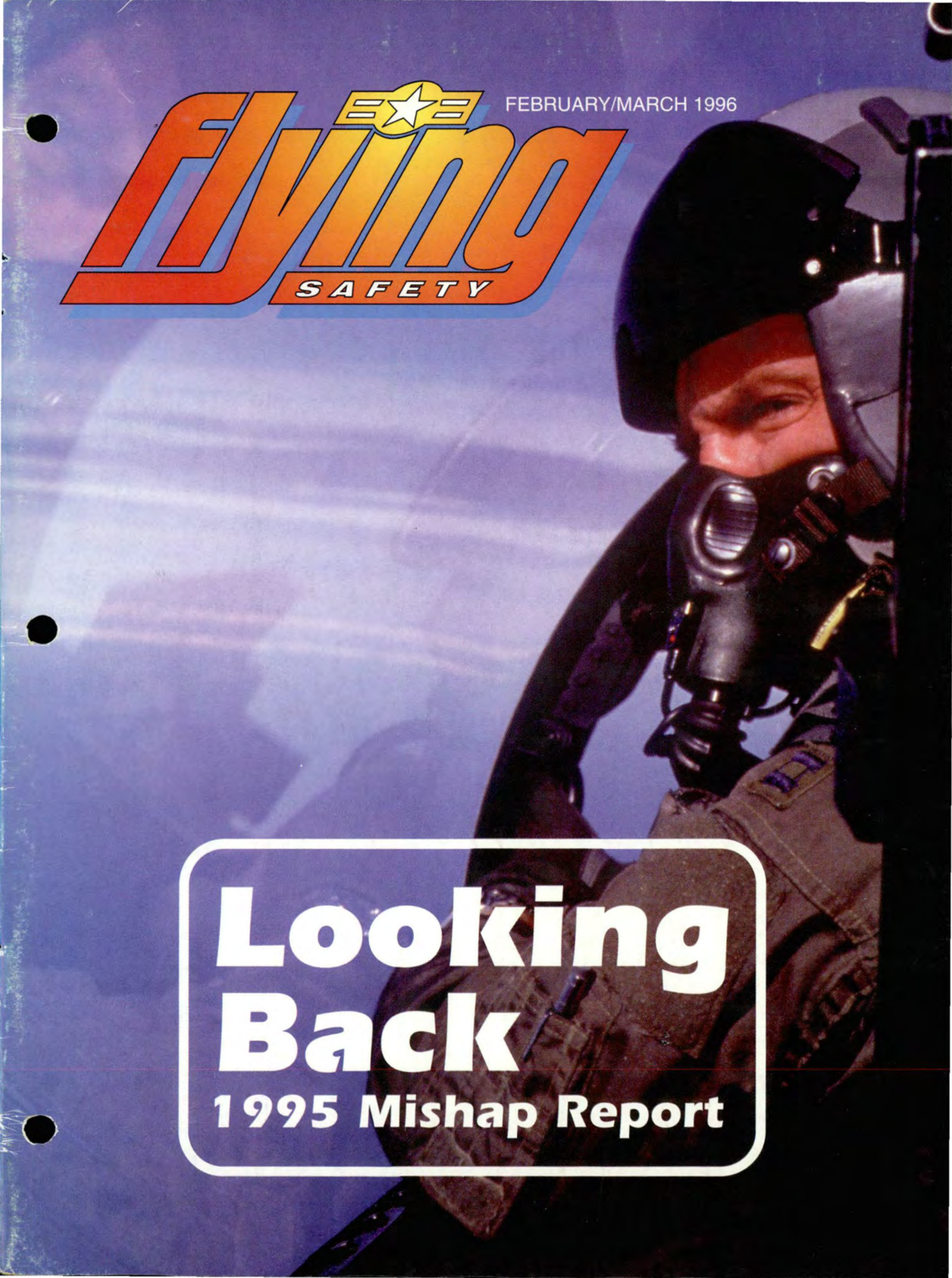
FEBRUARY/MARCH 1996

flying SAFETY



Looking Back

1995 Mishap Report

There I Was

■ There I was, on my first buddy instructor pilot (BIP) out-and-back sortie. My BIP and I flew a very uneventful sortie to McGhee Tyson in Knoxville, Tennessee. It was early in January, and the weather on the first flight was clear but rather cool. After rechecking the weather, verifying our flight plan, and getting a bite to eat, we headed back to Columbus AFB in Mississippi.

On our return flight, we filed to an altitude of 20,000 feet. As we headed back towards the west, weather began to build ahead of our flightpath. As we passed through about 18,000 feet, we began to get into a thin layer of clouds. At that exact time, I noticed our airspeed indicator was beginning to slowly decrease. I checked my throttles to ensure they were in military, which they were, and then thought maybe I had increased our pitch attitude as we entered the weather.

A quick cross-check of the ADI and VVI indicated this had not happened. I immediately lowered the aircraft's nose and descended just below the weather to level off. A check of our ground speed indicator showed our ground speed increasing while the indicated airspeed continued to decrease. At the exact time this was occurring, I noticed our elevator trim was also not working. This out-and-back was about to turn into an unexpected overnight stay at a civilian field.

We declared an in-flight emergency and notified Nashville Center we had lost our airspeed indications and trim. As soon as we notified Center, they started calling out headings and altitudes for us. In analyzing our situation, we realized we probably had a static system malfunction, and the elevator trim was most likely frozen. Realizing we needed to reestablish an alternate static flow in the aircraft's systems, we searched our craniums for the next logical step.

Recalling the procedure of breaking one of the aircraft's static system instruments (altimeters, airspeed indicator, or VVI), we chose to break the airspeed indicator on the instructor pilot's side of the cockpit. This procedure is talked about a lot, but I had never heard of anyone actually doing it. I discovered it is very difficult to reach the canopy breaker tool, located on the center canopy rail, if you are wearing your winter-weight flight jacket and are tightly strapped in. I struggled slightly and was finally able to release the canopy breaker tool. I used it to break the airspeed indicator, and immediately, just as advertised, all the static instruments began to operate properly.

As Center continued to call out altitudes, I verified our static system instruments were all functioning once again. In the meantime, my BIP was coordinating with Nashville Center for our divert. We had just passed the Chattanooga VORTAC on the jet route we had filed, so the decision as to where to go was pretty easy to make. With all systems operating correctly, we continued our descent for a landing. Well, one problem was solved, but another was there yet. Our elevator trim still did not work. Fortunately, I had kept the aircraft trimmed up at 160 KIAS, our climb speed. The mighty Tweet was completely controllable at slow speed, and our approach and landing were rather uneventful.

So, what did I learn from this situation?

■ Know your systems cold. This situation is not covered at all in our checklist or in-flight guide. We could have broken the altimeter on the IP's side, but the altitude encoding for ARTCC is in that instrument, so it's rather expensive.

■ Be aware of your surroundings. We had a pretty bad rainstorm the previous day, and the T-37 has a tendency to trap water in its static ports and in the trim motors. We were flying well above the freezing level on our trip home — a bad combination!

■ It is pretty difficult to reach the canopy breaker tool in flight. All you Tweet drivers out there should give it a try before you actually have to do it.

USAF Photo by SMSgt Bob Wickley

■ Work as a crew in an emergency if there is someone else in the jet. Use the knowledge and experience of each crewmember during an emergency situation. Between us, we had over 8 years of experience flying the Tweet, and we were able to handle this unique situation perfectly because we worked together so well.

As we suspected, the previous day's heavy rainstorm was the culprit in both malfunctions. Flying above the freezing level compounded the situation when everything froze up. But you can bet the next time I'm out there flying, I'm ready for anything the venerable Tweet can throw at me! ■

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Our front cover courtesy
SrA Andrew N. Dunaway, II
Official USAF Photo

SPECIAL FEATURES

FY95 was another good year for the Air Force. We had 32 Class A mishaps, and after several years of very gradual declines, the overall rate dropped from 1.51 to 1.44. Our fighter aircraft experienced their second best year with a rate of 2.55 only to be surpassed by FY91 at 2.54

In this issue, we take a look at how we did in FY95 in our heavy aircraft, helicopters, and fighter and trainer aircraft. To facilitate the use of this information and provide a consolidated reference resource, we have combined these articles into one issue. We hope you find it useful.

CONTRIBUTIONS

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

B-1/B-2/B-52

USAF Photo

LT COL TOM DYER
HQ AFSC/SEFP

■ Hi! This is my first article for *Flying Safety* magazine as I am the "new guy on the block" here at the Air Force Safety Center. With limited experience in the safety arena, I am working on a steep learning curve.

I had been on the job all of 2 weeks when a "friendly" coworker approached me and said, "How is your article going? Don't forget it is due by 15 September." As in all emergency situations, I looked at my watch and saw the date was 7 September. So I looked back at him with a curious expression on my face and asked, "What article?"


USAF Photo by SMSgt Boyd Belcher

I realized, by being a new guy in an organization, you tend to be the object of practical jokes, but I had a sinking feeling this was not going to be the case. He proceeded to tell me each year all action officers in the Aviation Safety Division are responsible for writing an article discussing the previous year's safety record and any current items of interest for the aircraft they oversee.

Well, I thought to myself, this assignment shouldn't be too hard — until I realized I am responsible for all bomber aircraft. Immediately, my head began to swim, and I started to develop a headache. So I decided to do what any self-respecting crewmember would do in this circumstance. I went to my computer and started to babble.

Well, that brings us to this point where I must now get down to the business at hand or maybe EJECT! Since this was never a happy thought (thank goodness all our bombers have more than two engines — eat your heart out, fighter guys!), I decided this assignment would not go away. So, the best defense is a good offense (my required sports metaphor). Well, here goes, and I hope you all enjoy my first article.

For FY95, the bomber force again produced excellent results. We had one Class A and three Class B mishaps this year. The one Class A was a B-52 mishap where the Nos. 3 and 4 engines separated from the aircraft, but the aircraft was recovered successfully with no further damage. We at the Safety Center congratulate the crew for a successful conclusion to this serious emergency.

The three Class B's included another engine problem on the B-52 where a compressor hub failed, causing structural damage. However, the aircraft again returned to base and landed safely. The B-1 had three Class B mishaps. These included a bird strike, cooling access door separation, and a hard point cover which was ingested into various engines. Again, all aircraft returned to base and landed uneventfully.

So, the FY95 Class A rate for the B-52 and B-1 are 4.05 and zero (the B-1 did not have a Class A mishap in FY95), respectively. The lifetime rates for these aircraft are 1.30 (B-52) and 4.49 (B-1). This is the second year of a zero Class A mishap rate for the B-1. Everyone involved in this program should have a great feeling of accomplishment. The B-1 is a very complex aircraft which has been expanding its role in aerospace employment. So a zero Class A rate is definitely noteworthy.

There is one aircraft I haven't mentioned yet, the B-2. The reason I haven't talked about the "Spirit of" aircraft is because there has been no reportable mishap in the last year. The B-2 has yet to have a Class A, B,

continued on next page

Flying SAFETY

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USAF Photo by SrA Andrew N. Dunaway, II

or C mishap. As a new safety officer, this is a great statistic, and I hope this is the case for the entire lifetime of this aircraft. The B-2 is truly a remarkable aircraft which is expanding the envelope in bomber warfare. I hope and pray this record will continue. Keep up the great work, and good luck!

Now, for an area that is not as easy to quantify as mishap rates, yet is just as (if not more) important than identifying the mishap rate for each aircraft type. What I am talking about is risk management. This is a new area the Safety Center is tackling and moving toward setting up as an Air Force program. You may ask, "What does this have to do with me? I am just a line crewmember at Base X doing my job." My answer to that is, "You are the perfect person to become aware of this concept and, more importantly, put its principles into practice."

We all know the Air Force is getting smaller (sometimes it seems to happen almost daily). However, the demands on the Air Force have not decreased along with our decreasing force structure. In fact, the operational tempo has increased over the last couple of years. It appears the Air Force is doing more with less.

The bottom line is: It is EVERYONE'S responsibility to ensure flying operations are as safe as possible.

I know the demands on our bomber force today are greater than just a few years ago. The crews are TDY more, flying longer missions (Global Reach missions), and being more heavily tasked by operations plans. All this can lead to an environment where caution could be "thrown to the wind" in the name of mission accomplishment. The pressure could be mounting on our crew force, squadron commanders, and wing commanders to accomplish a mission. If we are not vigilant during this time, tragedy may strike. Nobody wants this to happen. General Ronald R. Fogleman, Chief of Staff, USAF, has recognized the potential for disaster and has released a message giving everyone the authority and responsibility to stop any action which could potentially lead to a mishap. (See the back cover of the September *Flying Safety* magazine.)

So, how do risk management and General Fogleman's message relate? They are the same! It is up to everyone in the entire chain of command, from the individual crewmember to commanding officer, to understand that accurate, current, and timely assessments of the mission, work environment, and personal life are a necessity in prevention of mishaps.

If anyone thinks I can affect your mishap prevention program from the beautiful "Land of Enchantment," then I think you must take a serious look at your program. It is everyone's duty to call "knock it off" if the situation becomes too difficult for whatever reason. This includes while you are in the air or on the ground.

This "knock it off" call also includes when the operations officers see their crews dragging in the squadron or when the level of complaining is on the increase for no apparent reason. It may be time for the squadron to take a rest and recover to a safe situation. It is better to pass up a training mission and take a few days off than to convene a mishap investigation board and inform dependents their loved one is not returning from a "normal training" mission. I don't know about you, but the former is definitely on the top of my list.

The bottom line is: It is **EVERYONE'S** responsibility to ensure flying operations are as safe as possible. We hear this all the time (and after a while, it becomes so ingrained we do not listen), but it is **NOW** more important than ever. The Air Force has too few resources (both human and material) to lose even one asset in an avoidable mishap. So, from one former crewmember to all you current crewmembers, please watch out for yourselves along with observing all the people you are involved with in your flying operations. Keep your head up and **FLY SAFE!** ■

USAF TRANSPORTS
PROVIDING AMERICA'S GLOBAL REACH

USAF Photo

LT COL DAN DOUGHERTY
HQ AFSC/SEFP

■ *"The actual operation of a successful airlift is about as glamorous as drops of water on stone. There's frenzy, no flap, just the inexorable process of getting the job done. In a successful airlift, you don't see planes parked all over the place; they're either in the air, on loading or unloading ramps, or being worked on. You don't see personnel milling around; flying crews are either flying or resting up so that they can fly again tomorrow. Ground crews are either working on their assigned planes or resting up so they can work on them tomorrow. Everyone else is also on the job, going about his work quietly and efficiently. The real excitement from running a successful airlift comes from seeing a dozen lines climbing steadily on a dozen charts — tonnage delivered, utilization of aircraft, and so on — and the lines representing* ***accidents and injuries going sharply down*** (emphasis added). *That's where the glamour lies in air transport."*

Lieutenant General William H. Tunner provided the above quote, and he should know. He commanded airlift operations during the Hump, the Berlin Airlift, and the Korean War. He retired in 1960 as the commander of the Military Air Transport Service, and I think he'd be very proud of us now.

We measure mishaps per 100,000 hours, and the figure continues down. But if we measured mishaps per 100,000 tons, we might be absolutely astonished. Tables 1, 2, and 3 will give you an idea of the scope airlifters work in. That's not to say we're perfect — not yet.

We buried eight crewmembers this year as a result of two Class A mishaps, one in a C-130 and the other in a C-21. Then there were over 100 close calls in Class B's, C's, and High Accident Potentials (HAP). This year's article will cover seven airlifters, the C-5, -9, -12, -17, -21, -130, and -141. Without ado, let's get started.

continued on next page

Table 1
Inventory by Command

MAJCOM	C-5	C-9	C-12	C-17	C-21	C-130	C-141
AMC	75	12	29	16	19	—	176
ANG	28	—	6	—	4	217	16
AFRES	16	—	—	—	—	139	36
AETC	7	—	4	—	14	10	15
ACC	—	—	—	—	13	179	—
AFSOC	—	—	—	—	—	75	—
PACAF	—	3	6	—	6	29	—
USAFE	—	5	—	—	13	19	—
AFMC	—	—	31	5	6	18	4
AFSPC	—	—	—	—	6	—	—
Totals:	126	20	76	21	82	686	243

Source: Aerospace Vehicle Inventory, 30 Jun 95

USAF Photo by SrA Andrew N. Dunaway, II

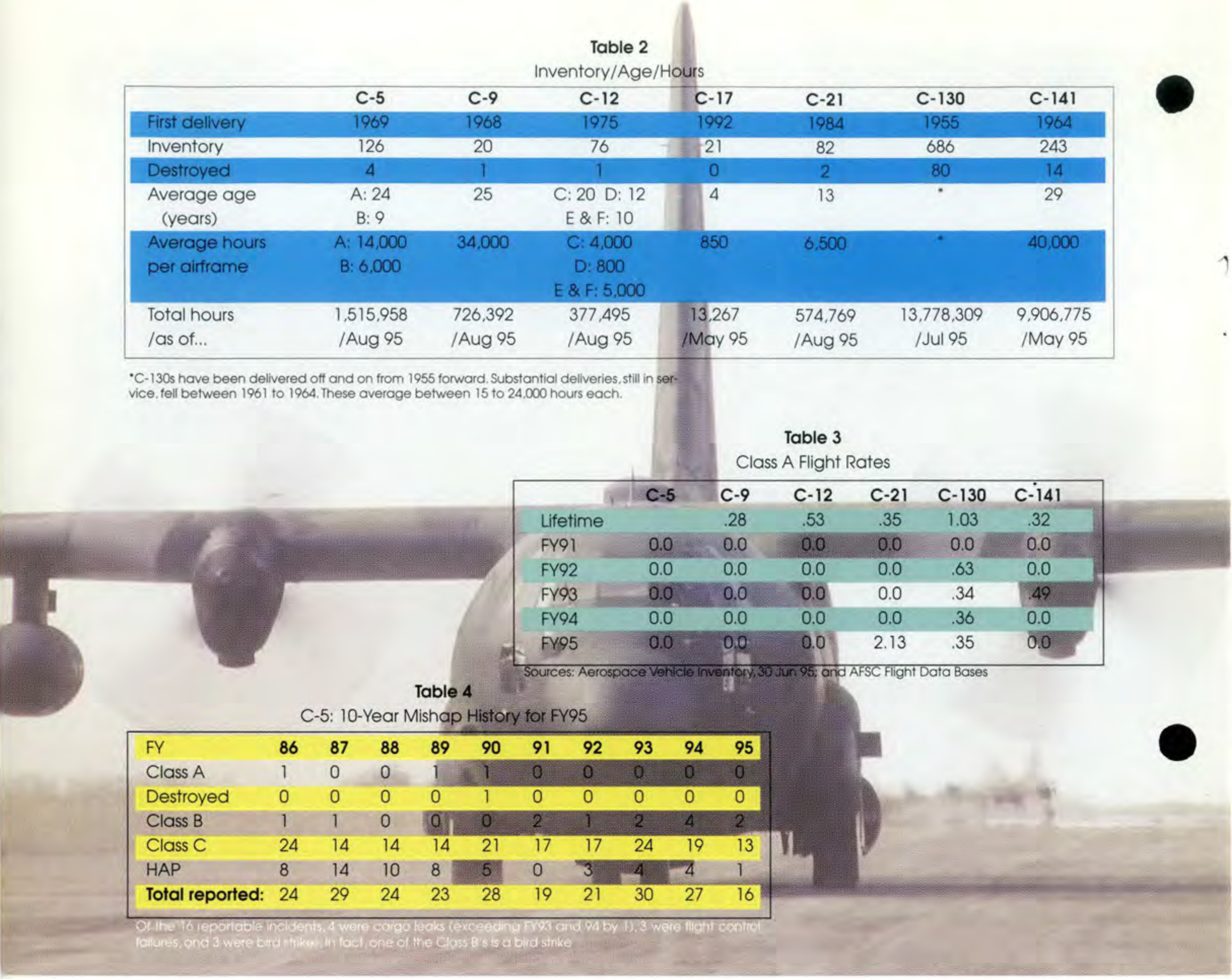

Table 2
Inventory/Age/Hours

	C-5	C-9	C-12	C-17	C-21	C-130	C-141
First delivery	1969	1968	1975	1992	1984	1955	1964
Inventory	126	20	76	21	82	686	243
Destroyed	4	1	1	0	2	80	14
Average age (years)	A: 24 B: 9	25	C: 20 D: 12 E & F: 10	4	13	*	29
Average hours per airframe	A: 14,000 B: 6,000	34,000	C: 4,000 D: 800 E & F: 5,000	850	6,500	*	40,000
Total hours /as of...	1,515,958 /Aug 95	726,392 /Aug 95	377,495 /Aug 95	13,267 /May 95	574,769 /Aug 95	13,778,309 /Jul 95	9,906,775 /May 95

*C-130s have been delivered off and on from 1955 forward. Substantial deliveries, still in service, fell between 1961 to 1964. These average between 15 to 24,000 hours each.

Table 3
Class A Flight Rates

	C-5	C-9	C-12	C-21	C-130	C-141
Lifetime		.28	.53	.35	1.03	.32
FY91	0.0	0.0	0.0	0.0	0.0	0.0
FY92	0.0	0.0	0.0	0.0	.63	0.0
FY93	0.0	0.0	0.0	0.0	.34	.49
FY94	0.0	0.0	0.0	0.0	.36	0.0
FY95	0.0	0.0	0.0	2.13	.35	0.0

Sources: Aerospace Vehicle Inventory, 30 Jun 95; and AFSC Flight Data Bases

Table 4
C-5: 10-Year Mishap History for FY95

FY	86	87	88	89	90	91	92	93	94	95
Class A	1	0	0	1	1	0	0	0	0	0
Destroyed	0	0	0	0	1	0	0	0	0	0
Class B	1	1	0	0	0	2	1	2	4	2
Class C	24	14	14	14	21	17	17	24	19	13
HAP	8	14	10	8	5	0	3	4	4	1
Total reported:	24	29	24	23	28	19	21	30	27	16

Of the 16 reportable incidents, 4 were cargo leaks (exceeding FY93 and 94 by 1), 3 were flight control failures, and 3 were bird strikes. In fact, one of the Class B's is a bird strike

USAF Photo by SrA Andrew N. Dunaway, II

C-5

The Galaxy suffered one Class B to a bird strike and another to an engine case rupture this year. That's compared to four bird strike Class B's last year. They suffered through four cargo leaks, one wheel well fire to a hydraulic leak, one loss of attitude direction, and three flight control failures.

One malfunction that continues to plague this community is false Thrust Reverser Not Locked lights. Aerodynamic tests indicated immediate (and that's spelled *IMMEDIATE*) engine shutdown is required or loss of directional control will occur. Now, it's not that our crews can't handle *quick* reaction checklists, it's shutting down perfectly good engines that gets old. The folks at San Antonio have a good idea about what's causing this problem and are rushing a fix out to the field.

Another problem came up with analyzing an engine vibration. When time permits, use the expanded checklist. One crew let a combination of miscommunication and unfounded assumptions about what each other was thinking lead them to a problem.

C-9A

The Nightingale had one Class B and three Class C's, none of which even resemble a trend. Of interest, a tire blew during takeoff roll, trashing pieces of the flap and an entire engine. In another incident which potentially could have been *REALLY* serious, water leaked onto engine control cables in an area where the cables then froze in place. The engine had to be shut down. The Navy's six FY95 incidents also did not show any trends other than they, too, had a tire blow on takeoff.

C-12

This multipurpose workhorse, beyond Air Force duties, also performs for our embassies and the DIA. It finished FY95 with eight Class C's and one HAP. Five of those eight were engine shutdowns. In another strange one, the engine feathered itself! Five of the Navy's 10 reportables were also engine shutdowns. I don't fly this airplane, but I'd bet those who do know their single engine procedures well.

C-17

The newest Globemaster is doing a fine job. Of only eight reported incidents, four were bird strikes to the radome. Interestingly, the other four were due to parts either falling off the airplane or delaminating. As many of you know, we're still testing the jumbo airlifter. That puts an additional strain on the crews maintaining and operating it. Hats off to both groups. You're obviously doing a great job.

C-21

The Learjet had a very unfortunate mishap this year. In a textbook example of the *chain of events*, many links joined to cause this Class A. This is our second C-21 Class A. The first one we lost in 1987 during a simulated single-engine approach.

Like our other twin-engine airlifter, four of the C-21's seven Class C's were engine problems.

USAF Photo by SrA Andrew N. Dunaway, II

Table 5

C-130: 10-Year Mishap History for FY95

FY	86	87	88	89	90	91	92	93	94	95
Class A	2	1	3	1	0	0	2	1	1	1
Destroyed	2	1	1	1	0	0	3	1	1	1
Class B	0	3	0	0	0	0	0	0	1	1
Class C	92	38	46	59	55	63	86	46	41	33
HAP	60	97	76	72	46	18	17	11	20	14
Total reported:	156	140	126	133	101	81	108	59	64	50

Of the 50 reportable incidents, 4 were due to overheated brakes, 4 more to smoke and fumes, and 4 were turbine failures. Only 3 were FOD (compared to FY93's 16 and FY94's 15). One was a wing fire and six were bird strikes. For the third year running, the Herc suffered a deer strike.

C-130

We lost another crew and their Herc this year. We wrote a new chapter in the *Things That Can Go Wrong With a Herc* book with this mishap. In its fortieth year of Air Force flying, yet another safety supplement is published, and Props and Bleed Air are not the only two things that can kill you anymore. The Herc still has the capability of killing you and will until we retire it.

Elsewhere, a crew discovered they had had a wing fire *in flight* during their *post flight*. Fortunately, while there was substantial damage, nothing serious happened. Incidentally, we wrote another new TCTO and maintenance procedure for this. Another crew got a generator-out light, disconnected the generator, and continued the flight to landing. Unknown to them, the generator bearing failed, and the magnet assembly broke apart with its pieces falling into the housing area. Upon landing, while using reverse, these pieces were sucked out, striking and damaging the prop, which then slung pieces through the fuselage into the cargo compartment. Pretty amazing, huh? Of the remaining 47 Class C's and HAPs, 4 were due to overheated brakes, 4 more to smoke and fumes, and another 3 to turbine failures. Only 3 were FOD damage compared to FY93's 16 and FY94's 15. And by the way, for the third year in a row, we had one deer strike. Physiologically speaking, six crewmembers were injured during turbulence or abrupt maneuvering.

C-141

Many venerable Starlifters are proudly pushing 31 years of service with an average of 35,000 to 40,000 hours of flight time. There were only 22 reported incidents in FY95, but some of them were a bit unusual. For example, several maintainers were working on the flight deck when the control column BROKE OFF AT THE FLOOR! They checked the other column and it, too, was close to breaking. It seems this one aircraft somehow missed an *old* TCTO that would have prevented it. But, what if this had

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USAF Photo

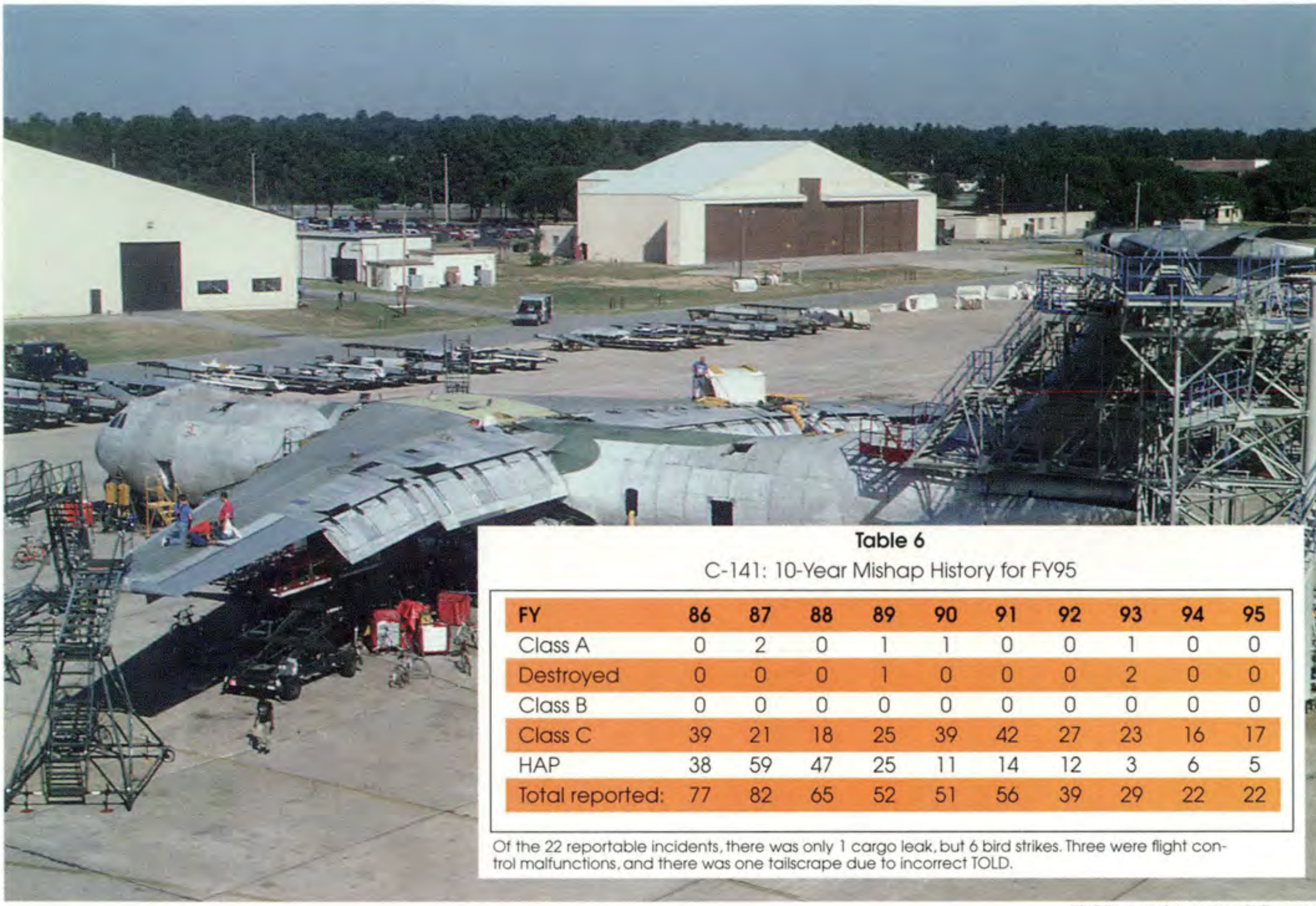

Table 6

C-141: 10-Year Mishap History for FY95

FY	86	87	88	89	90	91	92	93	94	95
Class A	0	2	0	1	1	0	0	1	0	0
Destroyed	0	0	0	1	0	0	0	2	0	0
Class B	0	0	0	0	0	0	0	0	0	0
Class C	39	21	18	25	39	42	27	23	16	17
HAP	38	59	47	25	11	14	12	3	6	5
Total reported:	77	82	65	52	51	56	39	29	22	22

Of the 22 reportable incidents, there was only 1 cargo leak, but 6 bird strikes. Three were flight control malfunctions, and there was one tailscrape due to incorrect TOLD.

USAF Photo by SrA Andrew N. Dunaway, II

been like another airplane that was in heavy rains and IMC when BOTH ADIs failed! The third case was an aircraft that would not roll out of a turn.

Don't panic! These were obviously the most unusual to happen in a while. They certainly are not trends. Some things did happen that we have always heard will. During a very sharp taxi turn, the paddles flipped, and an aircraft departed the prepared surface. In another incident, the chocks slipped on an icy surface, and the chase began. Actually, there was no harm done — but the potential is overwhelming. Can you imagine a fully loaded 18-wheeler rolling uncontrolled across a ramp? They're limited in most states to 40,000 to 80,000 pounds. Tricycled Starlifters start at 150,000!

The final odd incident was one of the YGTBSMs! The crew was already having a bad day when the gear wouldn't extend, and they had to use the *alternate extension* method. In the C-141, we have numbered "T" handles connected to various components that allow gear extension. When the crewmember pulled handle No. 2, THE HANDLE CAME RIGHT OFF IN HIS HAND! No fooling! The crew had to cut through the wall to lower the gear. Good thing they had plenty of fuel.

Final Thoughts

There are those of us who subscribe to the theory that most warnings and cautions and chapters 3 and 5 of the Dash One are *written in blood*. I've given some examples above. But, have you ever won-

USAF Photo by MSgt Perry J. Heimer

dered how a potential *gotcha* manages to lie dormant for many years and then somehow, for some odd reason, rears its ugly head to snatch life's breath from a crew of our comrades? The answer may be in the human factors realm.

I don't have the degrees to explore too deeply into this subject, but I know I do some *things* with an airplane that others won't. Further, I've also observed I will do some *things* on some days that I won't do on other days. Another aspect is I interpret input (advice, instrument readings, observations) differently than others. I base my interpretation on very individual programming — my upbringing, schooling, training, peers, and perception of *how I should act*. Those programming elements that duplicate yours will probably result in us responding identically to the same input.

That is the goal of standardization, ergonomics, and other things we do. They help us all react the same (correct) way to given stimuli. If I showed a chart of Air Force flight mishaps from 1908 to now, it would point to the huge successes of this approach.

We still average about 30 to 40 failures a year. In our airlifter Class A's, we see concrete examples of inappropriate responses to input. Don't read *inappropriate* as a condemnation — read it exactly as it says. A response can be inappropriate for many reasons — training, physical deficiency (temporary or permanent), incorrect interpretation, and so forth. So is the answer to mishap prevention *more* training, *more* eye exams, and *more* warnings, cautions, and notes?

No. We must certainly print and publish additional preventive information when we learn it. But proactively controlling the *gotchas* has to be our collective goal. For several years now, pilot error mishaps have topped the charts. We display an interesting response to these. It goes something like this: "What the pilot did was stupid. I'm not stupid. Therefore, this mishap would never happen to me."

While this is true in part, a flip side is that we are developing an overconfidence in our machines. In other words, "Mechanical problems are not a factor. As long as I don't do something stupid, I'll be okay." NOT! What I'm trying to tell you is when your air machine talks to you, listen! Just because something isn't prohibited doesn't mean it's authorized. Pay close attention to your stimuli, and select the appropriate action. ■

USAF Photo by SrA Andrew N. Dunaway, II

Aero Clubs

USAF aero clubs are, in effect, a 38-squadron, 400-airplane MAJCOM with over 8,000 members. Their annual flying hours exceed 165,000! That's more than either USAFE, PACAF, AFMC, or the Air Force Academy fly. Ignoring them, or hoping they'll go away, are not options.* continued on next page

FY 95 Aero Club Accident Summary

Type	Aircraft	Description
Accident	PA-28	Pilot recognized a high sink rate on short final and initiated a go-around but struck a snowbank.
Accident	T-41A	The engine failed in cruise. Pilot force landed in a field.
Accident	T-41A	The pilot became disoriented and initiated a downwind approach to an unfamiliar field, landed very long, and went off the other end. (Fatal.)
Incident	PA-28	Aircraft suffered a bird strike on final sustaining damage to the wing.
Incident	T-41A	Poor braking technique caused the aircraft to veer off the runway.
Incident	C-130	Nose gear failed to extend. Aircraft was landed with it retracted.
Unusual Occurrence	PA-30	One engine was shut down for running rough.
Unusual Occurrence	T-41A	Pilot heard a loud bang and the engine oil pressure dropped to zero. Then he made a successful forced landing on a nearby runway.
Unusual Occurrence	PA-30	One engine was shut down for running rough.

*Besides, it's darned nice any Air Force member who has the desire, should be able to *fly something!*

USAF Photo by SrA Jeffery Allen

" In a successful airlift, you don't see planes parked all over the place; they're either in the air, on loading or unloading ramps, or being worked on. You don't see personnel milling around; flying crews are either flying or resting up so that they can fly again tomorrow. Ground crews are either working on their assigned planes or resting up so they can work on them tomorrow." Lt Gen William H. Tunner

Near Midair Collision

At a remote island airfield, a civilian DC-8 at 14 DME requested an *overhead* approach to a right downwind. Before entering the airport traffic area, tower told the DC-8 about a C-141 at 6 DME planning an overhead to the same runway. The DC-8 pilot reported the Starlifter in sight, and tower told him he was No. 2 following the C-141. The -8 pilot responded with a *double click* on his mike.

Approaching the numbers, the C-141 pilot stated he saw the DC-8 at the same altitude, converging, at what he estimated to be a quarter mile. He then initiated a turning descent to evade collision. The DC-8 took no action. He had his TCAS operating to provide a 2-mile warning and received nothing.

The DC-8 crew misunderstood and misused the term "overhead" and was not familiar with what the C-141 was doing. Compounding it, the Starlifter interpreted the DC-8 pilot's request for an overhead from a right downwind to mean he would be behind them continuing to the field via the 5-mile initial. The DC-8 pilot's actual intentions were to overfly the field and intercept the right downwind.

The airfield commander stated that whether it was a quarter mile or 2 miles, in these situations, the "call" goes to the perceiver. Several items contributed to this situation. For one thing, this airfield doesn't have air search radar. Further, and from now on, aircraft will all be cleared for straight-in approaches *only*. Remarkably, the commander also said, "We constantly see the cowboy syndrome take effect here (i.e., large aircraft, military and civilian, doing breaks over the field, or tight circling approaches).

So, how *standard* is it to execute overheads at remote fields? The last remarkable one occurred over Cairo West on November 12, 1980. Ask an "old head" to tell you how that one ended.

Bird Strikes

Considering the very tragic mishap late last September, we ought to look a lot more carefully at our scores.

FY95 Bird Strikes

MDS	No. of strikes	Cost
C-5	3	$377,722
C-9	0	—
C-12	0	—
C-17	4	$198,814
C-21	1	$21,000
C-130	5	$307,724
C-141	6	$104,124
Total	19	$1,050,535

Other than the fact bird strikes happen close to the earth's surface, the C-141 was unique in that most occurred while in air drop formation. In particular, counting all Air Force bird strikes, 54 percent occur at airfields and 20 percent occur during low-level operations. Air Force-wide, we average over 2,700 strikes per year. Since 1985, bird strikes have cost almost $37 million per year, have destroyed 14 aircraft, and have caused the death of 33 airmen. If you're not taking birds seriously, it's time you started.

KC-135/KC-10

USAF Photo

MAJ ED JARRETT
HQ AFSC/SEFP

■ First, I would like to commend all of you on your aggressive safety reporting this year. Nearly half of the 42 KC-135 mishaps you reported and a third of the 9 KC-10 mishaps were high accident potential (HAP) mishaps. Identifying these problems early and sharing them through our safety channels provides a tremendous proactive safety benefit. More importantly, your local efforts at identifying and controlling your mission risks will provide an even higher payback in the long run. We will discuss this later in the article.

A few months ago, we experienced a Class B mishap involving the loss of a gear truck from a KC-135. The series of events which ultimately led to the failure of the gear gladnut appeared to be driven by poor tech order compliance, poor supervisory oversight, and incomplete/inadequate training.

Mission tempo within a training organization should never be so high that proper maintenance practices are forsaken to complete tasks more quickly than personnel are able to accomplish. Management plays a key role in determining both the pace of training and the underlying message of accomplishing tasks safely in a reasonable time frame. When that message is lost, those lowest on the pyramid have the most to lose, both in their learning to accomplish the job correctly and their ability to freely voice their concerns up the chain of command. Leaders must always weigh the short- and long-term costs versus the benefits when making these time-critical decisions.

The most notable trend in the -135 world was the nine air refueling mishaps we experienced this year. Although not highly remarkable in terms of number compared to the 5-year average of 5.4/year, there are a number of troubling factors involved in these mishaps. Seven of nine mishaps were ops related, with two related to material/maintenance. Of the seven ops, three were boom operator related, two receiver pilot related, and two were related to both. Additionally, five of the mishaps resulted in damage in excess of $70,000 each. What's happening, and what can we do to improve?

Here are some of the common threads from these mishaps. Two mishaps involved night AR with initial AR training or nonproficient receiver pilots. Receiver pilots' failure to identify excessive movement in the boom envelope was involved in three mishaps. Three mishaps involved IBOs' failure to call breakaway on AR primary or to intervene appropriately. Boom overcontrol on two mishaps resulted in the boom striking lower fuselage and causing significant damage. We've identified the results. Have we identified the risk factors?

The writer has attempted to pro-

continued on next page

vide a model risk-evaluation tool (see table 1) as an example of the numerous factors we may or may not consider every time we conduct air refueling operations. Adding up all of the risk elements and then applying them to the risk scale (see table 2) identifies the overall level or risk to which you are being exposed. An excellent tool to use during mission planning, this would provide you immediate feedback on your mission parameters. If the risk is too high (not acceptable), some elements of the mission must be modified to reduce the overall mission risk. If those mis-

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Table 1
MISSION RISK ELEMENTS

		Pts		Pts		Pts
Machine	Good autopilot	0	No elevator axis	15	No autopilot	30
	Funct SYD	0	No SYD	15		
Mission Planning	No interrupts or sched activity	0	Some interrupts; one scheduled activity	10	Numerous interrupts; more than one sched activity	20
	Contact receiver for MP	0	No receiver contact during MP	10		
Mission Complexity	One event: nav, AR, or transition	0	Two events	10	Three events	20
	Single tanker/receiver	0	Single tanker/multiple receivers	10	Multi tanker/multi receivers	25
Comm	EMCOM 1	0	EMCOM 2	15	EMCOM 3	40
Sched Crew Duty	Day < 12 hrs	0	Day 12-15 hrs	10	Day > 15 hrs	25
	Night < 9 hrs		Night 9-12 hrs		Night > 12 hrs	
Mission Transition	3/4 hrs night	0	0.75-1.5 hrs night	10	> 1.5 hrs night	20
	1 hr day		1-2 hrs day		> 2 hrs day	
Media	Day	0	Dawn/dusk	10	Night	20
	Vis > 5 NM	0	Vis 2-5 NM	5	Vis < 2 NM	15
	Lt turb	0	Mod turb	30		
Man Experience	Full MQ crew: all greater than 500 hrs in MDS	0	Full MQ crew, one member < 500 hrs	10	Initial qual sortie for one member	20
Proficiency	> 6 AR sorties/semiannual	0	4-6 AR sorties/semiannual	10	< 4 AR sorties/semiannual	15
Currency	Last flight < 7 days	0	Last flight 7-14 days	10	Last flight > 14 days	15
Crew Rest	Well rested	0	1 crewmember tired	10	2 or more crewmembers tired	30
Management	Clear mission guidance	0	Unclear mission guidance	15	Standards not enforced	30
	Standards enforced	0	Standards sporadically enforced	10	Major scheduling changes	25
	Fly as scheduled	0	Small scheduling changes	10		
	Clear procedures	0	Unclear procedures	15		
Total Each						
Grand Total						

Table 4
AIR REFUELING RISK LEVEL

Risk Level	Point Total
Low	0-32
Medium	33-66
High	67-100

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Table 2
RISK LEVEL & APPROVAL REQUIREMENT

Total Points	Risk Level	Signature Required
<35	Very low	
40-75	Low	
80-115	Medium	
120-155	Caution	SQ CC/DO
160-195	High	OG/CC
200+	Danger	WG/CC or higher

Table 3
AIR REFUELING RISK

Tanker	Autopilot on	0	Autopilot off	15
	MP, MC flying	0	Upgrade training	15
	AR current	0	Noncurrent AR	15
	Last AR < 14 days	0	Last AR > 14 days	10
	Single ship	0	Multitanker cell	15
	MB or IBO	0	SB training	20
Receiver	Day	0	Night	20
	AR current	0	Noncurrent	20
	MP, MC flying	0	Upgrade Training	20
	Last AR < 30 days	0	Last AR > 30 days	15
	Light, medium weight	0	Heavyweight	15
	Single ship	0	Multireceiver formation	15
Total ____				

sion elements cannot be modified, the tough decisions must be made. If it's a critical mission, either the crew or some level of leadership must determine that the risk level warrants the mission tasking. Leadership's signature requirement indicates acceptance of the high risk level to accomplish the tasking and establishes decision-making accountability. Seems easy, but do we consciously do this every time we fly? Obviously, in the previous seven mishaps we discussed, we didn't do it effectively.

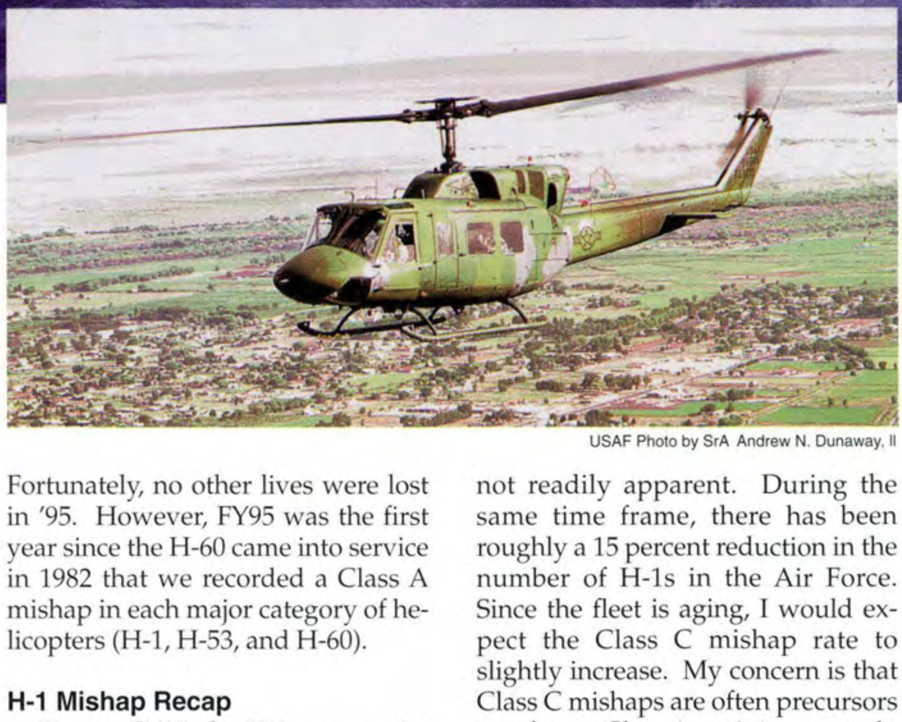
This is a model from which you or your unit may wish to apply to your own special mission needs. If we take the same concept and apply it to both the tanker and receiver crews using specific AR experience from both sides as criteria, we could easily come up with a standard by which we would communicate with both tanker/receiver the risk level and determine whether the planned activity is worth the cost. (See tables 3 and 4.)

Using a recent mishap, we can identify and assess the overall risk of the activity. The tanker copilot was flying the aircraft autopilot off. The weather was night, VMC with little moon illumination. The receiver was conducting recurrency training to accomplish a heavyweight night AR refueling. Neither IP or FP had flown AR in the past 30 days and had not accomplished a night heavy AR in 8 months or more.

If we add up the points, the risk level was high for this mission. Were both crews aware of the high-risk arena they were flying in? Did they understand that eliminating just one or two of the factors listed could have resulted in a safe mission accomplishment? Even if the risk level is high, this does not guarantee you a mishap but exposes you to the potential of having one. In this case, the combination of factors resulted in significant boom damage during this mission.

The challenge to each of you is to organize a system which clearly identifies and controls your risks. It can be as simple as sitting down and coming up with a risk chart identifying those things you think are real show stoppers. Once you've done that, you can clearly identify and control those things that will put you on the edge of danger and into the dark world of safety mishaps. Managing your risks is the best route to increasing mission effectiveness through preservation of resources — you, the plane, and time. Think about it. ■

HELICOPTERS



USAF Photo by Jeff Allen

USAF Photo by SrA Andrew N. Dunaway, II

MAJ DOUG TRACY
HQ AFSC/SEF

■ Well, I am the new guy in the job. Maj Resnicke moved on to Fort Rucker, Alabama, where he is instructing undergraduate helicopter pilot training students. My flying background is in HH-3Es and HH-60Gs. I instructed in both aircraft at the schoolhouse. I have also been an FSO at both squadron and MAJCOM levels. If I can be of any assistance, please call me at DSN 246-0703, FAX DSN 246-0684, or E-mail tracyd@smtps.saia.af.mil.

I encourage each of you to visit your unit safety office and read and discuss each mishap occurring in '95 and before. The lessons to be learned from previous mishaps are many. Repeating history would be tragic.

FY95 Helicopter Mishap Recap

FY95 started out disastrously when five of our fellow fliers were tragically killed in an H-60 mishap only 6 days into the new fiscal year. Fortunately, no other lives were lost in '95. However, FY95 was the first year since the H-60 came into service in 1982 that we recorded a Class A mishap in each major category of helicopters (H-1, H-53, and H-60).

H-1 Mishap Recap

During FY95, the H-1 community experienced one Class A and three Class C mishaps. The Class A involved a logistics issue. The aircrew was extremely fortunate to walk away from the destroyed aircraft. The number of H-1 Class C mishaps have continually decreased (39 percent) since 1992. See sidebar.

The reasons for this reduction are not readily apparent. During the same time frame, there has been roughly a 15 percent reduction in the number of H-1s in the Air Force. Since the fleet is aging, I would expect the Class C mishap rate to slightly increase. My concern is that Class C mishaps are often precursors to a future Class A, so it is extremely important that we track trends and intervene before we experience another tragedy.

H-53 Mishap Recap

Last year, we also recorded our first H-53 Class A mishap of the '90s with the last occurring in FY89. I believe this outstanding record speaks highly of your aircrew and maintainers when you consider the complexity and demands of the H-53 mission. This mishap also involved a logistics factor, and again, the crew was fortunate to get the aircraft on the ground before the fire began. There was one H-53 ground Class B mishap. This mishap occurred when an aircraft was taxied into a pole. There were also nine H-53 Class C mishaps during the year.

H-60 Mishap Recap

As I stated in the beginning, we began FY95 with the loss of five aircrew members when their H-60 struck a cable at night. Also, there was an H-60 Class B mishap involving a collective stick which became jammed during an autorotation. When the aircraft struck the ground, the FLIR sustained significant damage, driving the mishap cost into the reportable category.

The H-60 community had 10 Class C mishaps during FY95. Two of these mishaps involved damage to the FLIR. Based on the Class B and these two Class C mishaps involving the FLIR, we can conclude we have a trend.

There are 28 FLIR turrets assigned to USAF active duty HH/MH-60 units. During a recent 12-month period, the Air Force returned 6 of these 28 turrets for repairs due to damage. I know H-60 crews are well aware they have only 11 inches of clearance between the bottom of the FLIR turret and the level ground. Landing in an unimproved area, with an obstacle under the aircraft, and the clearance is further reduced to nonexistent.

Moving the turret to a new location on the aircraft is probably unacceptable unless we are willing to accept less capability, i.e., something less than a 360-degree view. Also, with us possessing so few FLIRs, I would anticipate reengineering costs to relocate the FLIR to be astronomical.

H-60 dual engine rollbacks (from 100 percent to approximately 95 percent NF) continue to present both aircrew and system engineers with a dilemma. A recent incident, and the resulting investigation, appear to shed some new light on the anomaly. A Tiger Team has been established to respond to these incidences. In accordance with Warner Robins ALC/LUH message 171822Z Feb 95, if you experience this phenomena, please take whatever actions are necessary to recover the helicopter to a satisfactory landing area and impound the aircraft without any troubleshooting attempts by the crew or maintenance, and call Warner Robins ALC/LUH.

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HELICOPTER MISHAPS

	1990	1991	1992	1993	1994	1995
H-1						
A	0	1	2	0	1	1
B	0	1	0	0	1	0
C	11	4	11	9	5	3
H-53						
A	0	0	0	0	0	1
B	0	0	1	0	0	1
C	10	8	8	9	7	12
H-60						
A	0	2	1	1	2	1
B	0	0	0	0	1	1
C	5	5	8	7	9	11

Class C Mishaps Provide Trend Analysis

As I indicated earlier, one of your best trend analysis indicators can be the Class C mishap. What's great about this indicator is no one dies or is seriously injured, and the financial costs are relatively minor. Hopefully, Class A's and B's never become frequent enough to provide trend information. If they ever become indicators, we have a serious problem.

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I have heard on several occasions that Class C mishaps are mishaps where someone intervened and stopped it from becoming a Class A. So it is important we report these mishaps for crosstell purposes. I do not believe incidences are intentionally going unreported. However, the average aircrew members are not issued (nor would I expect them to be) AFI 91-204, and as such, they are not familiar with all the Class C reporting criteria in the instruction. So, innocently, they may not report a particular incident to their unit safety office.

continued on next page

I have included a sidebar which contains the latest mishap reporting criteria from AFI 91-204, October 1995. I hope it helps. By the way, unlike Class A and B mishaps, HQ Air Force Safety Center (AFSC) does not generate a Class C mishap rate nor are organizations compared based on Class C mishap rates.

Situational Awareness

During FY95, we had a crew strike a cable resulting in five fatalities and another crew strike a pole with their main rotor blades during ground taxi. These two incidents resulted in Class A and B mishaps, respectively. Both of these mishaps can be attributed to a lack of situational awareness on the part of these aircrews. The flying business is not a place you want to lose your situational awareness.

Supervision

Ops tempo continues to present our units with challenges. Units are being tasked with continuous, recurring deployments in ever-changing flying environments. Flying in these conditions presents an ever-increasing risk for our aircrews. The challenge for unit supervisors is to reduce that risk and still meet the demands of operational tasking.

Again, please study old mishap reports in order to learn from others, and please contact me if I can be of any assistance. *Fly safe.* ■

USAF Photo

HELICOPTER SPECIFIC MISHAP REPORTING
(AFI 91-204, 1 October 1995)

CLASS A MISHAP (para 2.3.1)

1. Reportable damage of $1 million or more.
2. A fatality or permanent total disability (due to injury or occupational illness).
3. Destruction of an Air Force helicopter.

CLASS B MISHAP (para 2.3.2)

1. Reportable damage of $200,000 or more but less than $1 million.
2. A permanent partial disability.
3. Inpatient hospitalization of three or more personnel.

CLASS C MISHAP (para 2.3.3)

1. Reportable damage of $10,000 or more but less than $200,000.
2. An injury resulting in a lost workday case involving 8 hours or more away from work beyond the day or shift on which it occurred.

OTHER EVENTS REPORTABLE AS CLASS C AIRCRAFT MISHAPS (para 7.4.7) regardless of mishap cost

1. In-flight fires or massive fuel leakage in an engine bay.
2. Any wire strikes.
3. Engine case penetration, rupture, or burn-through from internal engine component failure.
4. Loss of engine power sufficient to prevent maintaining level flight at a safe altitude, or which requires the pilot to jettison stores.
5. Emergency or precautionary landing of a single-engine helicopter with imminent engine or rotor-drive system failure confirmed after landing.
6. Except for maintenance engine runs, report any single-engine flameout, failure, or emergency shutdown (single- and twin-engine helicopters) after initiating engine start until engine shutdown.
7. All cases of departure from intended takeoff or landing surface (runway, helipad, landing zone, etc.) onto adjacent surfaces.
8. Flight control events:
   - Report any malfunction (including helicopter flight control, stability augmenter, autopilot, and trim systems) resulting in an unexpected, hazardous change of flight attitude, altitude, or heading.
   - Report unintended departure from controlled flight for any reason. Do not report intentional departures.
9. Report spillage or leakage of radioactive, toxic, corrosive, or flammable material from aircraft stores or cargo, particularly when similar event could result in serious injury, illness, or damage.
10. Report in-flight loss of all pitot-static instrument indications.
11. Report in-flight loss of all gyro-stabilized attitude indications.
12. See para 7.4.7.13.1 for information on reporting physiological episodes.

HIGH ACCIDENT POTENTIAL (HAP) REPORT (para 7.4.8)

Report circumstances as HAP events when, in the judgment of the reporting official, there is a significant hazard to the crew or aircraft. Base this judgment on whether a similar event could result in serious injury.

USAF Photo

USAF Photo by SrA Andrew N. Dunaway, II

MAJ JEAN-GUY BEAUMONT, CAF
HQ AFSC/SEFO

A-10

Introduction

As I first sat down to write this article, we were *7 days into FY96.* Thus far, all was well on all Hawg safety fronts for our new fiscal flying year. How long would it be before our first FY96 Class A mishap? Which MAJCOM/NAF/wing/unit would have the misfortune to initiate the FY96 Hawg hit parade? When was the long overdue first NVG night Hawg mishap going to occur? How many Hawgs were we to lose this fiscal year? These were the questions I was asking myself as I sat in front of the monitor. The answers to all but one of the above questions were provided to me before I could even complete this article. On a dark arctic night, one of our Northern Hawg variety permanently imprinted its silhouette into the solitary frozen landscape. Fortunately, its "Tamer" successfully ejected and is alive to tell the story.

FY95 Recap

FY95 was a marked improvement on our FY94 safety performance. Our Class A rate for FY95 was 1.69 with a 1.69 aircraft destroyed rate. This represents a very notable reduction against our FY94 Class A mishap rate of 3.31 with a 4.13 aircraft destroyed rate. Even more significant is the fact that FY94 had been our worst A-10 flight safety mishap year on record since FY80. In real terms, for those of you who frown at statistics, this means that two A-10 weapon systems and at least one pilot were retained in our order of battle. Dollar-wise, this means that $13.3 million of previously expended hard-earned U.S. taxpayer money is still at work protecting the country's national interests. My kudos to U-ALL for achieving such a marked turnaround.

My Aim

As per last year, my focus in this article is to provide you with information pertinent to your future personal safety and that of your weapon system. I will not expound on detailed mishap events which were already communicated to you via privileged safety mediums. I will rummage through the A-10 recent past to provide you with the secrets to future safe and everlasting Hawg handling. I will give you condensed event descriptions and lessons learned, as well as expanded corrective actions where warranted.

Events, Lessons, and Corrective Actions

During FY95, two A-10 aircraft were lost to Class A flight mishaps, and one pilot was killed. We further experienced one Class B mishap as a

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result of a wheels-up landing, and we were a participant in a U.S. Army rated Class A mishap where one officer perished and 12 soldiers were injured. The common thread linking the FY95 mishaps is again our historically proven vulnerable human factors.

Controlled flight into the ground once again claimed one A-10 aircraft and the life of one of our fellow fighter pilots. It continues to produce the majority of A-10 Class A mishaps and is the No. 1 killer disease of A-10 pilots. Less than 10 months elapsed between genuine mirror-imaged A-10 controlled-flight-into-the-ground Class A mishaps. Produce your own flawless GOOD LUCK by ensuring your basic piloting technique while turning at low altitude is impeccable.

- The human inner ear sensory system, in isolation, is **totally unreliable** when you try to achieve or maintain a given attitude while carrying out a turn in an aircraft. Relying on this sensory system will readily create hazardous situations responsible for your premature graying and ulcers. Prolonged use will KILL YOU!

- The majority of past fatal mishaps involved single-seat pilots initiating or attempting to initiate shallow climbing turns (45 to 60 degrees of bank and 10 to 15 degrees of climb) between 400 to 2,000 feet AGL. All of them wrongly assumed that this climbing attitude while turning would guarantee their safety while they brought their heads into the cockpit or attempted to tally a bandit or wingman within a 40-degree cone of their rear hemisphere. The change in aircraft attitude that sealed their fate was attained within 2 to 4 seconds. Those nonrecoverable aircraft attitudes were between 90 to 125 degrees of bank, with their nose buried 12 to 45 degrees below the horizon.

- The only sure way for a single-seat pilot to clear his flightpath and maintain a given attitude while turning is for him to constantly cross-reference his nose attitude against the actual horizon or artificial horizon (preferably through a HUD) while constantly scanning towards his new flightpath.

- I strongly recommend you familiarize yourself with the warning inhibitions and narrow pull-out profile criteria that were programmed into GCAS to avoid unnecessary warning calls. These programmed inhibitors significantly reduce your GCAS protective envelope during a shallow descent and/or a slow rate of closure with the terrain.

Finding yourself at the control of a lamed Hawg, with a wing fire

USAF Photo

burning out of control and no way of putting it out, with flight controls that do not respond as you anticipate, is a situation no pilot wishes for. Since 1979, four A-10 pilots have been faced with such a situation. All of them elected to jettison their jet and regained contact with Mother Earth through successful silk letdowns. One of these four fire mishaps was the result of a vulture striking the *leading* edge of an A-10 wing, damaging adjacent hydraulic and electrical lines which resulted in electrical arcing, igniting the vaporized hydraulic fluid.

The remaining three wing-fire mishaps spanned over 16 years of A-10 service. These mishaps were a result of unsecured chafed live electrical wires contacting and arcing onto pressurized leading-edge hydraulic lines. Why have we been unable to correct this previously multi-investigated and operationally proven high-risk condition?

Corrective actions already taken include a one-time inspection of the suspect areas on all A-10s as well as the addition of a locking hardware to the screw securing the electrical wire bundle clamps where the previous fires have occurred. These alone have significantly lowered the odds of an encore performance of this "deja vu" mishap scenario. Long-term corrective actions currently in progress will provide for possible Teflon™ wrapping of causal electrical wire bundle sections, more elaborate inspections, wire chafing video training, and improved maintenance practices. Once these longer-term corrective actions are implemented, I believe we will have minimized our risk of a recurrence of this type of mishap to zero for the remaining active service life of the A-10. What can you do?

Pilots and flying ops supervisors . . . Never rush maintenance or an individual technician. You are unlikely to get your jet(s) any sooner, but you are very likely to borrow it from them for a period far shorter than your expectations.

Technicians and maintenance control . . . Never let yourself be rushed. Always follow sound maintenance practices. Take Julio Gallo's approach: "Never release a jet before its time." When faced with performing higher-level structural repairs, always consult your Air Logistic Center for an accurate and detailed description of the job procedures and/or replacement parts to be used.

Insofar as pilots of aircraft equipped with retractable landing gear (L/G) are concerned, there are only three kinds of these fellows in this world — those who have had the misfortune to carry out an actual wheels-up landing, those who have had a close call and carried out a wheels-up missed approach, and those who will eventually experience one of the two previously listed scenarios. The common thread to most wheels-up mishaps is that a situation is created where the potential mishap pilot will interrupt or modify the sequencing pattern and/or location of switch selections due to the desire to accommodate a menial cockpit task or to effect air traffic separation. Our problem is what can we do to minimize risk, short of welding the A-10 L/Gs down or equipping them with skids? My suggestions are as follows:

I strongly recommend you familiarize yourself with the warning inhibitions and narrow pull-out profile criteria that were programmed into GCAS to avoid unnecessary warning calls. These programmed inhibitors significantly reduce your GCAS protective envelope during a shallow descent and/or a slow rate of closure with the terrain.

Never, never, never deviate from your personal landing sequence switch selection and positioning confirmation pattern. Should you need to extend your pattern or delay a radio transmission, use power against drag to keep the jet aloft.

Establish a must-do routine in your personal landing sequence from either an overhead break or a straight-in approach. It must be part of a ***binding contract*** with yourself. As an example, here is my contract:

Article 1

On a straight-in approach, I will never proceed inside the final approach fix or 3 miles without lowering the landing gear. On a traffic pattern, I will never initiate a final turn without lowering the landing gear.

Article 2

On final approach or during my final turn, should my airspeed or approach angle feel wrong, I will immediately carry out a drag check of all my switches and gauges, starting with the landing gear.

Article 3

On all landing sequences, as I cross the half-mile point or the start of the approach lights, I will physically reconfirm all of my switch selections, starting with the landing gear.

Risk Management Concerns

1. *Flight Safety Reporting.* During each of the past 3 years, we have flown around 117,500 hours. With this number of flight hours, we continue to produce a significant number of incidents which must be reported. Over the past year and a half, we have gotten involved with a high-risk mission profile NVG operation. One NVG Class A mishap is now in our data bank without even a HAP message to forewarn us. The mishap has thus far shown many obvious discrepancies and warning signs we failed to act upon.

I believe most Class A and B mishaps are preceded by a minimum of two to three warning incidents. These incidents are supervision's only opportunity to halt the mishap chain before the Class A or B mishap occurs. I refuse to believe none of you has experienced at least one NVG operational flight situation worthy to be forwarded to fellow

continued on next page

Hawg drivers. I refuse to believe all of you are in full agreement with the use of non-NVIS modified A-10s for NVG operation. I believe you have many questions which cannot be addressed until you express them. We must all reestablish the safety dialogue. Otherwise, we will continue to operate blind, fail to address correctable hazards, and be doomed to repeat costly mishaps.

2. *Engine Problems.* Lately we have experienced situations where A-10s have been flown outside the engine-authorized flight envelope during defensive BFM situations. In the past, this has caused severe engine damage, single and dual engine flameouts, controlled flight departures, and Class A mishaps during FCFs. We continue to experience problems with flight outside of the authorized engine envelope. This causes very extensive contained damage to a TF-34 engine because of a massive undetected overtemp. We cannot continue to push the engine flight envelope as we have without eventually paying a high price for it. We must take steps to reduce the risk of flying outside of the authorized engine envelope before we provide a simulated bandit with an unexpected fratricide flying kill. We must maintain much better SA during BFM defensive turns so that we can defeat the attacker while remaining within the TF-34 engine flight envelope. Keep track of the bandit, and be fully aware of our weapon system operational status. All units are requested to report future occurrences so the extent of these potentially hazardous excursions to the edge of the TF-34 can be accurately quantified. If left unchecked, a badly performed defensive scenario is my wild card mishap of choice as the additional high-risk A-10 Class A mishap scenario for FY96. See the paragraph below for my primary FY96 A-10 Class A mishap predictions.

Our FY96 Class A Mishaps

1. *NVG operation with SA loss and spatial disorientation.*

A fortune teller's delight — 100 percent hindsight since we have already experienced this one. And now here goes Jean-Guy with some real crystal ball educated guesses.

2. *Controlled flight into the ground.*

We have experienced one of these for each of the past three fiscal years. Odds that one of our A-10 pilots will lose his SA during a turn at low level remain extremely high. We live in that dangerous environment and repeat this tasking maneuver countless times. See above for suggested corrective actions and training.

We have lately experienced situations where A-10s have been flown outside the engine-authorized flight envelope during defensive BFM situations. In the past, this has caused severe engine damage, single and dual engine flameouts, controlled flight departures, and Class A mishaps during FCFs.

3. *NVG operation, SA loss, and spatial disorientation.*

NVG flying is without a doubt the A-10's riskiest flying phase. A-10 NVG flying forces you to operate in an environment where there is little room for surviving any mistake you might make. During FY96, the A-10 NVG flying phase will be expanding significantly. We will provide basic NVG checkouts to new A-10 units as well as introduce more demanding advanced NVG tactical scenarios to A-10 units that previously received the basic A-10 NVG checkout. To protect yourself and prevent this type of mishap from revisiting us in FY96, I suggest you familiarize yourselves thoroughly with the interior cockpit lighting requirements for both modded and non-modded NVIS A-10s. Also, have a plan for inadvertent IMC penetration.

Last, but not least, devise ahead of time a personal course of action you would follow should you ever have the misfortune to find yourself spatially disoriented with no SA while operating an A-10 under NVG at low level. Your survival depends on it.

4. *Midair collision.*

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

Guard against an upgrade-type A-10 formation mission where a pilot resource, external to your unit, will be a participant. This guest help will further be unfamiliar with your operating range(s). You will have an unwanted, imposed last-minute addition. This pilot will request to fly as a semi-independent formation member in a chase capacity. Two or more of your unit's flying supervisors will also be formation members, i.e., unit stan/eval officer, flight commander, SQDN DO. Element and flight leads raise your guards when your planned two- or four-ship is untimely modified to a three- or five-ship. The new arrival senior pilot will say something like, "Don't worry about me. I'll just chase you and stay out of your way. Just fly your normal two- or four-ship mission." Effective and safe tactical formation flying requires all participants be fully conversant with each other's roles and responsibilities. A wild card amongst or near your tactical formation is an unwanted added operational risk.

Our publications and flying training tell us what to expect from a lead, a wingman, the Red Baron, and enemy defenses. As the lead, you must control your flying environment. Any flying scenario which denies you full control of all of your formation participants is one that must be abandoned and modified prior to stepping. Never accept the lead of a formation where you are not fully aware of the intentions of all partici-

USAF Photo by SrA Andrew N. Dunaway II

pants. Remember that nobody has ever successfully and consistently been able to stay ahead of, or lead turn the unknown

FY96 Pilot Fatalities

This year's prediction of a potential for a total of four A-10 Class A mishaps for FY96 implies indirectly that up to five jets could be destroyed and four aircrew killed. Insofar as the above midair scenario is concerned, avoiding the midair completely is all you can do to protect your life. Following impact, you will either be conscious and able to effect a successful ejection or you will have suffered multiple crushing fatal injuries.

Collision with the ground and NVG loss of SA situations will likely provide you with a 3 to 12 seconds "fight or flight" ejection opportunity window. As mentioned earlier, this will be a critical moment in your life, a moment that will make an eternity of difference for you and your family's future. Plan now for such a quick decision-making eventuality. The A-10 pilot who experienced our one NVG Class A mishap did. Today he is alive to tell his story and cherish his loved ones. Will you?

In closing, let me reiterate that I welcome and need your comments and concerns. Being a full-fledged HQ staff weenie with my feet nailed to Mother Earth, I rely on you for information. Receiving your comments and concerns allows me to detect A-10 problems before being sent to yet another A-10 crash site. Please allow me to be of value to you by letting me implement proactive A-10 operational risk management. Keep our communication channels open and the information flowing. I have acted and will continue to act on anonymous tips. My coordinates are as follows: AFSC/SEFF, 9700 G Avenue SE, Kirtland AFB NM 87117-5670; phone commercial (505) 846-0737, DSN 246-0737; FAX DSN 246-0684, E-MAIL beaumonj@smtps.saia.af.mil ■

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Photo by Gerald C. Stratton

USAF Photo

Fratricide

MAJ JEAN-GUY BEAUMONT, CAF
HQ AFSC/SEFO

Introduction

■ Are fratricide[1] casualties part of the cost of waging high-tech warfare? Can anything be done to minimize the chances our A-10 weapon system will inflict fratricide casualties?

A review of Persian Gulf friendly fire incidents (1991)[2] reveals a total of 28 separate fratricide events took place from 29 January 1991 to 27 March 1991. Of these fratricide events, 15 were ground-to-ground, 10 were air-to-ground, 2 were ship-to-ship, and 1 was ground-to-air. Overall, Gulf War fratricide casualties amounted to 42 soldiers killed and 71 injured.

Three of the above fratricide events were attributed to the A-10 weapon system. One more A-10 fratricide event, not recorded above, occurred when an element of A-10s mistakenly fired upon an allied armor column. Our overall fratricide tally for the A-10 weapon system during the Gulf War was 16 soldiers killed and 15 injured.

Whether you are operating within an actual war or a peacetime scenario, providing effective close air support (CAS) or battlefield air interdiction (BAI) to our ground forces implies you will shoot the bad guys, only the bad guys, and nothing but the bad guys. This is, however, much easier said than done. A review of the available data held at the HQ Air Force Safety Center, the U.S. Army Safety Center, and the USMC Safety Division revealed they have no recorded accident involving the Target Identification Set Laser (TISL), Pave Penny, or other laser trackers, except for a 1995 incident involving HELLFIRE and an FA-18 laser designator.

The accident investigation board (AIB) in the 18 July 1995 A-10 ordnance mishap produced 32 findings and 12 recommendations.

The AIB did an excellent job of reviewing a massive amount of evidence relevant to this mishap. You can literally visualize the mishap sequence from their extensive report. The AIB's findings center on laser energy, FAC actions, and pilot actions. The AIB identified three elements which could have prevented the mishap:

1. Adequate precautions to prevent the Pave Penny system from acquiring the Ground/Vehicular Laser Locator Designator (G/VLLD).

2. Proper terminal control of the aircraft by the FAC.

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3. Positive target identification by the pilot.

Improper identification of the target, through either operator error or a weapon malfunction, is the common thread in all cited fratricide mishaps. Older munitions and weapons systems were deadly and inaccurate. Newer weapons systems are deadly and very accurate. This means if you misidentify a friendly position as a target and pickle, you will hit it.

Whether we are aviating in a peace or war scenario, our credo must be to never squeeze the trigger or press the pickle button unless we have positively identified the objective as a foe and are fully aware of the actual location of friendly forces in the target vicinity. We, as aircrew members, have full control of our ordnance, and we are the last safety valve in all fratricide air-to-ground mishaps.

Here is a line present in many fratricide events: "The terrain in the mishap area was flat and featureless except for the odd defensive positions, several destroyed vehicles, and numerous tracks criss-crossing the area." All of you are familiar with this statement — not because you have read it, but because you have lived it by flying over it many times. After all, this is an accurate description of the old moonscape at most major U.S. Army joint warfare ranges. Airborne weapons platforms have misidentified and hit friendly positions within a few hundred meters of the intended targeted enemy position. Our worst case on record saw an aircraft strike a friendly position that was 20 kilometers away from its fragged Universal Transverse Mercator (UTM). To spare our friends and destroy our enemies, our training and flying doctrine must be flawless. Let's look at how we can get the job done.

Training

All of us slated for CAS or BAI must be able to quickly and positively identify all enemy and friendly military equipment within the possible contingency areas where we may be called upon to operate. This is a "must attain" training objective. The pass mark is 100 percent.

Do not rely on the old "no friendly beyond the yellow brick road" statement. This only tells you where you are most likely to find the enemy. It does not, by any means, relieve you from your ultimate responsibility to positively identify your selected target(s) just in case you got the wrong yellow brick road, your INTEL is lacking, or some friendly force is where they should not be.

Do not rely on special recognition panels or lettering affixed to friendly equipment to save the day either. Tests during the Gulf War showed these special markings could first be distinguished from a slant range of only 5,000 feet. This is well past the firing point of most A-10 ordnance. Well-trained pilots were reportedly able to identify noncamouflaged vehicles in the open desert at ranges of up to 14,000 feet. Remember your

USAF Photo by Bill Barber

USAF Photo

basic hunter safety training: "Never point or shoot your weapon unless you have positively identified the game."

The Pave Penny system has a limited search window during the acquisition phase. All laser designators generate varied amounts of atmospheric laser scattered energy. Should you elect to carry out an attack where your chosen delivery profile search window at the time of acquisition includes the laser designator, but not the target being lased, the system will lock on and display the most prominent visible laser energy. To guard against such eventuality, you must always take into account the following:

1. The laser-to-target azimuth line.
2. Your allowable attack headings/quadrants in relation to the target and designator.
3. NOTE: When conducting laser-designated ordnance deliveries, always ensure your pre-attack briefing includes laser-to-target azimuth information.

Finding the Target

To find the target, follow this simple method. It will get you there every time. Not only that, it will also allow you, during the post-flight debrief, to accurately tell your INTEL section and all of your squadron buddies what you shot and where you shot it.

1. Always fly to the given target

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[1]Fratricide is a term, along with "Friendly Fire," used for a circumstance in which members of a U.S. or friendly military force are mistakenly or accidentally killed or wounded in action by U.S. friendly forces actively engaged with an enemy, or who are directing fire at a hostile force or what is thought to be a hostile force. Fratricide is also used to describe death or injury caused by live fire in a training circumstance.

[2] Historical Review of the Causes of Fratricide, Chapter 2, Page 27, Table 2-3. Source: Assistant Secretary of Defense (Public Affairs). Review available through the Project Manager Combat Identification, 5109 Leesburg Pike, Suite 309, Falls Church VA 22041. Phone (703) 681-6910, FAX 681-5825, DSN 761-XXXX.

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Whether we are aviating in a peace or war scenario, our credo must be to never squeeze the trigger or press the pickle button unless we have positively identified the objective as a foe and are fully aware of the actual location of friendly forces in the target vicinity. We, as aircrew members, have full control of our ordnance, and we are the last safety valve in all fratricide air-to-ground mishaps.

GRID or UTM.

2. Positively locate and identify the GRID or UTM.

3. Then, and only then, locate and identify the target.

4. Fire.

Supervisors, remember your CAS and BAI pilots must be trained to attack a GRID or UTM where an enemy land element is likely located. When conducting ***dry weapon delivery***, take every possible advantage to teach and reinforce the above method. You can move the enemy land element in the GRID, replace it with a friendly one, or simulate a mistake by intentionally fragging a friendly position. The INS, the TD BOX, and TISL are tools designed to help us fly to and locate the target area. We must still confirm the target location and ID it prior to opening fire.

For peacetime training runs, always abide with Paragraph 7.I.(1) of ACC Regulation 55-26 which states: "The specific target will be marked by a unique terrain feature or a conspicuous marking device (i.e., white phosphorous marking rocket, artillery round, smoke grenade, etc.)." Note that a laser designator does not produce a conspicuous mark visible without sensors or infrared viewing equipment. To further minimize the risk of a fratricide mishap, carry out as many of the following steps as possible:

1. Acquire and preflight study a current Vertical Line Overlay (VLO) photograph of the range. Study it until you know the terrain as well as your own neighborhood. If your area of operation warrants it, have both summer and winter VLO photographs available for preflight references.

2. Always conduct an orientation flight over the range to which you intend to deliver practice or live ordnance. This orientation flight should include dry weapon runs.

3. Prior to the start of any live or practice ordnance operation, pay a visit to the range facility where you intend to drop. Walk the grounds, visit the Ops and impact areas, reach out and touch your potential targets, and have face-to-face briefs with range control personnel, the land unit(s) you will support, and the local FACs.

4. Ensure that the planned targets are viable and that they will not teach your pilots a negative tactical lesson. An inverted red car wreck will appear as a most obvious target to a ground FAC who is standing less than 1 kilometer away from it. To you, once airborne and searching during your attack, this "clunker" will only show its rusty underside against a murky brown background. This target will be fully cloaked and impossible to identify prior to reaching minimum firing range. You will be lucky if you acquire it while you overfly it during your pullout and if you don't lose it again during your re-attack.

If it's a real bad day and Murphy is out to get you, some dirt brain will park his red-colored range safety vehicle in close proximity to your assigned cloaked target so you can waste him and it. Our aim is to train as we will fight. Sufficient resources must therefore be expended to provide aircrew with targets that can and must be ID'd well before reaching minimum firing range. This becomes evermost crucial when conducting NVG ordnance deliveries. Failure to do so will markedly increase your operational risk factor during training. Worst of all, you will pass on negative learning to our pilots which will eventually lead to a costly and deadly fratricide mishap on the actual battlefield. ■

USAF Photo by SMSgt Boyd Belcher

F/RF-4 REPORT

LT COL KARL-HEINZ ASCHENBERG, GAF
HQ AFSC/SEFO

Looking Back

■ In the last few years, we have experienced unrelenting change in the Air Force. Reorganizing the MAJCOMs, restructuring to objective wings, unit redesignations, personnel cutbacks, decreased promotion rates, career field changes, and base closures are some prime examples. Since 1991, the Air Force has averaged three to four times the level of overseas deployments it did during the cold war.

In FY95, the Air Force had nearly 10,000 men and women deployed to support operations in Bosnia-Herzegovina, Iraq, the Caribbean, and South America. Some Air Force units have been involved in sustained combat or combat support operations for almost 5 years. The PHABULOUS PHANTOMS, most of them with a service age of 24+ years, were out there participating and adding value to these operations. Despite operating a weapon system which is scheduled to be phased out in the near future, the F-4 community performed in a magnificent manner with professionalism and skill.

FY95 in Review

We can summarize our F-4 safety statistics as very satisfactory. The F/RF-4 Class A mishap rate of 4.08 per 100,000 hours reflects one Class A F-4G mishap. The relatively high F-4 mishap rate is driven by the overall reduced total flying hours for the F-4 fleet (24,500 hours for FY95).

Looking at all mission design series (MDS) and analyzing the mishap causes from 1985 to 1995, we see that the percentages of OPERATIONS causes (55 percent) and LOGISTICS causes (40 percent) haven't changed much.

The F-4 fleet did well in one field. Aircrews and supervisors were able to reduce the high number of operations causes. We haven't had a single OPs Class A since 1991 when an F-4G departed controlled flight during high-angle-of-attack maneuvering.

A word of caution about the numbers in Figure 2. "OPERATIONS" and "LOGISTICS" doesn't always mean the pilot, a crew chief, or a maintenance supervisor was causal

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Figure 1

	FY95 No	Class A Rate	FY95 No	Class B Rate
All F-4s	1	4.08	0	0.0
F-4G/E	1	5.77	0	0.0
RF-4C	0	0.00	0	0.0

Figure 2

FLIGHT MISHAP CLASS A CAUSES

FY	OPS	LOG	UNDET.
85	6	4	0
86	8	8	1
87	5	5	0
88	3	4	1
89	4	1	1
90	7	5	1
91	2	2	0
92	0	0	0
93	1*	1	0
94	0	1	0
95	0	1	0

*nonrate producer

or that a part just broke. In many cases, the working environment, established rules and regulations, overtasking, real or perceived time pressures, or normal human physiological limits are the root causes of mishaps. The safety community is trying very hard to analyze, document, and address the real reasons — the root causes of mishaps — in a different manner.

Looking at Class B flight mishaps, the F-4 did pretty well. The last Class B, a few years ago, involved an F-4 takeoff abort after an AB fuel pump failure resulted in a fire. Of the 20 Class B mishaps we experienced over the last 10 years, five (25 percent) were OPERATIONS-related and 15 (75 percent) were LOGISTICS-related.

Six of the LOG-related causes were tied to the high cost "electronic countermeasure equipment" parts, while the remaining involved a cross section of failures as listed below.

- Nozzle flap seal burn-through
- Main landing gear strut failure
- RCP electrical fire
- Engine FOD
- AB fuel pump failure
- Antiskid failure
- Utility hydraulic failure resulting in a nose-gear-up landing.

A broad look at the F-4 Class C mishap statistics in FY95 shows 50 percent of the reported Class C's came from the *F-4G* community flying 60 percent of the active F-4 fleet. The *RF-4Cs*, representing about 25 percent of the F-4 fleet, reported 14 percent of the Class C mishaps, and the *F-4Es*, flying 15 percent of the total F-4 fleet, reported 36 percent of all Class C mishaps.

I'd like to stress the importance of reporting any and all Class C mishaps according to AFI 91-204. Analyzing all available Class C mishap information allows the NAFs, the MAJCOMs, and us to identify trends within the whole fleet, or within a particular wing, from a different perspective. A trend of seemingly minor Class C mishaps could be Finding 1 in the next Class A mishap. Let's try to keep that from happening.

Grouping the causes in our Class C mishaps, we identified about 36 percent engine-related causes. The trend identifiable here is several airborne and ground F-4E "uncommanded engine shutdowns." Detailed investigation revealed a problem with the throttle rigging procedure being used and with the design of some of the throttle box assemblies. Twenty-three percent of the Class C mishaps related to "false fire light" indications where moisture, shortages, resistance problems, and worn parts were identified as causal. The other 41 percent were normal wear-and-tear causes, including two nose-gear-up landings within the F-4E community.

A bailout from an F-104 Starfighter at ground level and 100 knots on a cold, windy, and rainy typical German winter night in 1970 with one swing before "ground impact" taught me, among other things, one important lesson. ***Study all available ejection seat data and limitations in depth.***

FY95 Flight Mishap Class A

Let's talk about the F-4G Class A we experienced during FY95. My information concerning accident details was derived from the releasable AFI 51-503 accident investigation report.

The aircraft was No. 2 of a fourship sortie. While practicing tactics and weapons employment, the aircraft had a malfunction that produced heavy smoke and heat in the cockpits. The crew decided to land at a nearby suitable emergency airfield and started a climb through and around clouds to an altitude that ensured terrain clearance. En route to the airfield, smoke in the cockpits became so thick the crew had to jettison first the rear canopy, followed shortly afterwards by the front canopy.

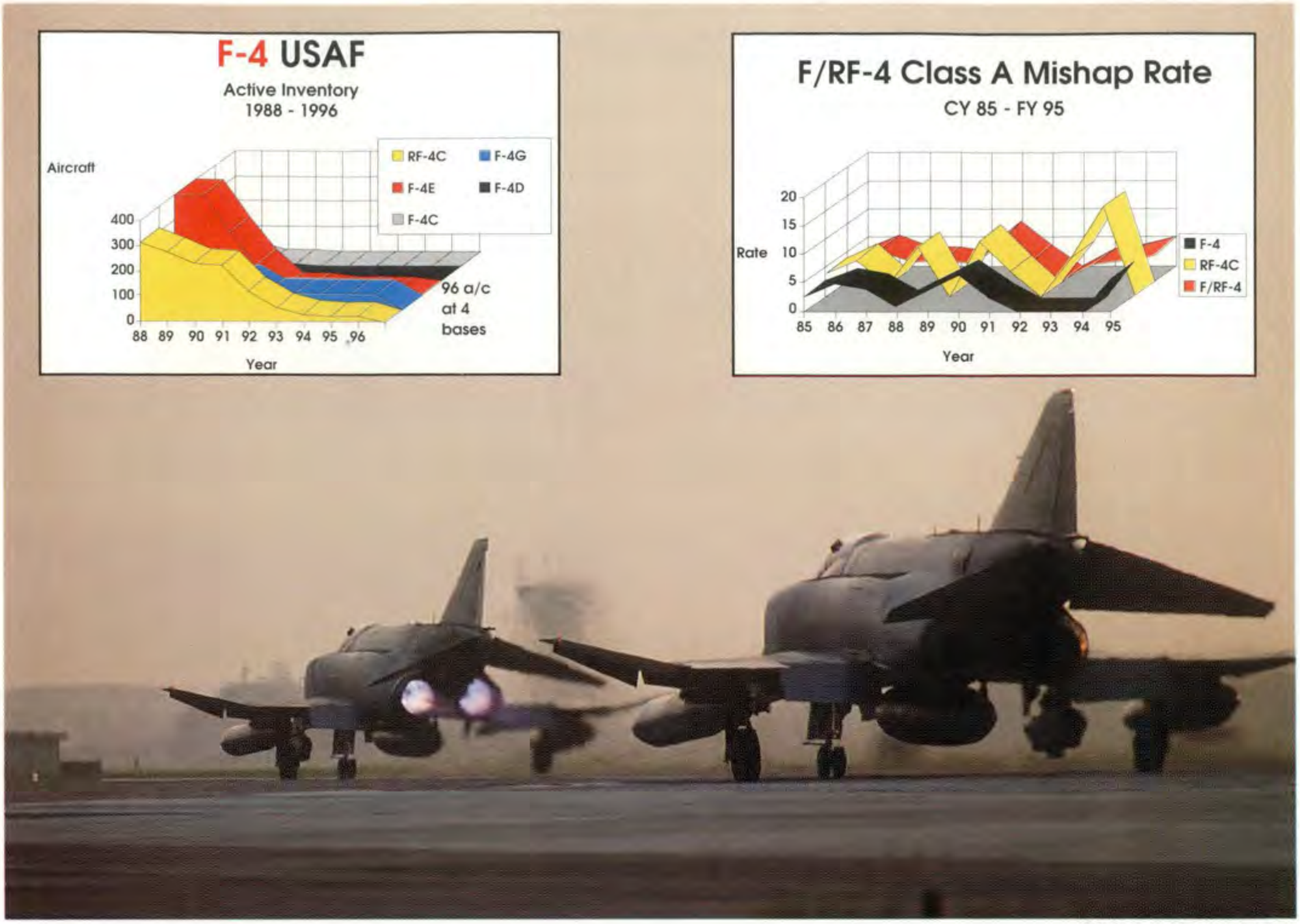
(NOTE: *If ejection is required after both canopies are lost, the electronic warfare officer (EWO) should rotate the command selector valve to the horizontal position and initiate dual ejection of both crewmembers. If the front canopy is lost, and then the pilot initiates the ejection, the front seat will eject without the normal delay, exposing the EWO to the front seat rocket blast, and a collision between seats could occur.*)

Even with both canopies gone, smoke persisted in parts of the front cockpit, and the pilot was not able to see cockpit instruments. The crew's ability to talk over intercom and UHF radio deteriorated without canopies.

Shortly after lowering the landing gear, the intercom and UHF radio failed. Failure of intercom and UHF went unnoticed by the pilot. The pilot began to feel intense heat on his right calf. While maneuvering for landing, the aircraft went into an uncommanded left skid and left roll which the pilot could control only with right rudder input.

Shortly thereafter, the pilot decided the aircraft was not adequately responding to his control inputs. He also judged that heat on his right calf was becoming more intense, placing him in imminent danger of a burn injury. The pilot initiated ejection around 4,500 feet above ground level, near wings level, and about 225 knots. Since the intercom had failed, unnoticed by the pilot, the EWO was ejected without warning and with unstowed equipment on his lap. Despite potential for serious injury to the EWO due to the rocket motor blast and/or front seat collision, the EWO received relatively minor injuries. The pilot was not injured.

The investigation concluded the accident was due to failure of one or more engine-bleed-air-associated components under panel 6R. These components are part of the cockpit air-conditioning system and make use of engine compressor 17th stage bleed air. Panel 6R is on the righthand side of the fuselage by the front cockpit. Wiring for the aileron rudder interconnect (ARI) system is near the components under 6R. Heat damage to this wiring could result in malfunction of the ARI system and



USAF Photo by MSgt Perry J. Heimer

result in uncommanded skid, with associated roll due to dihedral effect. This scenario is consistent with aircraft behavior prior to ejection and rudder displacement found after the accident.

After the investigation, a safety TCTO was issued requiring replacement of one component and addressing safety wire usage on all hot ducting in Panels 6L and 6R. Appropriate changes to technical orders were initiated.

Aside from the engineering lessons learned, we aircrews are reminded once again that we can go from a standard mission to a serious emergency in the blink of an eye. Emergencies involving any kind of bleed air failure are inherently dangerous due to the numerous failure modes as indicated in our Dash One. Positive communication within the emergency aircraft, and then to other members in the flight, is essential to handle severe and deteriorating emergencies. Positive communication in our environment must be seen as a transmission *received* and properly *acknowledged*. Dual ejection without positive communication by primary or secondary means (eject light) can lead to serious injury or death.

By experience, we all know distraction and task saturation lead to channelization. Knowing this, we need to train ourselves to manage tasks during the available time. Prioritize the tasks and then work them in a building-block-type approach. Normally, we can manage about eight tasks at the same time before our performance degrades significantly. During an emergency situation, however, we need to reduce the task load to less than normal. Depending on the severity of the situation, flying and one additional task may be all we could cope with.

Nice to Know

Ejection stats. The only Class A mishap in FY95 and two successful ejections did not change our TOTAL LOSSES/EGRESS statistics too much. For the period 1963 to 1995, we have an updated number of 595 total Class A mishaps, with 518 destroyed F-4s. The egress database comes up with 544 total fatalities (289 pilots), and we count 752 total ejections over that time period. Eighty-one percent of the ejections from the F-4 are recorded as successful. We all know the success rate could be a lot higher. We aircrews need to clearly understand the limitations of our ejection system. Know your ejection envelopes!

A bailout from an F-104 Starfighter at ground level and 100 knots on a cold, windy, and rainy typical German winter night in 1970 with one swing before "ground impact" taught me, among other things, one important lesson. ***Study all available ejection seat data and limitations in depth.*** Since that day, I set personal ejection parameters for every aircraft I fly. I mark the four corners of my "ejection envelope" with parameters for

- controlled flight,
- out-of-control flight,
- off the perch (traffic pat tern/range), and
- T/O (engine failure).

I've never had to use a "nylon letdown" again, but having these parameters ready every time I light the burners gives me a good feeling.

Cockpit/crew resource management (CRM).

Nearly every time I use the term *CRM*, I get the answer "We, in the fighter community, don't need that," or "Another mandatory program is all we need!"

I thought the same way, first reading about the use of CRM in the airline world about 1987. More knowledge about CRM, what it really is, the way it developed, the applications, and the success this type of program all over the world has made me a believer. No matter what area of the Air Force mission we talk about, the human (even fighter pilots) can be taught to overcome human limitations in order to do a job more efficiently — or even better, stay alive longer. A recent USAF study of 323 Class A and B mishaps, occurring from FY89 through July 1994, identified aircrew awareness and aircrew judgment as causal factors. We must use CRM in the "fighter community." Tailored to our tasks, to our environment, and to our single- or dual-seat mentality, CRM will be a powerful tool to reduce the consistently high number of "human (pilot/crew) causes" in our mishaps. CRM, professionally applied and openly accepted by the customer, will maximize mission effectiveness by enhancing our ability to use available resources more efficiently. It will improve our coordination and our communication skills within our aircraft, within our formation, and with others who are part of our task. I urge you to look at CRM with an open mind, pick up AFI 36-2243, and get involved. Accept CRM as a management tool for professional pilots. ■

Summary

From the first flight of BuAer (Bureau of Aeronautics) No. 142259, an aircraft designated F-4H-1, on 27 May 1958, in St. Louis, Missouri, more than 38 years have gone by. The USAF has flown more than 10,200,000 flight hours with all models of the F-4, and aircrews and aircraft have performed the assigned tasks very well. There is an old saying that "all good things have to end sometime," and that holds true for the F-4 in the active USAF inventory.

The future of the USAF fleet is clearly defined. There is a further reduction of the total force this year. The 152 RG of the ANG at Reno Cannon IAP, Nevada, will retire the RF-4Cs and convert to KC-135 tankers. The F-4G squadron at Nellis AFB, Nevada, will inactivate soon, and the last ANG F-4G Fighter Group in Boise, Idaho, will convert to A-10s by next year. Only the F-4Es of the 49 FW at Holloman AFB, New Mexico, will be around a little bit longer. It's sad to note, but it looks like the F-4 is pretty much disappearing out of the active USAF flying inventory. For all of you who really are in love with the PHABULOUS PHANTOMS, this advice: If you haven't gotten a picture of good old "UGLY" yet, and you see one flying around, get your camera fast! It might be a QF-4 Drone, and you never know how long she will look like an F-4.

WHATEVER YOU FLY IN THE FUTURE, MANY HAPPY LANDINGS AND CHECK SIX! ■

EAGLE REVIEW '95

USAF Photo

LT COL KEN BURKE
HQ AFSC/SEFO

■ Greetings to all, out there in Eagle Land! Ready for a review of FY95 from a "Safety" point of view? I knew you were waiting for me to ask.

Stats

A few numbers for your lineup card before we commit. "We" suffered four Class A mishaps again last year, flying 206,649 hours, for a 1.94 rate (mishaps per 100,000 hours, for the metric-challenged). That's a small increase over the previous year's 1.9 rate and fairly reflective of the 10-year look-back of 42 mishaps, during 2,118,599 hours, for a 1.98 rate. The overall fighter/attack Class A rate last year was 2.55.

We experienced five Class B mishaps for a 2.42 rate. That's up from the previous year's three mishaps, for a 1.43 rate, and well above the 10-year average of 1.51.

So what's the good news? The F-15 is *still* the safest fighter ever flown from a Class A mishap rate point of view!

The Mishaps

Okay, now that we have that out of the way, let's take a *little* closer look at the year. I say "a little closer" because we can't get too close to that *Privilege* stuff here. Your local flight safety officer can elaborate on specifics of these mishaps in order to help **YOU** prevent their recurrence.

- On their second mission for the night, the flight was getting in a few practice intercepts over the Atlantic. During a planned descending spacing maneuver as the adversary element, the mishap pilot (MP) got into a steep dive and became confused over the aircraft's attitude. Recognizing they had over 500 KCAS, rapidly passing 10,000 feet, and with neither crewmember able to verify attitude, the MP commanded bailout. Both crewmembers suffered severe flail injuries, and the mishap WSO was fatally injured.
- On a formation mil-power takeoff, the MP had control problems. Directing the wingman to clear off, the MP continued the takeoff attempt. The aircraft departed the runway, rolled over, and was destroyed. The MP was a fatality in this one, also. Investigation revealed the longitudinal and lateral flight control rods to the mixer assembly were installed backward. Neither the MP nor any of the ground crew associated with the launch of this aircraft detected the problem.
- On a large force exercise, the MP's aircraft departed controlled flight. The mishap aircraft quickly entered a low-rate, oscillatory spin. Lacking sufficient altitude to recover from the spin and dive, the MP successfully ejected. An undetected fuel imbalance in the external wing tanks was suspected to be a factor in this mishap.
- During a 2 v 1 ACM engagement, the furball got a little too thick. While maneuvering against the bandit, the two fighters collided, resulting in damage to both aircraft. The jets were landed safely, but the repair costs exceeded $1 million.

So, what does this mean? We lost three good aircraft. That's not a number any of us should be satisfied with. We lost two of our squadron mates. That's unacceptable. I don't see anything new in these mishaps — it's all been invented before. Did we not pass the word out? Are we eating the books? No, the word's been passed, the books have been read.

There are no easy answers here. We could add some training rules, have a safety slogan contest, or maybe have a day where we all sit around and think about safety. Of course, we've done all that before, and still, here we are — most of us, anyway. In every one of these mishaps, someone let their guard down, even if only for a short period of

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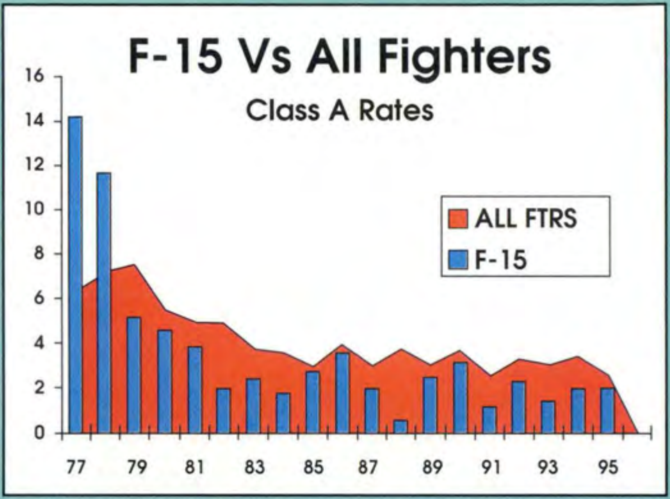
FTR Destroyed Rate

USAF

TYPE	NUMBER	RATE
F-104	170	26.43
F-100	889	16.25
F-5	40	9.05
A-7	102	5.77
F/RF-4	518	5.01
F-16	204	4.54
A-10	83	2.64
F-15	84	2.57

As of 30 Sep 95



time. Priorities were in other places, maybe because the pilots were too comfortable with what they were doing, and they had been successful that way for years.

Sometimes an unplanned event distracts us long enough to break our normal/good habit pattern. A change in the game plan steals part of the situational awareness (SA) we built into our mission when we planned it and briefed it in detail. When Lead aborts, or the launch is slipped and the airspace gets changed, or the unplanned weather rolls in, or the alternate mission is suddenly THE mission, a great BIG warning should light up in the HUD. "WARNING, SA LOW; WARNING, SA LOW" should be ringing in your ears. The number of mishaps and near mishaps that occur when the plan changes is amazing.

Do I advocate canceling when an unplanned event happens? No. The ability to cope with the unexpected is one of the things that makes the USAF the best in the world. The point is, you're not STANDARD anymore. You're a candidate for the mort locker and its permanent kill removal. The good news is that by recognizing this threat, you are in a much better position to protect yourself and your wingmen.

Let's face it — "Safety" can be boring. It involves paying attention to boring little details. However, if you live your life daily without thinking "Safety," you can't just insert it at any moment when you think you need it. "Train like you're going to fight!" Yeah, okay, likewise with safety. If your safety attitude is there every day, it'll be there for you during emergencies and other contingencies (even if only subconciously).

Is there anyone left out there who has not heard in some safety brief, "We can always buy another airplane, but we can never replace you!"? **BS.** There are thousands of folks ready, anxious, and able to take your place. Oh sure, it won't be *you*, but that doesn't mean any of us is indispensable. When one of us gets killed, the rest of us all lose something. But life (for us) goes on. The only one who can take care of you is **YOU**.

The Class B's

■ As the mishap aircraft (MA) was on short final, a large flock of small birds flew into its flightpath. With insufficient altitude or knots to jink, the MA took numerous hits. The MP went around and got a battle-damage check. No aircraft damage was noted, and a successful landing was completed. Postflight inspection revealed extensive damage to one of the engines.

■ Four Class B's made the list this year due to engine failures and/or fires. The fixes are still being developed. Until the failure modes can be eliminated, each of us will continue to be responsible for taking due care of those two motors like they were a pair of our own personal appendages hanging from our bodies. This is where I usually say something derogatory about the F-16, but this year I'm not going to make fun of the Lawn Dart, here. See Capt Dave Wood's article "FY95 Engine-Related Mishap Summaries" for a more detailed (read "better") discussion of our engine problems.

Class C's

There were about 100 Class C's reported to the Safety Center this year. The rate? Not important! The fact is engine and engine indication problems accounted for over half of the reported Class C mishaps in FY95. The only other "trend" was departures from controlled flight and uncommanded roll/yaw. The departures were about equally attributable to pilot-induced and flight control system malfunctions. The rest of the incidents reported were miscellaneous.

There was an unusually high number of pieces of Eagles falling off in flight, as well as melted windscreens as a result of the anti-ice switch being left in the "on" position too long. Water intrusion beneath the aircraft "skin" that later leads to delamination is the largest single suspect for losing parts of your jet.

As usual, accurate reporting of Class C mishaps is something we highly encourage so we can all benefit from the incidents and lessons learned.

Have a good flying year out there! Check six!

Adios. ■

VIPER MISHAPS '95

USAF Photo by SrA Andrew N. Dunaway, II

MAJ KENT DUKES
HQ AFSC/SEFO

■ FY95 has proven to be a relatively "quiet" year for the Viper. With past years averaging around 16 Class A mishaps, we slid under the wire with 9 Class A's for FY95. While it would obviously be better to have zero, nine Class A's, as compared to a "squadron-a-year," is remarkable.

Statistics

The nine Class A mishaps break down into two operations and seven logistics. The two operations mishaps consisted of a GLOC and a midair. The seven logistics mishaps were all engine failures. Without a doubt, the aspect of flight mishaps we all are most concerned about is the loss of a comrade. Unfortunately, we did suffer one fatality this fiscal year.

The accompanying chart compares FY 95 to our past.

The year's Class A breakdown by MAJCOM shows ACC with one, AETC with two, USAFE with two, and ANG with four. Kudos to PACAF and AFRES for no Class A mishaps!

The venerable ACES II has given us another year of flawless support. Nine more Viper drivers (and one crew chief) have earned their ACES II "wings" and returned safely to terra firma. Hats off to all those life support and egress types out there. Without their attention to detail, it might have altered the 10-for-10 record for this year. Sierra Hotel, people!

There was one Class B this year for a rate of 0.26. There were 58 Class C's of note: 5 departure from controlled flight, 8 hard landings/ wake turbulence, 6 bird strikes, 16 engine, and 5 brake-related mishaps. If you want a realistic definition of a Class C, I'd say that a lot of them are Class A's in the making, and either luck or pilot skill gets the jet back on the ramp without further incident! While these numbers, by themselves, don't appear to be too bad, I have to wonder how many similar IFEs have happened this year that didn't meet the Class C criteria! I don't think it would be much of a stretch to say there were a plethora of brake problems this year. How about landing-gear problems?

	Class A	Rate*	Fatal	Hours
FY95	9	2.33	1	386,445
FY94	17	4.24	3	400,902
10-year avg.	16	4.27	4	358,000

*per 100,000 flying hours

Class A's

■ While approaching the IP on a SAT mission, the engine failed. The Viper driver zoomed and turned toward the nearest divert base. His attempts to restart the only engine on board (we don't carry an airborne spare like "Rodan") were in vain and he successfully stepped over the side.

■ "All right! I finally get my incentive ride," says the steely-

continued on next page

USAF Photo

Can you say "low altitude engine failure"? *Quelle surprise.* (My sources seem to have a lack of imagination.) Anyhow, this turbo-machinery failed abruptly, and flames erupted from the jet. Hmmm? Yep, you guessed it. The pilot bailed. He did, however, get hung up in a tree — for about 45 minutes. I never did like hanging harness training...

eyed Viper crew chief. All went well until (you guessed it, again) the *only* engine kinda quit running — and rather violently, at that. The pilot and guest successfully utilized the nylon letdown and were safely returned to earth. That's a crew chief who got one heck of an incentive ride! Wonder if he'll volunteer for another one? You bet!

■ During an ACM sortie, while maneuvering to support the fight, the aircraft impacted the water with no attempt by the pilot to eject. GLOC/fatigue is a likely factor in this tragic fatality. Especially in this day and age, with flashpoints across the globe, we are seeing more and more demands placed on our pilots. We can't ever forget just how demanding flying the Viper in any arena can be. It's a very unforgiving environment.

■ While low level to the range, the engine auto-transferred to SEC. Again, the Viper driver climbed, knocked it off, and turned toward the nearest field. The engine slowly began to lose thrust and soon failed. After one unsuccessful airstart, the pilot ejected. Of note, the parachute risers twisted, and the riser tacking remained intact, impairing the pilot's ability to four-line jettison.

■ This one's a little more spooky. While landing from sequential overhead patterns, two Vipers experienced an unbriefed rejoin on short final (Ouch!). One pilot ejected, and the other jet limped around the pattern and landed safely. As mundane as the traffic pattern may seem, IT'S NOT! It's potentially more dangerous than a 4 v 4, heaters and guns scenario (especially if you throw in a little post-mission letdown)! While there were no fatalities in this mishap, the outcome could very easily have been disastrous. One more bullet for the old saying, "It's not over 'til the debrief's over." Don't let up — not even for an instant!

■ During a low-level student sortie in the "family model," the engine ceased to produce thrust — it flamed out. The crew attempted an unsuccessful airstart. As we all know, that's full-scale *bad* on the Viper *good-bad* scale. On the good side, we got both pilots back.

■ Can you say "low altitude engine failure"? *Quelle surprise.* (My sources seem to have a lack of imagination.) Anyhow, this turbo-machinery failed abruptly, and flames erupted from the jet. Hmmm? Yep, you guessed it. The pilot bailed. He did, however, get hung up in a tree — for about 45 minutes. I never did like hanging harness training...

■ During a 4 v 6 ACT mission, the pilot initiated AB during the initial tactic and felt an explosion and severe engine vibrations. He snapped to MIL with no change, so he then selected IDLE. The RPM and FTIT continued to decay, so he initiated the CAPs for airstart to no avail. The ejection was uneventful (It seems to me that ejection is an event unto itself!), and the pilot was rescued within an hour.

■ The final Class A was a three-ship ACM sortie. During a defensive break turn, the pilot felt a bang and engine vibrations. While turning to the nearest base, he initiated the airstart CAPs. The engine did not respond. Of merit and worth mentioning here, the chase pilot very judiciously chose his words to describe what he saw. He didn't just scream "YOU'RE ON FIRE!" He calmly described a "10- to 15-foot orange flame contained within the burner can." The reason I bring this up is this is exactly what a stall/stagnation looks like. I'd hate to jump out of an airplane that had a stagnation and could have been restarted. On the other side of the coin, if you think someone's truly on fire, say so. The SAR took about an hour. As luck would have it, our steely-eyed aviator was rescued by the local news helicopter. They, of course, wanted an interview!

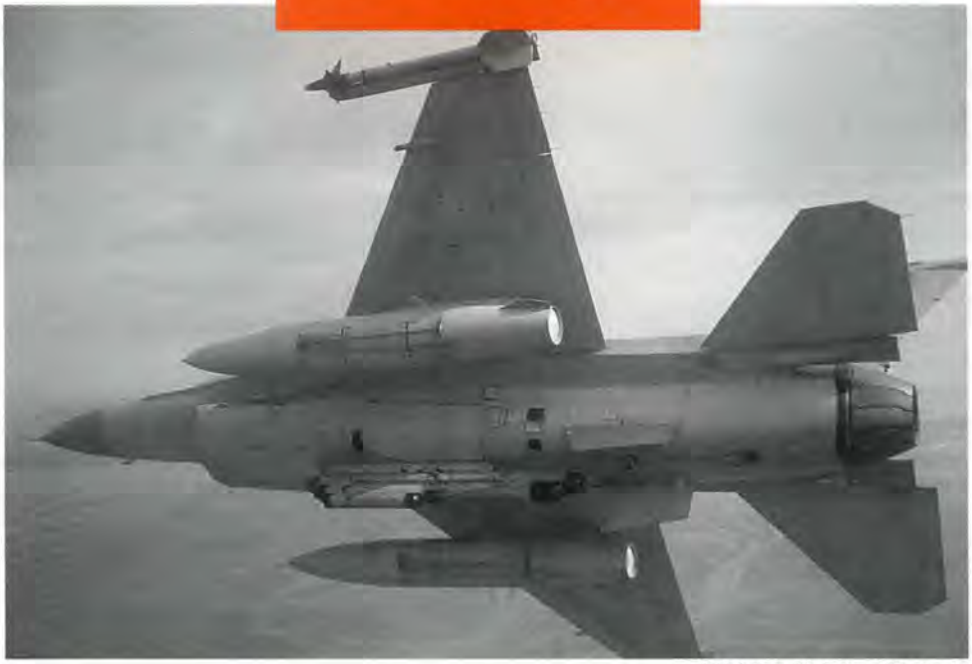
Class B

■ A craniums-up RSU crew noticed what appeared to be a tire failure on takeoff. They immediately notified the pilot, and the IFE began. The tire in question was the nose tire, and the SOF initiated a Conference Hotel since this was not a "normal" EP. The safety shop at Lockheed Martin developed a game plan to recover the jet. The pilot then safely recovered the jet with some minor damage to the nose strut and other assorted parts.

Concerns

Unquestionably, the biggest concern in the Viper world is collision with the ground. We've lost countless Viper drivers primarily to GLOC and spatial disorientation. The potential for GLOC is still out there. Don't kid yourself into thinking that just because you don't hear many GLOC stories or that you wear COMBAT EDGE, the problem has been "fixed." It's the most insidious and ever-present threat to all Viper drivers. Physical conditioning and a solid straining maneuver are still your best tools in "keeping your lights on." Manual ground collision avoidance system (GCAS) is coming. The automatic version won't be in place until the next millennium.

Never hesitate to call the big "knock-it-off" if something just doesn't seem right.


USAF Photo by SrA Andrew N. Dunaway, II

Obviously, engine reliability is also a major concern. There are numerous specific problems being addressed. The past answer has been to create an inspection for each successive engine problem. This has put quite a workload on local engine shops. It did not fix the problem — it treated the symptoms. Most of the problems have long-term fixes, but they're costly and will take time.

Landing gear and brake problems have plagued us over the past year as well. There have been some close calls with landing gear this year. One that comes to mind is an MLG trying to retract on landing. The brake problems typically have been with the wheel speed sensor, the brake controller, and even the parking brake switch.

Well, that's all I have. There're 15 minutes to step. Any questions?

In closing, let's look to the future. Empowerment has shifted more responsibility to the lower levels. The high ops tempo we currently face has greatly increased duties across the board. Having said that, there is a greater need for all of us to take a hard look at ourselves and our buds. We need to ensure we're completely prepared to strap on that jet. Never hesitate to call the big "knock-it-off" if something just doesn't seem right. You just can't be too careful anymore. Once you do strap on that mighty Fighting Falcon, stay focused and "kick butt and take names." (Names are optional.) Cranium's Up! Seeeee ya! ■

USAF Photo

F-111 MISHAP REVIEW

MAJ STEVE PRETESKA
HQ AFSC/SEFO

Less Is More

■ The numbers of the last century-series fighter remaining in active service continue to dwindle at scenic Cannon-by-the-sea. I guess the Lawn Darts have finally discovered one of the best-kept secrets left in the USAF: Supersonic aircraft and cattle can co-exist! What's not secret are the cold, hard facts of operating the venerable 'Vark in FY95: 1 Class A, 3 Class B's, and 24 Class C's. Additionally, the facts tell us engine failures and birds were the biggest threat in FY95.

The Cost of Going Low and Fast

Engine-related malfunctions were involved in 1 Class A, 1 Class B, and 16 Class C's. Superior airmanship (and the spare motor) recovered all crews and all but one E-model which obviously didn't want to leave the enchanting desert of eastern New Mexico for the scenic desert in southern Arizona. Similarly, bird strikes precipitated two Class B's and two Class C's and detracted from an otherwise exceptional mishap record.

"I've Got a Sinking Feeling..."

The Quick and Dirty on Our Class A

All was ops normal for our mishap crew (MC) until the final — and I really mean final — turn when a seemingly innocuous generator light lit. A common F-111 IFE is single generator failure with the other side reliably picking up the load. On this day, the MC intended to deal with this "common" IFE by completing the full stop. Good answer, if the $200 question was "What do you do if you lose a generator in the final turn during a severe clear day with a 'tie' indication?" A better analysis by the MC of what the problem really was would have revealed that it was $1,000, Double Jeopardy time and that they had no generator because they had no engine. Confirmation of how quickly life went from good to really bad came when the throttles were pushed up to intercept the glidepath upon rolling out of the final turn. One engine room answered the captain's call for flank speed, but No. 2, of course, was out to lunch (and out of gas) because of a fuel control problem. A recovery attempt was made, but as airspeed and altitude ran out, the MC made the wise decision to transition to a nylon letdown. All was as expected from that point on, and the ground rescue crew was even able to cajole the crew to leave the relative comfort of their now slightly used escape module to avoid the ground fire heading their way!

Okay, what did we learn? First, stuff does happen, and it can happen very quickly. Sometimes, it's all you can do to quickly figure out if you can adequately control the jet and if there's sufficient thrust to keep flying. If you've got both, you can proceed to Step 2 and answer the "Why" question. The Dash One doesn't address all possible scenarios (although this mishap did point to some improvement areas); you'll sometimes have to creatively apply systems knowledge.

Time and conditions permitting, do what the SIB will do when they show up to figure out why the aircraft is now permanently "parked" short of the runway sans crew module instead of whole and in storage at D-M — keep asking yourself "Why?" Why is the generator light lit? Why is there a notable lack of thrust? Why is the engine rolling back? Why didn't I transition to the Mudhen with the first wave? Why is this happening to me?!?

Lastly, make a timely ejection decision. Obviously, this crew did, and the escape system worked as advertised. The mishap contributed to the Class A rate but fortunately did not affect the fatality numbers.

Rating the Rate

The F-111 Class A rate for FY95 was 3.33 per 100,000 flight hours. A review of other aircraft rates at the end of their lifetimes was inconclusive. Some tapered off gradually while others swung widely as the flying hours were reduced to zero. The bottom line is not to get hung up on the rates but to recognize some other truths about end-of-lifetime concerns and the future of F-111 operations such as:

Aircrew and maintainers alike need to remain focused as the operations tempo continues to pound away at the jets and the people. As my predecessor pointed out so accurately last year, "...worldwide crisis response seems to take its toll, particularly on EF-111 crews and maintainers...and the families."

Likewise, the imminent departure of all but the "air-superiority gray" swing-wing jets will undoubtedly cause stress simply because of the significant changes involved with this massive transition. While, as was stated before, there appears to be no direct correlation between the deactivation of a weapons system and the mishap rate, there's no sense in starting a trend either.

Below are the statistics to help you draw your own conclusions.

Know your single-engine procedures, pay attention to the bird hazard status, and take good care of yourself, your crewmate, and your family. We're all about maintaining mission capability. Cover your ASSets and manage the risks wisely! ■

	Class A rate	Class B rate	Total destroyed
All USAF FY95	1.44	.86	29
Ftr/Atck FY95	2.55	1.433	18
F-111 FY95	3.33	9.99	1
F-111 FT94	0.0	3.31	0
F-111 Lifetime*	6.13	5.27	95

*does not include FB-111 data

USAF Photo by SrA Andrew N. Dunaway, II

FY95 ENGINE-RELATED MISHAP SUMMARIES

MAJ (SEL) DAVE WOOD
Chief, Propulsion Engineering
HQ AFSC/SEFE

Introduction

■ Historically, engines cause about 20 percent of Class A mishaps in fighter/attack-type aircraft and rarely ever cause Class A mishaps in bomber/tanker/transport/helo-type aircraft. As you can see in Figures 1 through 3, FY95 was an unusual year.

Is this just a statistical aberration, or is this an indication of an emerging trend? Well, it's still too early to tell whether FY96 will see the same engine-related mishap rate. However, one fact is disturbing. Nearly half of the engine-related Class A and B mishaps in FY95 were repeats of previous problems.

You're probably asking yourself why? Don't we fix these problems? Well, we try. First, you have to recognize the problem exists. Many problems first surface as Class C mishaps or nonmishap events reported via the Product Quality Deficiency Report (PQDR) system. Since there are literally hundreds of engine-related Class C mishaps and PQDRs every year, it's hard to keep on top of all the problems. Second, you have to know what's causing the problem. The sheer number of failures often overwhelms the capacity of AFMC to investigate and identify the cause in a timely manner. Finally, you usually need money to fix the problem. That's a commodity in short supply these days.

There are some initiatives under way to try to eliminate repeat mishaps. We at AFSC plan to provide a quarterly engine Class C mishap trend report to the engine depots. We are also getting access to the PQDR data base (GO21) to look for items

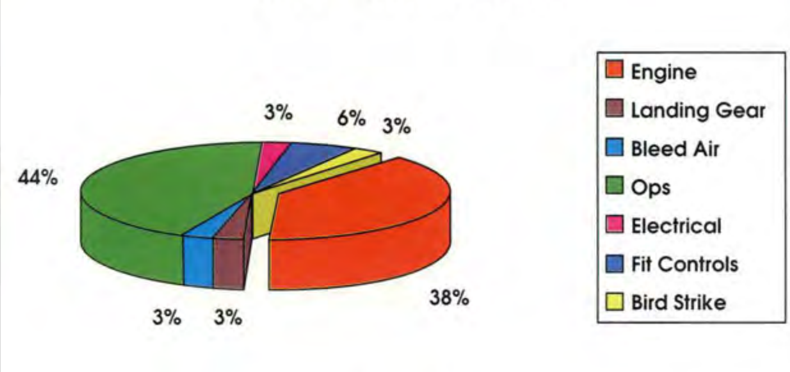


Figure 1

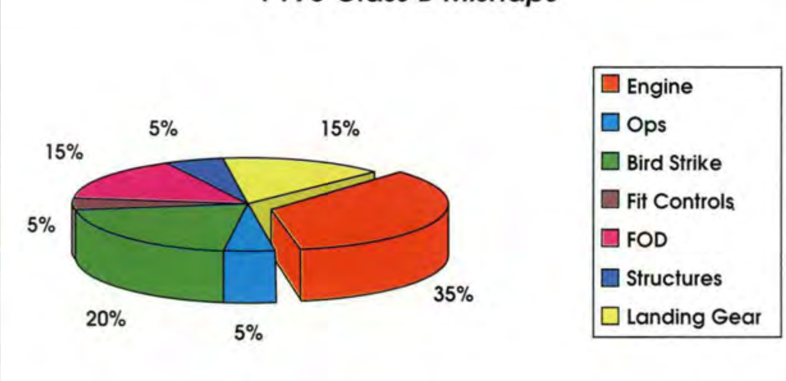


Figure 2

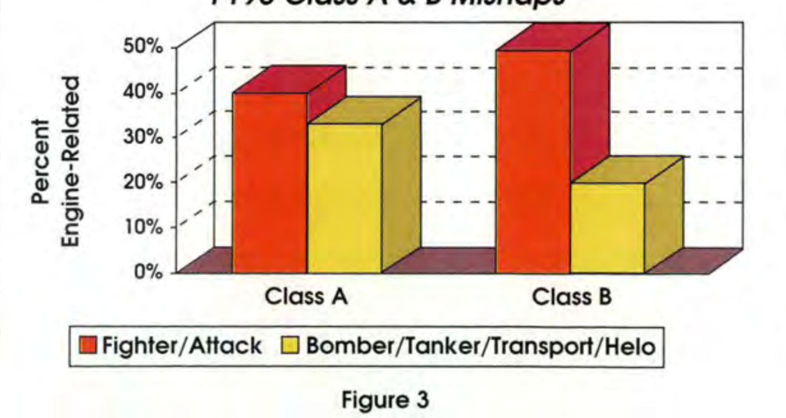


Figure 3

that may lead to future mishaps. By taking the first step, identifying the problem exists, we should provide the engine managers with more lead time to find the causes and funds needed to fix engine problems.

Another initiative, spawned by a Class A mishap last year, is being tested on a trial basis. The wing safety office now has to coordinate on all PQDRs; in particular, the FSO will ensure the appropriate category is assigned to each PQDR. For example, a CAT I deficiency is one that can cause death, severe injury, or major system damage or loss. In other words, a deficiency that can cause a Class A mishap should be assigned as a CAT I.

USAF Photo

Heavies experienced two Class A and two Class B mishaps in FY95, which is unusual. That's because these were all uncontained engine failures. Chucking large pieces of metal, spinning at thousands of revolutions per minute, is bad medicine. In fact, it was a bad year for uncontained failures for all aircraft types (see Figure 4).

Another way to look at engine problems is by cause. Basically, engine parts fail for one of three reasons: (1) the design of the part is deficient, (2) the part does not meet the design specification requirements (i.e., a quality problem), or (3) the part was not properly maintained. Figure 5 shows the distribution of causes for FY95.

As you can see, design problems were the major contributor to engine mishaps last year. Included here, rather than in the maintenance category, are designs which are not maintenance friendly (see the discussion of the F110 Variable Stator Vane system and the F100 No. 5 Bearing Compartment in the mishap summaries later in this article). As stated earlier, declining defense budgets mean we are forced to live with problems rather than fix them.

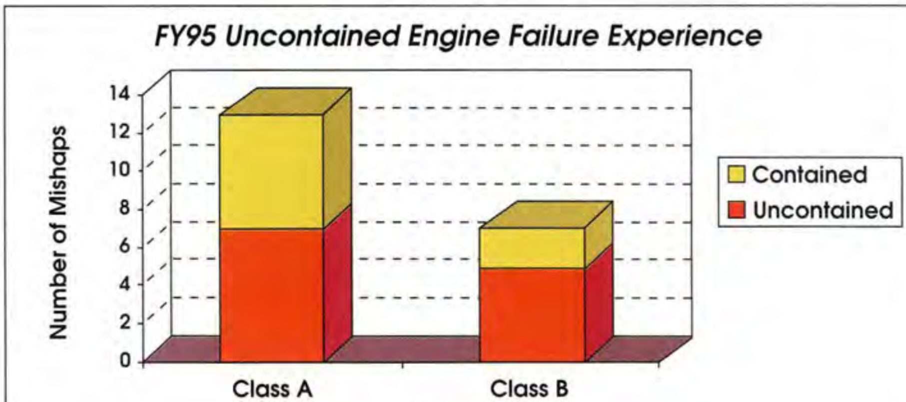


Figure 4

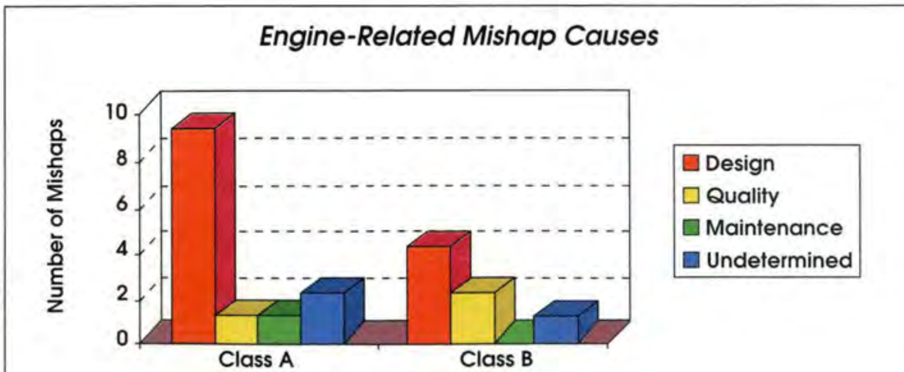


Figure 5

The following sections provide a summary of all the engine-related Class A and B mishaps. As you read them, you'll notice the themes discussed above coming up again and again.

F-16 Summary

Table 1 (next page) shows how we fared this year compared to FY94. Although we did not fare as well in FY95, it was a pretty average year for F-16 engine problems. A summary of the Class A and B mishaps is provided for each engine model.

F100-200 Engine

This Class A mishap is a good example of a known problem. The F100 fuel manifold and clamping system has been an area of concern, having caused 13 flameout and fuel leak events. Normal engine vibrations can cause the clamps to wear and fail, eventually leading to manifold fractures. That's exactly what happened here. The fracture led to a flameout,

continued on next page

USAF Photo

Table 1
F-16 Engine Related Class A Mishap Statistics

Engine	FY 1994			FY 1995		
	Class A Mishaps	FY94 Rate	6 Qtr Rate End FY94	Class A Mishaps	FY95 Rate	6 Qtr Rate End FY95
F100-200	0	0	1.07	1	1.81	0.99
F100-220	1	1.07	0.71	2	1.81	1.24
F100-229	0	*	*	0	*	*
F110-100	3	2.33	1.84	2	1.30	1.41
F110-129	1	*	*	2	*	*
All engines	5	1.49	—	7	1.86	—

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

and the pilot ejected safely. The depot is evaluating a redesign of the clamping system to eliminate this failure mode. They are also discontinuing the practice of reinstalling used clamps during overhaul.

F100-220/220E Engine

Late in the fiscal year, both the F-15 and F-16 began experiencing unexplained low pressure turbine failures on 220/220E engines. Whereas the F-15 events led to Class C mishaps, they caused two Class A mishaps in the F-16. The pilots successfully ejected in both cases. Areas being investigated include the third-stage blades, third-stage blade outer airseals, fourth-stage blades, and the No. 5 bearing support rods.

F100-229 Engine

The -229 has yet to cause an F-16 Class A mishap, but then it hasn't accumulated many flight hours yet. It has also gained valuable experience in the F-15E, leading to design fixes and inspections which have prevented an F-16 mishap. With the incorporation of some major hardware upgrades over the next several years, such as the robust fourth-stage turbine blade and disk, the outlook for the -229 is very good.

F110-100 Engine

Both F110-100 Class A mishaps were due to known problems. The first was a turbine failure caused by an aft high-pressure turbine blade retainer fracture. The retainer is prone to creep, radial growth due to exposure to high temperatures and loads. The mishap pilot was forced to eject after the turbine failure. The same retainer is in the F101 engine used in the B-1B and receives a creep inspection during routine borescopes. This inspection is now being implemented in the F-16. In addition, a creep-resistant retainer is being retrofit during overhaul.

The second F110-100 Class A was due to the Variable Stator Vane (VSV) system. It has long been recognized that the VSV system is prone to misassembly. This can result in a once-per-revolution excitation of the compressor blades and an eventual fatigue failure. These failures usually result in titanium fires caused by damaged blades rubbing against the titanium compressor case. That's exactly what happened here, and the pilot ejected safely. This is not the first Class A attributed to the VSV. A Murphy-proofed design is available, but funding this modification is still pending.

F110-129 Engine

The F110-129 also experienced two Class A mishaps in FY95. Again, the ACES II ejection seat prevented any fatalities. Both mishaps were due to first-stage fan blade failures. One was an airfoil fracture. It appears that even the most minor FOD nicks (0.005 inches) can cause rapid fatigue crack propagation. FOD inspection and blade blending criteria have been tightened, and a more FOD-tolerant blade is being developed. The second fan blade failure occurred below the platform due to high cycle fatigue (HCF). The exact cause of the HCF is still under investigation.

F-15 Summary

Although the F-15 did not experience any engine-related Class A mishaps this year, there were four Class B mishaps. As with the F-16, most of these were due to known problems.

F100-100 Engine

There were two Class B mishaps involving the -100, both due to third fan stage disk lug fractures, another known problem area. The ultrasonic inspection interval has been decreased several times, but disk lugs continue to fail. The problem here is also high cycle fatigue (HCF). The third stage's proximity to the eight intermediate case struts results in an eight-per-revolution excitation, leading to fatigue cracks in the disk lugs. When the disk fails, the liberated fan blades penetrate the fan case, cut fuel and oil lines, and begin an in-flight fire. The aircrews made successful single-engine landings in both cases. A redesign of the third-stage fan blade and disk is being evaluated which will improve aeromechanical damping and increase fatigue margin. The earliest retrofit hardware could be available, assuming engine testing is successful, in late 96/early 97. So we're going to have to rely on inspections in the near term.

F100-220/220E Engine

The one Class B mishap involving the -220 was due to another familiar problem, the No. 5 bearing compartment. An oil leak at the oil jet adapter led to an oil fire and eventually an uncontained low pressure turbine failure. The crew made a successful single-engine landing. The current design is extremely prone to installation errors, which can go undetected by the current vacuum check. A redesigned No. 5 bearing compartment has been approved, but the TCTO hasn't been funded.

F100-229 Engine

There was also one -229 Class B mishap in FY95. A first-stage high pressure turbine blade failed forcing a single-engine landing. The blade failed due to thermal-mechanical fatigue cracks. That is, the cracks were caused by changes in temperatures rather than load. Routine borescope inspections failed to catch the cracks prior to the blade failing. The tech order limits are being revised, and improved borescope equipment is being procured to ensure our maintainers can find these cracks. An improved first-stage turbine blade is also being evaluated to reduce the susceptibility to thermal gradients.

F-111 Summary

The F-111 suffered one each Class A and Class B engine-related mishap in FY95. The Class A resulted from a faulty main fuel control. During final approach, the No. 2 engine rolled back to sub-idle. The right generator light illuminated, but the mishap crew did not recognize this as an indication of an engine problem. Not surprising, since the flight manual makes no mention of this. The aircraft began to sink below the normal glidepath, and the crew attempted a single-engine go-around, but was forced to eject when they could not arrest the sink rate. Examination of the fuel control revealed the governor power boost piston hung up at a sub-idle position. The inspection and overhaul intervals for fuel controls were lowered as a result of this mishap. The flight manual was also amended to alert crews that a generator light might be an indication of an engine failure.

The Class B mishap resulted from a No. 4 bearing area fire on a TF30-P-111 engine. It appears the area was either misassembled or had a nonconforming part installed at some earlier point in its history. With the imminent retirement of the F-111, no corrective action is planned. The EF-111 will remain in the inventory for several more years, but it uses the TF30-P-109 engine which has a different No. 4 bearing area design.

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F-117 Summary

There was one F-117 engine-related Class A mishap in FY95. It, too, was the result of a known deficiency. A full 8 months prior to the mishap, the depot discovered an unknown quantity of fuel recycling kits were produced with manifolds that could not withstand normal in-flight vibrations. Unfortunately, the PQDR system did not ensure a timely resolution of the problem. When the mishap aircraft's No. 1 engine fuel recycling kit manifold failed, the massive fuel leak caused both a fuel imbalance and an engine nacelle fire. The mishap pilot successfully landed and egressed the aircraft.

Several actions are being taken as a result of this mishap. The recycle kit has been deactivated in the interim until a redesigned manifold is available. Life limits/inspection intervals are also being established for the recycle kit. The PQDR risk categorization and tracking procedures are being revised to ensure safety-related PQDRs get appropriate emphasis.

T-38 Summary

The one T-38 engine-related Class A mishap was from another known problem, compressor disk corrosion.

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A crack propagated from a corrosion pit in the No. 1 engine's eighth stage compressor disk. When the disk eventually failed, it penetrated the case, severed several fuel and oil lines, and caused an in-flight fire. The shrapnel and fire affected the mishap aircraft's flight controls, forcing the crew to eject.

The source of the corrosion is still unknown. Oddly enough, no other users of the J85 engine have reported corrosion problems, including the Navy. Regardless, life limit reductions are being implemented to reduce the risk. Corrosion-resistant coatings and materials are also being explored.

B-52 Summary

The B-52 experienced one Class A and one Class B engine-related mishap in FY95. The Class A resulted from a second-stage turbine disk failure in the No. 4 engine. Shrapnel from the No. 4 engine penetrated the No. 3 engine and FOD'd the No. 2 engine. Eventually both the Nos. 3 and 4 engines departed the aircraft. The crew successfully landed the aircraft after burning off fuel.

The disk failure was actually initiated as a result of another problem in the No. 4 engine. The second-stage turbine vane inner airseal developed a crack which eventually caused it to rub against the second-stage disk. The exact cause of the air-seal failure is still being debated. Regardless, improvements to the depot's repair and inspection processes have been identified which should prevent a recurrence.

The Class B was another uncontained engine failure, this time due to a second-stage compressor hub failure. There was some structural damage to the aircraft, but the crew successfully returned to base. The safety investigation board never found the hub, so was unable to determine the cause of the failure. This was the only such failure in the history of the TF33 engine and was likely an isolated event.

C-5 Summary

There was one C-5 Class B last year. A second-stage fan blade was liberated, blowing off the thrust reverser and fan inlet cowl, and causing secondary damage to the pylon and wing. The crew safely landed the aircraft. An improperly repaired second-stage fan disk caused the blade liberation. The C-5 MADAR system did detect abnormal vibrations prior to the failure, but the crew continued to operate the engine in the vibration and resonance range. Besides correcting the repair process, changes were made to the engine vibration analysis procedures in the flight manual.

C-130 Summary

There was only one Class A last year, but it was a bad one. Besides the loss of the aircraft, we lost six souls. Here is another case of a crew continuing to operate an engine that, in hindsight, should've been shut down. The No. 2 engine's turbine inlet temperature (TIT) gradually began decreasing while the fuel flow increased. Because neither the flight manual nor the O-level maintenance T.O.s addressed this phenomena, the crew continued their mission. Unknown to them, the turbine was being overtemped.

Failure of thermocouples causes them to read lower than actual TIT. The TIT system not only displays these erroneous temperatures to the aircrew, but it also causes the engine fuel control to pour in more fuel, causing more thermocouples to fail, causing more fuel flow, and, well, you get the picture. Eventually, the 2-3 turbine spacer failed in stress rupture, sending a white-hot chunk of metal into the horse collar area. The resulting in-flight fire damaged the engine mounts, and the engine departed the aircraft. Not much later, the wing outboard of the No. 2 engine departed the aircraft, leading to a total in-flight breakup. The flight and maintenance manuals are being updated to alert crews to this scenario. A redesign of the engine is not likely given the cost and rarity of this type of event.

MH-53 Summary

During an MH-53J landing, the No. 1 main gearbox input drive shaft multiple coupling assembly failed. The loss of power forced a hard landing. In addition, pieces of the failed coupling impacted the engine fuel filters, manifold assembly, and oil coolers and penetrated the cabin firewall. Shortly after landing, the fuel and oil leaking from the No. 1 engine entered the cabin and ignited. Although the crew extinguished the cabin fire with a handheld extinguisher, the engine compartment fire continued. The loss of electrical power prevented the main and reserve fire-extinguisher systems from actuating when the pilot pulled the T-handle. The crew egressed safely, but the aircraft was destroyed in the subsequent ground fire.

The exact cause of the coupling failure was not determined. The practice of reusing self-locking nuts, as well as the run-on torque values, is being evaluated. In addition, it was recommended to place the fire-extinguishing system on the battery bus so that the system would still operate if electrical power was lost, as occurred here. ■

T-1, T-3, T-37, T-38

MAJ RICH DUBLIN
HQ AFSC/SEFF

Congratulations again to the 559th Flying Training Squadron, Randolph AFB, Texas, for extending their incredible Class A and B mishap-free record to over 28 years!

■ Overall, trainer aircraft enjoyed a very safe FY95, with three Class A mishaps — one each in the T-3, T-37, and T-38. There were no Class B's this year. Mishaps in Flight Screening are rare. The last Class A in the T-41 occurred in 1981. Due to the limited number of hours flown in the Flight Screening mission, the T-3 Class A this year produced a rate of about 4.7, well above the lifetime rate for the T-41. On the good side, the T-37 and T-38 Class A rates, about .75 and .65 respectively, fell well below their lifetime average. Amazingly, these trainer aircraft had no Class A or B mishaps in FY94.

Numbers can be deceiving, but interesting. Historically, people thought of ATC (Air Training Command) as the command of the "white airplanes" and associated an extremely low mishap rate with it. But now that ATC has become AETC (Air Education and Training Command), with a further-reaching training mission and many more aircraft types, the statistics are starting to change.

The Air National Guard had 14 Class A mishaps in FY92, but only **five** this year. AETC had **six** Class A's this year — the three mentioned above, two F-16s, and a C-21. It is probably too early to draw any specific conclusions from these statistics, other than the nature of Air Force operations is changing and human factors-related training seems to be paying off.

Following are summaries of the Class A mishaps involving the T-3, T-37, and T-38 this year. This information has been extracted from the AFI 51-503 (Accident Investigation) reports and reflects a mixture of fact and the accident investigators' opinions.

Class A, T-3A

The mission was planned to take off from the USAF Academy airfield, conduct basic aerobatic-maneuver training in the local area, and return for traffic-pattern practice. The crew consisted of a USAF captain (instructor pilot) and a USAF Academy cadet (student pilot). While working in the area, the student entered a planned syllabus directed spin (to the right) at 11,500 feet MSL. During the recovery, he misapplied recovery procedures. The instructor took control of the aircraft but failed to recover from the spin. The mishap aircraft impacted the ground in a right spin 47 degrees nose low, with full aft stick and full right (pro-spin) rudder. The aircraft was destroyed and the crew fatally injured.

The accident investigating officer concluded the instructor's academic instruction, flying training, and error analysis experience did not adequately prepare him to recognize his improper rudder application. His lack of exposure to misapplication of controls (rudder) during a spin led to confusion and futile attempts to counter the abnormal stick forces and high rotation rate using elevator controls only.

Performance data indicates the mishap crew experienced at least 17

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USAF Photo by MSgt Fernando Serna

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spins prior to impact. The instructor's ability to analyze the situation diminished as his disorientation increased. T-3A PIT (pilot instructor training) did not adequately address missed spin-recovery characteristics and error analysis. The instructor should have been required to fly a spin demonstration sortie prior to flying the spin maneuver with students.

Class A, T-37B

The mission was scheduled and briefed as a student solo contact training sortie. In the working area, the student pilot began a cuban eight at approximately 9,000 feet MSL. Everything appeared to be normal until he rolled from an inverted to an upright position toward the end of the first half of the maneuver. Although he noted he was more nose low than the normal 45 degrees, he pushed the nose down even further to help gain airspeed. At 250 KIAS, he started his pull-up for the second half of the cuban eight. He noted the aircraft responded slower than he thought was normal and continued to accelerate. He stated he then attempted a nose-low recovery (though the throttles were found in the full-forward position, and the speed brake was retracted). When the aircraft still did not respond the way he thought it should, he successfully ejected from the aircraft at approximately 350 KIAS. The aircraft was destroyed upon impact, and the student pilot sustained minor injuries.

The accident investigator determined although the student pilot was making below-average progress in T-37 training, his instruction up to the accident met established standards. His supervisors were well aware of his progress, and they had ensured that he was flying with the most experienced instructors. It was found that the student failed to perform a high-speed nose-low recovery by retarding the throttles to idle and extending the speed brake. He had been instructed to do this on numerous occasions — the most recent of which was his last dual ride when he demonstrated it with excellent proficiency. Although the nose-down trim, the lower-than-normal nose-low attitude, the accelerating airspeed, the increased ground rush, and aircraft tuck-under contributed to his confusion, the aircraft should have been recoverable if he had initially followed the procedures he had been taught for a high-speed nose-low recovery. Given that he did not recognize what was occurring, he made a good decision to eject when he did.

Class A, T-38A

The mishap sortie was scheduled as a syllabus contact mission with an instructor pilot (IP) in the rear cockpit and a student pilot in the front. Over an unknown period of time, a very small corrosion pit had developed on the inner bore of the engine's eighth stage compressor disk. This pit eventually developed into a fatigue area which then resulted in an overstress failure. At the moment of highest stress on this component (shortly after takeoff when afterburner was terminated), the disk catastrophically failed. When the disk failed, a portion of it cut through (exited) the compressor case, severing the main fuel manifold line and fuel flow transmitter line. The engine seized nearly instantaneously, an engine bay area fire ignited, and the left engine fire light illuminated.

The IP assumed control of the aircraft and commenced emergency procedures. Coincidental with retarding the throttle to idle, the fire warning light went out. He was misled into believing his action had caused the fire light to extinguish when, in fact, it most likely went out because the fire-warning loop had burned completely through.

The flight manual presents several facts pertaining to the situation this crew faced. However, the specific course of action to be taken in this rapidly evolving emergency must be extrapolated from several different subsections.

The crew followed the normal emergency procedure steps. Thus, when the fire light went out, in accordance with the checklist, the IP did not proceed with the subsequent bold face step which would have led to shutting down the engine. Being fully occupied with safely flying the aircraft, the IP did not test the fire warning circuit. With the throttle at idle, the electrically activated fuel shutoff valve upstream of the severed line was open, and fuel was still being supplied to the fire. The fire migrated to the aft section of the aircraft and destroyed the hydraulic lines supplying the stabilizer control system. All flight control authority was lost, and the crew was forced to eject, sustaining only minor injuries. Shortly after the crew encountered this emergency, the IP selected a flightpath toward a

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USAF Photo by MSgt Fernando Serna

sparsely populated area. However, when flight control authority was lost, the aircraft began a series of extremely erratic and unpredictable movements, eventually impacting immediately adjacent to, and against, an apartment building.

While documentation shows that this engine's periodic inspections were accomplished in accordance with USAF guidance, the cumulative number of cracked eight stage disks returned for product quality deficiency reporting had risen from 1 in 1993 to 24 in July 1995. At the same time, the allowable interval between major engine overhauls has changed from 1,200 hours to 1,800 hours, the acceptable low cycle fatigue cycle (LCFC) number has remained constant at 7,300, and the hourly postflight requirement (i.e., engine "hot section" inspection) has gone from every 600 hours to every 900 hours. A reduced inspection interval and/or a modified LCFC program may have resulted in this disk being replaced or the ensuing fault being discovered before failure.

Class C Statistics

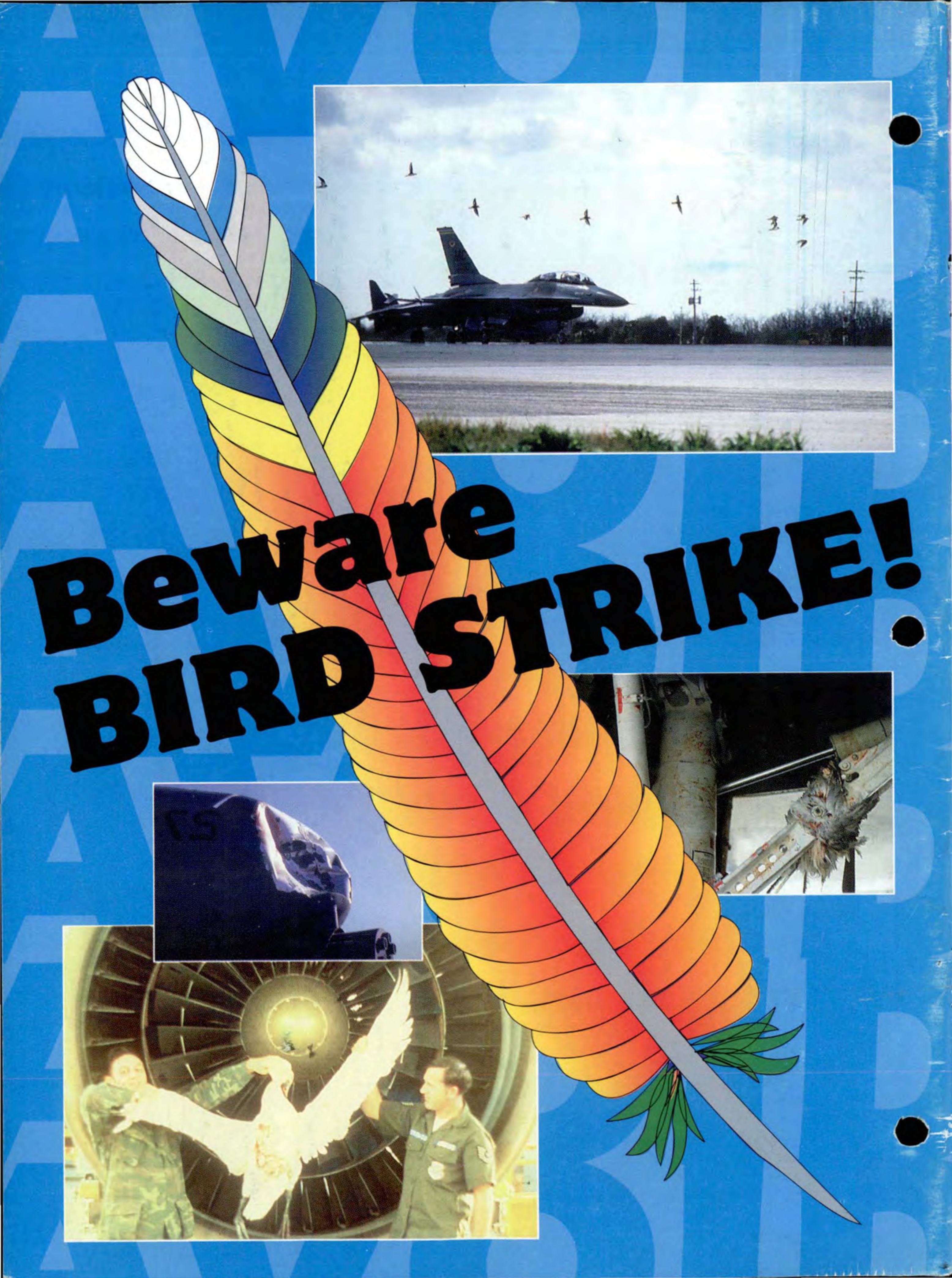
The T-1 has yet to experience a Class A mishap. This year, about 10 Class C mishaps were reported. Data showed no obvious trends except possibly throttle problems (two incidents were reported).

The T-3 had about a dozen reported Class C's this year, most of which were known engine problems.

The Tweet's Class C statistics didn't reflect any dramatic changes this year. A little over half of the reported mishaps involved engine problems. Of those, about 40 percent were flameouts, 17 percent fuel control problems, and 15 percent false fire/overheat lights. Standard for the T-37, physiological mishaps comprised a large chunk of the total reported incidents, about one-fifth this year, or half of the non-engine-related mishaps.

T-38 Class C mishaps were comprised of a few canopy departures and miscellaneous mishaps, but, as usual, the bulk (about 70 percent) involved engines. Almost half of the engine mishaps involved flameouts (some of which were pilot induced). Compressor stalls were down this year. There were a few mishaps due to faulty fuel controls and at least 10 mishaps in which birds were ingested by engines. ■

USAF Photo by Walt Weible


Beware
BIRD STRIKE!