mishaps, and 18 Class C mishaps during FY08.

The H-1 series experienced no Class A, one Class B, and six Class C mishaps in FY08. The Class B resulted from a UH-1N hard landing, damaging the landing gear cross tubes, transmission mast assembly, and the input drive shaft. FY08 was slightly worse for H-1s than the 10-year average for mishaps due to the number of Class C's.

The HH-60 experienced two Class A, two Class B, and 12 Class C mishaps in FY08. Both Class A mishaps involved hard landings in brownout conditions at deployed locations. The first was a very low-illumination night landing for a medevac, resulting in damage to the FLIR, radome, refueling probe, landing light, search light, and LARS antennae, as well as extensive damage to the aircraft structure. The second was also a night brownout hard landing, resulting in a partial rollover, extensively damaging the aircraft and rotor system.

The first Class B was the result of a wire strike during a low-visibility daytime mission. The wire struck about four inches behind the OAT gauges on the forward edge of the roof, slid aft over the greenhouse windows and into the upper WSPS groove, where it was cut. The MA sustained two shattered greenhouse windows above the MP and MCP, two sheared pitot tubes, and FOD damage to both engines. The aircraft was able to be flown back to the base for a safe landing. The second Class B was the result of a night hard landing, which resulted in extensive damage to the FLIR. FY08 for H-60s was also slightly worse than the 10-year average for mishaps. This can be attributed to ops tempo and loss of overall experience in the CSAR community.

The MH-53 experienced no Class A, one Class B, and no Class C mishaps for FY08. The Class B resulted from eight jumpers who landed past the trailing edge of the DZ during unilateral jump operations. Two of the jumpers, both tactical air control parties, were hung in trees (No. 4 and No. 6). The No. 6 jumper broke through the tree branches and fell to the ground, causing multiple soft-tissue injuries, breaking several vertebrae, fracturing his sternum, crushing discs, and inducing a severe concussion. The injured jumper was airlifted by helicopter to a local hospital.

FY08 was the best year by far of the last 10 for mishaps, but this was largely due to the relatively small number of H-53s still flying. The last flights of the H-53 were completed in the AOR in September 2008, and the Special Ops workhorse is now officially retired from its long and distinguished service in the Air Force.

The biggest challenge for USAF helicopters appears to be NVG brownout operations in the AOR. This is a very difficult part of terminal operations that requires training and continual practice for

H-1

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	1	3.7	0	0	0	26,981.60
5-YR AVG.	0	0	1	3.92	0	0	0	25,526
10-YR AVG.	0.2	0.89	0.5	2.23	0.2	0.89	0	22,452
LIFETIME FY59-FY08	54	3.07	18	1.03	40	2.28	52	1,754,806

H-53

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	1	20.37	0	0	0	4,909.20
5-YR AVG.	0.6	7.3	2	24.39	0.4	4.88	1.2	8,191
10-YR AVG.	1.4	13.6	2.2	9.75	0.2	1.95	0.5	10,268
LIFETIME FY66-FY08	39	7.5	31	5.96	23	4.42	86	520,008

H-60

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	2	7.86	2	2.86	0	0	0	25,431.90
5-YR AVG.	1.4	5.12	2	7.47	0.4	1.42	0.4	26,781
10-YR AVG.	1.2	4.42	1.1	4.1	0.4	1.46	0.8	26,403
LIFETIME FY82-FY08	20	4.15	13	2.7	11	2.28	42	481,977

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

proficiency. For your situational awareness, this has lots of top-level attention throughout the Air Staff and even OSD, who are partnering with our sister services to develop and field technological solutions to help make whiteout/brownout landings safer. Until then, it's up to us to train hard, and employ our CRM and ORM. Congratulations on another good year for USAF helicopter safety. Keep up the good work, focus on risk management, and fly safe.

U.S. Air Force photo by Staff Sgt. Jeremy Smith

DV AIRLIFT

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Great news! The heavy Distinguished Visitor airlift community still has not experienced a Class A mishap. More impressively, there are no Class B mishaps on record for the VC-25, C-32, or C-37.

The C-37 had one Class C mishap in FY08. The aircraft sustained gear damage on taxi. Before that, the only Class C mishaps for the C-37 were a FY99 flap-asymmetry problem and a FY01 improper-towing incident. The last Class C mishap for the VC-25 was in FY95, where an engine run caused a large patch of asphalt shoulder to separate from the ground and damage the surfaces. Before that, the only other VC-25 Class C happened in FY03, when a motorized boom lift basket damaged an aileron. The C-32 has no history of Class C mishaps.

The C-32 had nine Class E events last year, compared to 10 in FY07. All FY08's Class E events were BASH-related, and eight of the 10 FY07 totals were for BASH. The other two FY07 Class E incidents included a HATR with civilian traffic and a TCAS resolution advisory for VFR traffic.

FY08 was also an improvement over FY07 for the C-37 Class E totals, with nine in FY08, compared with 11 in FY07. BASH continues to lead the way, carrying almost 89 percent of the Class E events in FY08 and 100 percent in FY07. The only non-BASH Class E in the last two years for the C-37 fleet is a flap malfunction.

The only Class E incident on record for the VC-25 was a bird strike in FY95.

While these platforms have been exemplary, a testament to both operators and maintainers pushing a demanding mission with proven effective ORM, we should be cautious about becoming complacent. Stay engaged in the sound practices rewarding the community with this healthy safety record!

VC-25

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	686
5-YR AVG.	0	0	0	0	0	0	0	745
10-YR AVG.	0	0	0	0	0	0	0	671
Data Since 1993	0	0	0	0	0	0	0	10,512

C-32

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	3,904.80
5-YR AVG.	0	0	0	0	0	0	0	3771
10-YR AVG.	0	0	0	0	0	0	0	3323
Data Since 1999	0	0	0	0	0	0	0	33,226

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

C-37

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	7,412.40
5-YR AVG.	0	0	0	0	0	0	0	7,658
10-YR AVG.	0	0	0.1	1.75	0	0	0	5,708
LIFETIME FY99-FY08	0	0	1	1.75	0	0	0	57,082

Note: RC-135 hours are combined with all C-135 hours.

U.S. Air Force photo by Staff Sgt. Alex Lloyd

Human Factors

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FY08 was a ground-breaking year in the U.S. Air Force for the field of Human Factors. The safety community has become so keenly aware of human factors' pivotal involvement in nearly all mishaps across all safety disciplines that the former USAF Chief of Safety, Maj. Gen. Wendell Griffin, launched a Human Factors Division at the Air Force Safety Center. Armed with experts from across the aviation human factors spectrum, we've taken a close look at last fiscal year's aviation safety record and have some definite target areas for FY09.

Human Factors or Brain, Body and Stuff

To aid our discussion, it helps to organize human factors into categories to make it easier to understand. Brain includes those things that involve the brain: thinking, decision making, discipline, managing tasks, and situational awareness. Body is everything the environment or we do to ourselves, including hypoxia, G's, heat, cold, fatigue, dehydration, and alcohol consumption. Stuff is everything else, including cockpit/system design, publications and checklists, HUD symbology, training, and equipment.

We've investigated human factors in aviation long enough to understand the limitations of the brain and body. We generally employ the stuff to compensate for these limitations. Review of human factors involved in Aviation Class A and B mishaps during the past year revealed some interesting stuff.

U.S. Air Force photo by Tech. Sgt. Jeffrey Allen

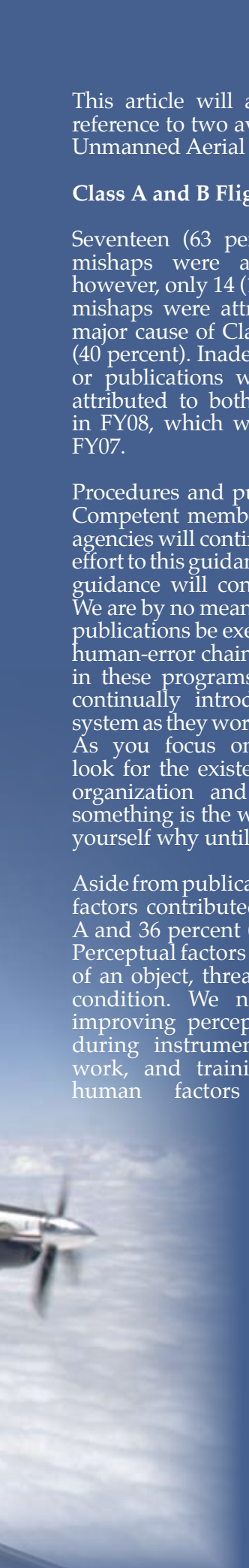
This article will address these human factors in reference to two aviation sub-categories: Flight and Unmanned Aerial Systems.

Class A and B Flight Mishaps

Seventeen (63 percent) of the 27 Class A flight mishaps were attributable to human factors; however, only 14 (16 percent) of the 87 Class B flight mishaps were attributable to human factors. The major cause of Class B flight mishaps was engines (40 percent). Inadequate procedural guidance and/or publications were the leading human factors attributed to both Class A and B flight mishaps in FY08, which was also a leading contributor in FY07.

Procedures and publications will never be perfect. Competent members of the USAF and supporting agencies will continue to dedicate valuable time and effort to this guidance, but inadequate and/or absent guidance will continue to plague our operations. We are by no means suggesting that procedures and publications be exempt from scrutiny and cause in a human-error chain. However, humans are involved in these programs and, as humans do, they will continually introduce latent conditions into the system as they work on procedures and publications. As you focus on procedures and publications, look for the existence of latent conditions in your organization and fix them. Ask yourself why something is the way it is, and then continue to ask yourself why until you develop a prudent answer.

Aside from publications and procedures, perceptual factors contributed to 65 percent (11/17) of Class A and 36 percent (5/14) of Class B flight mishaps. Perceptual factors are those in which misperception of an object, threat, or situation creates an unsafe condition. We need to increase emphasis on improving perception and combating this trend during instrument refresher courses, simulator work, and training sorties. Other contributing human factors included training (stuff), complacency (brain) and skill-based errors (brain). Fighting complacency is a constant battle. Fighting complacency starts on an individual level, but must get emphasized at leadership levels.



In FY08, there were 15 destroyed aircraft; 12 (80 percent) were caused by human factors. All 13 fatalities were caused by human factors. Many fatalities were due to late decisions to eject. Decisions to eject are not simple "go/no-go" calls. Aviators must interrupt a very intense activity (trying to solve the emergency) and then evaluate the decision to eject. In lab scenarios, such mental-task switching may take as long as 1.1 seconds. This does NOT include the time to perform the ejection actions. Reaction time is more than just "recognize, confirm and recover;" it includes stopping the previous actions. In FY08, that extra time meant 330 to 900 or more feet in lost altitude. Leadership must re-emphasize aircrew's requirement to follow personal ejection minimums, as well as published minimums. Also, remember that no matter what you fly, you're not alone. Using solid cockpit/crew resource management principles, your aircrew or flight wingmen must monitor remaining altitudes and call for the ejection before the final ejection altitude approaches. Wingmen and crew members are always part of a successful ejection, even if they don't actually pull the handle.

Class A and B UAS Mishaps

Eleven of the 12 Class A and two of the four Class B UAS mishaps were attributable to human factors. Just as with flight mishaps, inadequate procedural guidance and/or publications were leading contributors to both Class A and B UAS mishaps. In addition to procedures and publications, four of the 11 (36 percent) Class A UAS mishaps were attributed to design and acquisition processes. As these systems mature, design issues should be addressed both post-mishap with recommendations and during operations with risk-management and risk-reduction efforts. Channelized attention and proficiency also showed higher incidence in Class A UAS mishaps compared with manned aviation. With improved design and continued improvement in training, we hope to counter these attention-management issues.

Human Factors Emphasis Areas

Sometimes an accident occurs because we set ourselves up for failure. How can we set ourselves up for success? Examine publications for incompleteness and inconsistencies. How many techniques or "procedures" do you use that work well but are not codified in formal guidance? Perceptual errors are greatly influenced by experience. Building in larger safety margins for less-experienced aviators will help mitigate this hazard. We need to create and sustain a culture/environment that allows people to learn and know what "right" looks like, and also motivates/enables them to speak up when they see something that doesn't look/feel right. Combating potential mishaps due to human factors is everyone's job. If it doesn't seem right, it probably isn't.

Others

U.S. Air Force photo by Senior Airman Andy M. Kin

C-9

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	794
5-YR AVG.	0	0	0.2	15.96	0	0	0	921
10-YR AVG.	0	0	0.1	7.98	0	0	0	1,095
LIFETIME FY68-FY08	3	0.33	6	0.67	1	0.11	3	899,620

C-12

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	3,567.80
5-YR AVG.	0.2	4.74	0.2	4.74	0	0	0	4,219
10-YR AVG.	0.2	4.96	0.2	4.96	0	0	0	4,029
LIFETIME FY75-FY08	3	0.7	3	0.7	1	0.23	6	429,068

C-20

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	5,106.10
5-YR AVG.	0	0	0	0	0	0	0	4,757
10-YR AVG.	0.1	2.22	0.2	4.03	0	0	0	5,149
LIFETIME FY83-FY08	1	0.7	2	1.39	0	0	0	143,269

C-21

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	27,284.20
5-YR AVG.	0.2	0.64	0	0	0.2	0.64	0	39,480
10-YR AVG.	0.2	0.52	0.3	0.62	0.2	0.52	0.2	43,678
LIFETIME FY84-FY08	4	0.35	3	0.26	3	0.26	12	1,142,936

C-38

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	0	0	0	0	0	1,035.40
5-YR AVG.	0	0	0	0	0	0	0	1,025
10-YR AVG.	0	0	0	0	0	0	0	1,060
LIFETIME FY98-FY08	1	0.7	2	1.39	0	0	0	10,848

C-40

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	1	15.24	0	0	0	6,561.6
5-YR AVG.	0	0	0.2	3.67	0	0	0	5,445
10-YR AVG.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LIFETIME FY02-FY08	0	0	1	2.97	0	0	0	30,372

CV-22

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	6	205	0	0	0	2,919.90
5-YR AVG.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-YR AVG.	N/A	N/A	2	N/A	N/A	N/A	N/A	N/A
LIFETIME FY06-FY08	0	0	7	134	0	0	0	5,222

F-117

Year	Class A		Class B		Destroyed		Fatal	Hours
	No.	Rate	No.	Rate	A/C	Rate	All	
FY08	0	0	1	0	0	0	0	3,289.20
5-YR AVG.	0	0	1	13.27	0	0	0	9,235
10-YR AVG.	0.1	0.76	0.8	8.99	0	0	0	11,097
LIFETIME FY84-FY08	7	3.19	10	4.56	3	1.37	1	219,440

Note: These charts reflect flight-only mishaps, not all flight-related mishaps.

Engines

FY08 Year in Review

CARY HEMBREE
Air Force Safety Center
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FY08 provided a major accomplishment for propulsion safety in the U.S. Air Force. There were no aircraft losses (non-UAV) due to an engine-related issue (Figure 1). This statistic speaks volumes for those who maintain and manage the USAF inventory of engines, both in the field and at the depot. It also speaks well of the professional relationship that exists between USAF engine managers and maintainers, and the engine manufacturers. This relationship is a key factor in finding cost-effective solutions to safety issues that arise year to year. This accomplishment also further confirms the effectiveness of the risk-management process employed by the director of propulsion and the senior leader for propulsion. Overall, there were only five engine-related Class A mishaps for the year: one B-1B, one A-10, and three KC-10s. A summary of each appears in this article.

The Fighter Factor

The fighter section of this article usually provides ample opportunity to discuss the year's Class A mishaps. For FY08, there were three Class A mishaps for the F-16, with ***none*** caused by the engine, a significant improvement from FY07 (Figure 2).

Photo courtesy of Pratt & Whitney

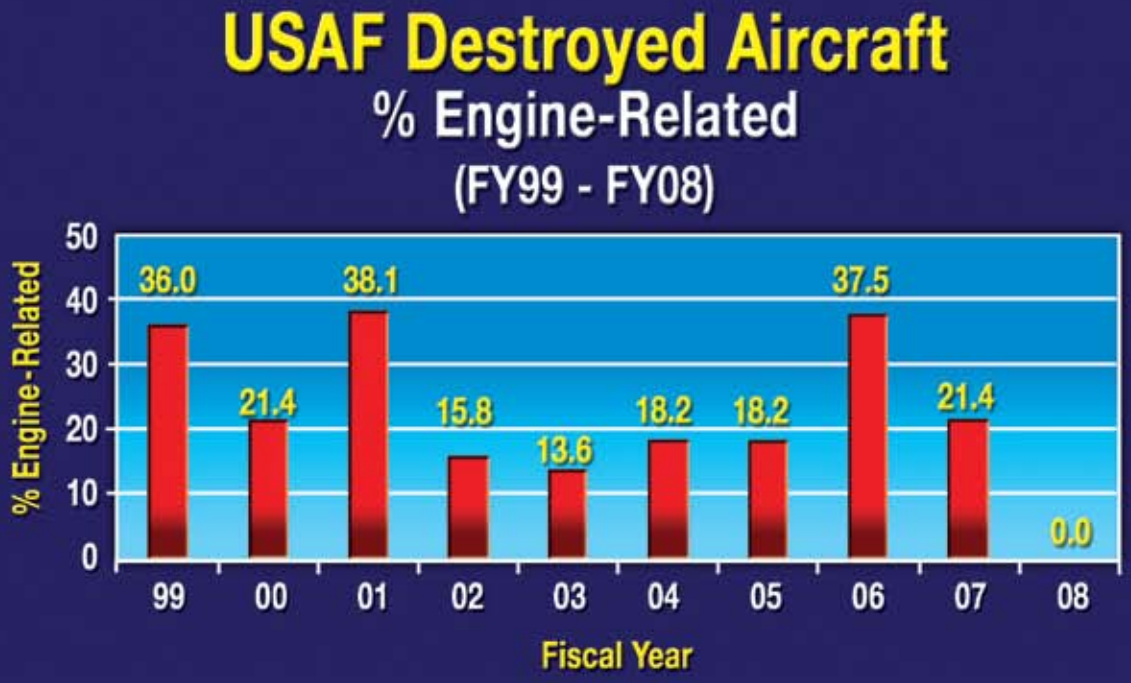

Figure 1

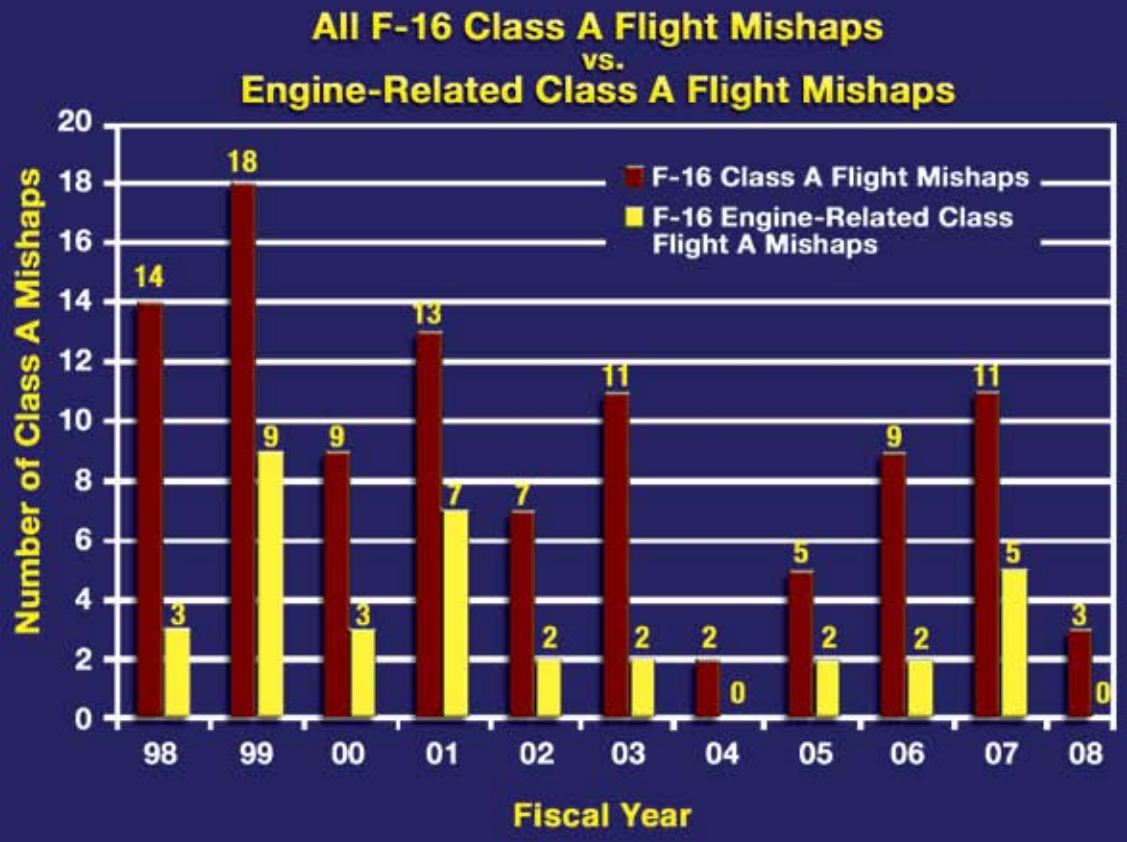

Figure 2

F-16

Table 1

F-16 Engine-Related Destroyed Aircraft Statistics						
Fiscal Year	FY06		FY07		FY08	
Engine	Aircraft Losses	FY05 Rate	Aircraft Losses	FY06 Rate	Aircraft Losses	FY07 Rate
F100-PW-220	1	0.94	3	3.34	0	0.00
F100-PW-229	0	0.00	0	0.00	0	0.00
F110-GE-100	1	0.68	0	0.00	0	0.00
F110-GE-129	0	0.00	0	0.00	0	0.00
All Engines	2	0.62	3	0.99	0	0.00

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

Table 1 depicts the F-16 engine-related destroyed aircraft by engine model and their mishap rates per 100,000 flight hours for the last four fiscal years. FY08 was a definite improvement for the engines powering the F-16.

The engines powering the F-15 continued their return to a reputation for being unremarkable with regard to causing aircraft losses — there were no engine-related losses of aircraft or engine-related Class A's for the F-15 (Table 2 and Figure 3).

U.S. Air Force photo by Staff Sgt. Henry Hoegen

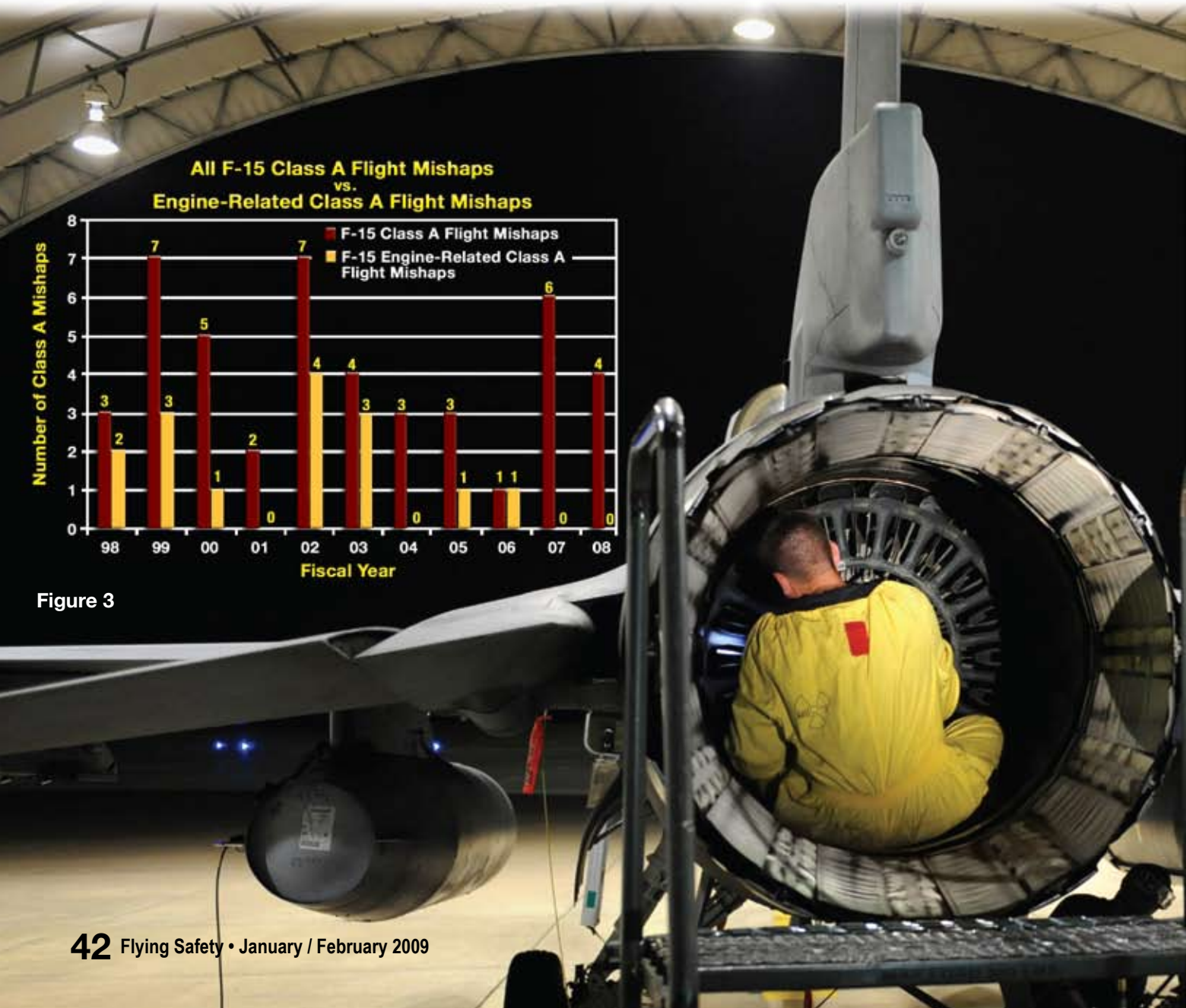

Figure 3

Table 2

F-15

F-15 Engine-Related Destroyed Aircraft Statistics						
Fiscal Year	FY06		FY07		FY08	
Engine	Aircraft Losses	FY05 Rate	Aircraft Losses	FY06 Rate	Aircraft Losses	FY07 Rate
F100-PW-100	0	0.00	0	0.00	0	0.00
F100-PW-220	1	0.60	0	0.00	0	0.00
F100-PW-229	0	0.00	0	0.00	0	0.00
All Engines	1	0.32	0	0.00	0	0.00

Note: This chart reflects flight-only mishaps, not all flight-related mishaps.

KC-10 / F-103-GE-101

There were three dollar-value Class A events in the KC-10 fleet during FY08. Unfortunately, at the time of this writing, all three were still undergoing teardown and technical analysis. Because the investigations are still open, details are not yet releasable. Also, the mishap classifications could potentially be downgraded.

During departure on a local training sortie, the No. 2 engine experienced a loss of engine oil quantity and pressure. In accordance with flight manual procedures, the crew shut down the engine and returned to base. Postflight maintenance inspection revealed several pieces of metal on the engine chip detector, requiring the engine to be removed.

During departure/climb, the crew noticed the No. 3 engine exhaust gas temperature climbing above 1,000 degrees, with associated EGT light. The crew brought the engine to idle, transitioned to two-engine operations, and returned to base. Postflight inspection revealed damage to the high-pressure turbine, requiring the engine to be removed.

During a routine maintenance inspection, maintainers discovered metal debris in the engine "C" sump. In accordance with technical order requirements, the engine was removed and submitted to maintenance.

B-1 / F-101-GE-102

About two hours into a navigation test-leg sortie, the crew experienced a No. 2 engine malfunction. The engine was reduced to idle with normal indications. Thirty minutes later, the engine EGT began to rise. Soon after, engine RPM decreased and the constant-speed drive subsequently decoupled, causing the generator to fall off line. The crew shut down the engine and returned to home station.

Teardown and analysis of the engine revealed the No. 4 bearing failed due to frictional heating and melting of the bearing component surface. Unfortunately, due to the extensive damage to the bearing hardware, the root cause of the bearing deterioration could not be determined.

The OEM currently has a redesigned bearing, which provides risk mitigation for this issue. Bearings are in procurement.

A-10 / TF34-GE-100

During return to base following a four-ship flight-lead upgrade close air support sortie, the pilot experienced an engine failure and completed a single-engine straight-in approach and landing.

Postflight inspection revealed extensive damage to the No. 2 engine (low- and high-pressure turbines sections missing). Both the interim and safety board members performed numerous searches to locate/recover the missing engine hardware. Nearly all the engine components were recovered, except for portions of the high-pressure turbine section. Post-mishap analysis of the engine and recovered hardware indicate the HPT Stage 1 disk liberated and exited the engine, causing the low-pressure turbine section to separate and exit out the aft portion of the cowling. Because the first-stage disk was not recovered, a clear root cause for the failure could not be determined. The SIB evaluated the most likely reasons for an HPT disk failure, and determined the failure occurred for one or more of the following reasons: manufacturing defect, assembly defect, operation of life-limited parts beyond the OEM's recommended life limit.

At the time of this writing, the TF34 engineering flight at the OC-ALC depot continues to pursue the root cause for a Stage 1 HPT disk failure. This includes inspecting disks from the same manufacturing lot, review of assembly/engine build procedures, and lab analysis of a percentage of removed disks.

F-16 / F-110-GE-100/-129

As shown earlier, there was no engine-related loss

of aircraft or dollar-value Class A mishaps involving the F110-powered F-16 fleet for FY08. This is a great tribute to the entire F110-GE-100/-129 maintenance and engineering communities, especially in view of current sortie demand and ops tempo realities both at home and at deployed locations.

More on the F-110 engine

Much of this positive trend can, in part, be attributed to the influx of new and improved hardware as a result of programs such as the Service Life Extension Program and Augmenter Exhaust Nozzle Refurbishment Program. Additionally, the entire F-110 maintenance community is having a positive impact as a result of increased awareness to top safety drivers, diligent hardware inspections, and other preventive maintenance efforts.

Another key contributor to fleet safety and readiness is the Component Improvement Program. This joint program between the system program office and GE-Aviation works long-term design solutions for field issues. For example, the No. 4 bearing design improvements (stiffened high-pressure turbine-rotor aft shaft, improved chip-migration nut, stronger nitrided M50 bearing) are making their way into the fleet, addressing one of the higher-risk issues associated with the F-110. Several other CIP initiatives include:

- Turbine-frame strut oil-tube redesign (F-110-GE-100): This initiative introduces a redesigned turbine-frame aft sump oil-supply tube to address tube cracking and consequent oil-loss concerns. A TCTO to incorporate this redesigned tube was released in late 2005 and is underway.

U.S. Air Force photo by Margo Wright

- Alternator rotor and drive-shaft redesign (F-110-GE-100/-129): Both the alternator rotor and drive shaft have been redesigned to prevent slippage and consequent erroneous speed input to the digital-engine control. A TCTO to incorporate this improved design is underway.

- Inlet Guide Vane Actuator Fuel Manifold (F-110-GE-100/-129): An improved design manifold was introduced to address fuel-leak events. All operational engines have been modified.

- Improved No. 4 bearing-assembly procedures (F-110-GE-100/-129): The F-110 maintenance community recently received improved No. 4 bearing-assembly procedures, leveraging best practices from other engine lines. These improvements address assembly-induced bearing-damage potential, which was identified as a leading cause of premature bearing distress. This root-cause contributor information became available as a result of finding bearing spall events early in the progression sequence because of SEM/EDX detection capability, another product of CIP.

- Augmenter Fuel Manifold (F-110-GE-100/-129): A redesigned manifold was recently qualified and will be introduced via TCTO. This new manifold addresses fuel-leakage concerns associated with the legacy configuration.

- Turbine-Frame Fairings (F-110-GE-129): Redesigned turbine-frame fairings, which address one of the leading safety risks for the F-110-GE-129, are now available for retrofit and are being introduced via TCTO.

The F-110 program is reaping big safety benefits from the hard work of many in the entire propulsion community, from the maintainers in the shop and on the line, all the way up to the senior leadership within the SPO, ALC, and OEM.

There were no aviation propulsion-related destroyed aircraft or dollar-value Class A mishaps in any Pratt & Whitney-powered military aircraft for FY08. This is quite a testament to the proactive risk-management procedures of the USAF and the dedication of Air Force maintainers, engineers, equipment specialists, and support from P&W.

Congratulations to all who made FY08 such an exceptional year for propulsion safety! Let's all strive to continue those efforts into FY09.

Maintenance

U.S. Air Force photo by Airman 1st Class Kenny Holston

CHIEF MASTER SGT. SANDY STACY
Air Force Safety Center
Aviation Safety Division
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It's the end of the year and time to review how safe we've been for the last 12 months. What do you think? Did supervision enforce tech data use? Did your trainer teach you the book, or "This is how we do it on the flight line"? Did you have to call a "knock it off"? For the most part, you're taking the time to do the job right. However, some of you are still choosing not to follow tech data, correctly torque parts, or control your tools. How do I know this? Because these were the leading reasons we maintainers caused mishaps this year.

This year, maintenance contributed to one Class A and six Class B mishaps. Compared with recent years, this is definitely an improvement. Since 2000, we've averaged five Class A and 10 Class B mishaps a year, so be proud of yourselves for the work you've done. Still, we've got some work to do. Below is a recap of FY08 mishaps.

Class A

B-1 — Total loss of system No. 3 hydraulics during flight. Supervision failed to ensure crimping tools were properly maintained, preventing maintainers from correctly crimping the hydraulic line. Additionally, after installing the hydraulic line, maintenance failed to properly leak-check the line.

Class B

F-16 — After aircraft taxi, the crew chief noticed some tools missing from the CTK. The aircraft was called back from EOR and significant engine damage was found. The crew chief left mirror and flashlight in the intake.
F-16 — Compressor stall after flight, in chocks. Engine backshop improperly rigged the VSV bell cranks.
C-130 — The No. 4 engine was FODed out by an aircraft screw. During maintenance, a screw was left in the intake and not found during intake inspections.
A-10 — Gun and aircraft panels damaged during gun firing. During installation, the gun barrels were not locked in place; the mid-barrel support was also not correctly installed.
E-3 — During climbout, a bushing, washer, and retaining nut from the fuel manifold liberated and struck the first-stage turbine blades. Depot supervision failed to provide the correct tools to properly crimp fuel manifold hardware, resulting in an improperly installed manifold.
CV-22 — The swashplate was damaged by a dislodged shear bolt during blade stowage. During installation of the swashplate horn, the shear bolt

nut was improperly torqued.

In addition to the Class A and B's, we caused 29 Class C mishaps this year. While these don't have the same high dollar-value impact, they still create extra work and the temporary loss of a combat asset. What causes a Class C mishap? Not installing the correct software in the F-16 anti-skid system. Not installing the correct wheel bearing and locking nuts. Not removing the old "O" ring before installing the new one. Failing to document aircraft forms and provide a good turnover to the next maintenance crew. Not performing a running torque check or using the correct torque value when installing parts. All these caused Class C mishaps, but the No. 1 reason was failing to follow tech data.

Why do people not read TOs? I know section chiefs, NCOICs, and OICs continue to impress upon us to "follow the book." From our first day in tech school to our first duty station, we've been told to follow TOs, so why don't we? Did our first trainer tell us, "This is the real Air Force, so forget all that stuff you learned in tech school"? If your supervisors said this, they were wrong. There's no excuse for not following tech data.

What do you do if you're preparing to tow an aircraft, and the tow supervisor tells you there's no time for a briefing, so just get going? What if you haven't towed an aircraft for awhile and are unsure of the procedures and really need the briefing? Do you go ahead and start the tow, or do you call "knock it off?" We all know the answer is to stop the tow until the briefing is completed. AFI 21-101 empowers you to do just that — stop any unsafe act regardless, even if you're the most junior person on the team. That's what we call maintenance resource management.

MRM is a new program available to all the maintenance groups in the Air Force. It's a terrific way to bring all maintainers together in one room to discuss the correct way to do maintenance. From the lowest Airman to the chiefs and officers, they hear the same thing: the only way to do maintenance is to follow tech data, communicate up and down the chain, and work safely.

Now that you've read this, I want you to think about these mishaps the next time you work on an aircraft, engine, tester, or test stand, and contemplate not following the rules. Do you want to be the person who causes the next mishap? Is it really worth the risk of damaging equipment or hurting someone to deviate from tech data? If you're a supervisor, enforce the rules. If you're a section chief, enforce the rules. If you're the OIC or NCOIC of a branch or AMU, enforce the rules. If you're just walking around the flight line and see something that looks unsafe, stop and investigate; you may just save someone's life or keep an aircraft from crashing. Be proud of what you do. I'm proud of each of you.

U.S. Air Force photo by Airman 1st Class Jason Epley

Class A Flight Mishaps

FY09 (through Dec. 4)

Class A Mishaps

	FY09	Same Date in FY08	Total FY08
ACC	1	1	9
AETC	1	1	6
AFMC	0	0	1
AFRC	0	0	3
AFSOC	0	0	0
AFSPC	0	0	0
AMC	0	1	4
ANG	0	2	3
PACAF	0	1	1
USAFE	0	0	0
AF at Large	0	0	0
Total	**2 / 0.56**	**6 / 1.69**	**27 /1.37**

Flight Rate Producing

Nov 12 F-16C ✈ Engine fire; aborted takeoff; departed runway; no injuries

UAS

Nov 02 MQ-1B ✈ Crashed after takeoff
Dec 04 MQ-1B ✈ Crashed during landing

- A Class "A" aircraft mishap is one in which there is loss of life, injury resulting in permanent total disability, destruction of a USAF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crew members successfully ejected/egressed from their aircraft.
- Reflects all fatalities associated with USAF aviation category mishaps.
- "✈" Denotes a destroyed aircraft.
- USAF safety statistics are online at ***http://afsafety.af.mil/stats/f_stats.asp***
- **If a mishap is not a destroyed aircraft or fatality, it is only listed after the investigation has been finalized (as of Dec. 4).**

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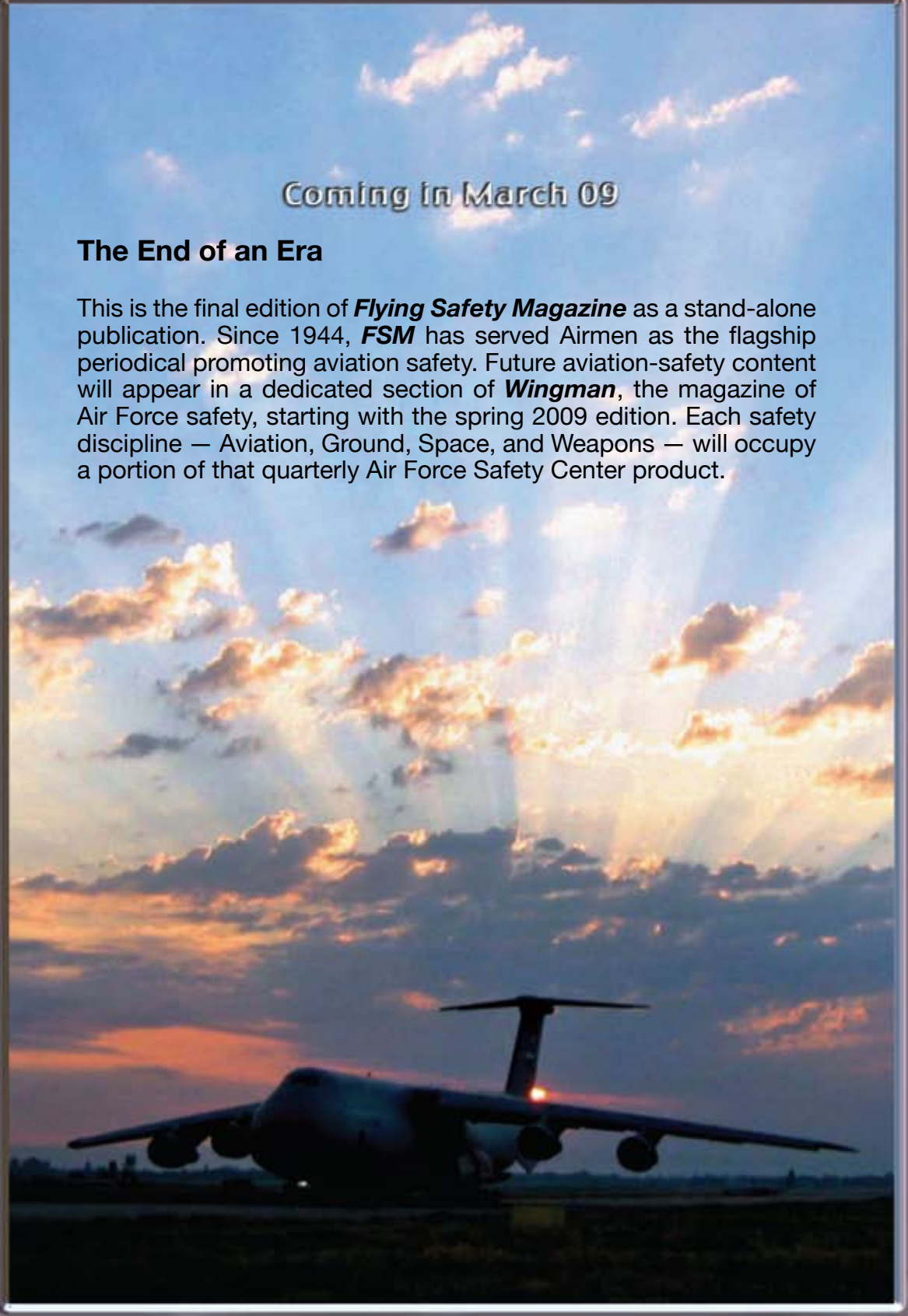

The End of an Era

This is the final edition of ***Flying Safety Magazine*** as a stand-alone publication. Since 1944, ***FSM*** has served Airmen as the flagship periodical promoting aviation safety. Future aviation-safety content will appear in a dedicated section of ***Wingman***, the magazine of Air Force safety, starting with the spring 2009 edition. Each safety discipline — Aviation, Ground, Space, and Weapons — will occupy a portion of that quarterly Air Force Safety Center product.