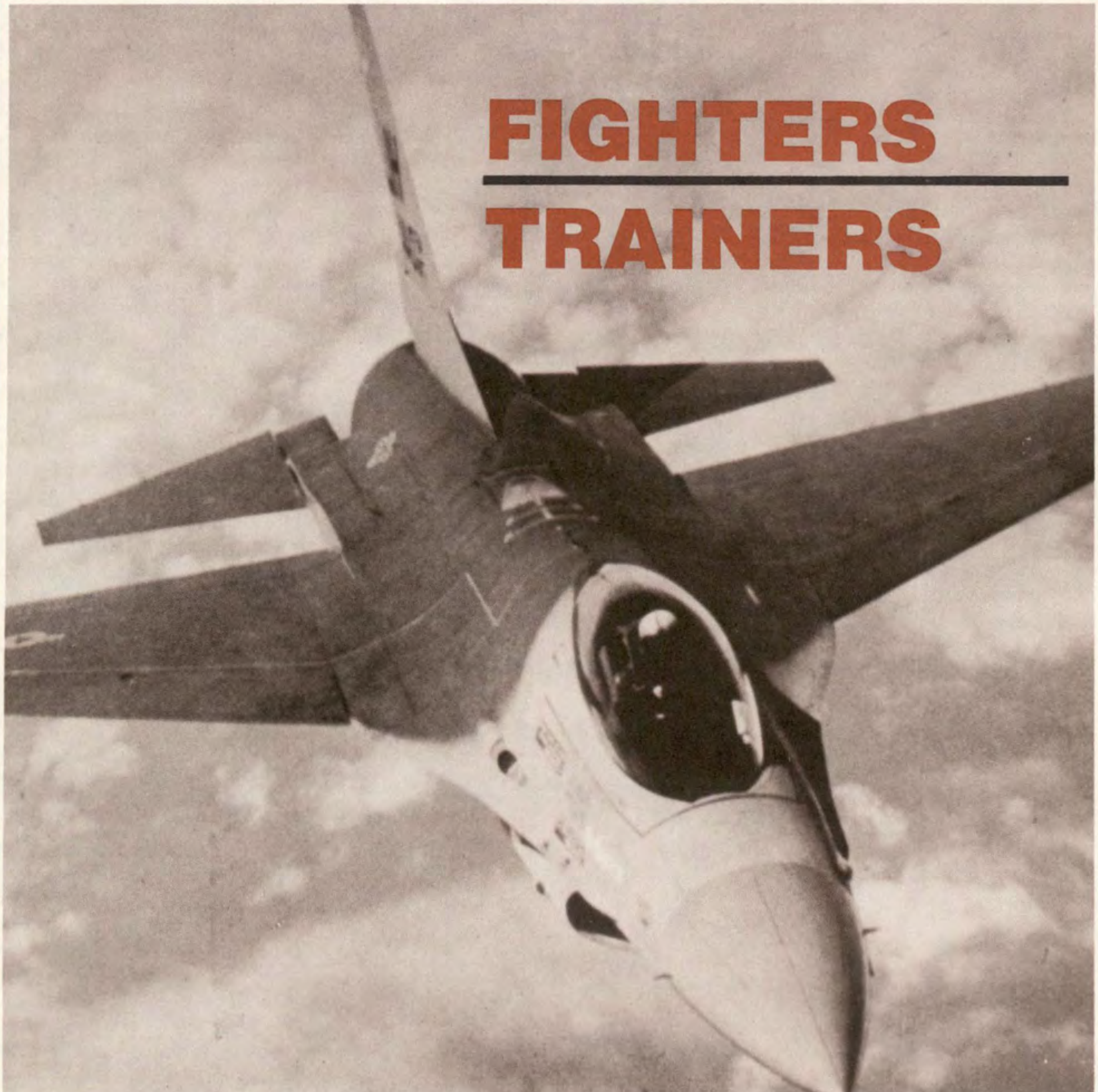
flying

SAFETY

MARCH 1987

SPECIAL ISSUE

Mishap Review and Forecast



F-106

MAJOR BOB MULVIHILL, CF
Directorate of Aerospace Safety

■ Once again, the F-106 has flown a whole year without an operations-related Class A mishap. Despite the two logistics-related Class As in 1986, the F-106 has proven to be a safe aircraft to fly. There have been no fatal Class A mishaps since 1983. When the first aircraft was lost in 1986, the F-106 had gone over 18 months since the last Class A mishap. The record of 23 Class A free months still stands, and I challenge everyone involved in keeping the F-106 flying to break it. My calculations indicate if we fly the bird mishap-free past mid-November 1988, we'll have broken the old record.

One Class A mishap in 1986 involved an aircraft which had been on an active scramble. When the scramble was canceled, the two F-106s set up to do some practice intercepts. During a high speed hard turn, the right hand main gear door of the No. 2 aircraft dropped down into the slip stream, and the door, landing gear, and wing tank were torn from the aircraft. The overpressure in the other gear well caused the same thing to happen to the left side. Left without pneumatic pressure needed to jettison the ordnance, the pilot was forced to eject. The controlled ejection was safely accomplished, and the pilot was picked up shortly afterwards. Fortunately, the wreckage was recovered, the cause isolated, and corrective action has been undertaken.

The other Class A happened to a dual model during a routine instrument flight. The AC had recently completed an instrument approach and had leveled off en route for home when the engine flamed out. Relight attempts were unsuccessful, and the two pilots ejected successfully.

There were no F-106 Class B mishaps in 1986, but there were a couple of Class Cs that might just as easily have been Class As had it not been for good luck and the skill of the pilots involved. One involved severe engine damage due to broken turbine wheel blades and the other, a broken towershaft. For those not familiar with the F-106 engine, when you lose a towershaft, your engine flames out and it doesn't relight. (In a previous year, the only aircraft lost was the result of a broken towershaft.) In both of the above cases, the pilots involved demonstrated considerable flying skill and brought their aircraft home and landed them successfully.

In an article last year, I mentioned one of the big safety advantages the F-106 has is the fact it is being flown by seasoned pilots. The successful forced landing patterns carried out by the above pilots bears this out.

The news media tells us the F-106 will eventually be replaced by modified F-16s, but it will be a while yet before the last Delta Dart is retired from service. It's a safe and reliable aircraft which has demonstrated that with the proper care and attention, it can be flown mishap free for the rest of its service life. That will only occur if everyone involved in F-106 operations and maintenance strives to ensure each and every flight is conducted safely. Let's make it happen! ■

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SPECIAL ISSUE

The USAF flight safety success story continued in 1986. Although we didn't beat 1985's record rate, there were a number of significant improvements in all areas of the mishap prevention program. By heeding the lessons learned last year, we will improve our safety record for 1987.

In this issue, we take a look at how we did in 1986 in our fighter, attack, and trainer aircraft. Next month, the magazine will be devoted to the heavies.

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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A-7

MAJOR LINN L. VAN DER VEEN
Directorate of Aerospace Safety

■ The A-7, an all weather attack aircraft that has been in the USAF inventory since 1968, is a proven combat performer also in service with the Navy and the Air Forces of Greece and Portugal. After almost two decades, it is still one of the most accurate and reliable attack aircraft in the world. Navy and Air Force A-7s performed with surgical precision in Southeast Asia, and more recently, Navy A-7s in Grenada and Libya.

The USAF has about 400 D and K models in service, mainly with the Air National Guard. Our fleet flies around 80,000 hours per year and had accumulated over 1,370,000 hours at the end of 1986.

We have experienced 87 Class A mishaps from the first mishap in 1970, which yields a cumulative destroyed rate of 6 aircraft per each hundred thousand hours flown. This rate equates to 87 aircraft and 36 lives lost. While this is a great deal of lost capability, the rate does compare favorably with other USAF fighter/attack aircraft. In fact, the A-7 has one of the lowest lifetime destroyed rates of any USAF single engine attack aircraft.

While 1986 was not a great year for many of the other fighter/attack aircraft detailed in this issue, the A-7 has the distinction of completing its safest year ever. The performance of pilots, maintainers, and the aircraft itself has steadily decreased the number of yearly mishaps experienced since the early years. In 1986, we lost only one A-7, and had no fatalities, for an outstanding Class A mishap rate of 1.2. See the figure for past A-7 mishap rates.

Since the mission of the A-7 has remained relatively constant over the years, it is very valuable to examine historical mishap factors. There were a total of 51 operator-error Class A mishaps through the end of 1986. Two categories accounted for three-fourths of all ops-related mishaps.

As is expected given the low altitude attack mission of the A-7, *collision with the ground* is the largest single category, with tragic results: 19 destroyed aircraft and 18 fatalities. The second largest category is *loss of control*, which accounted for 18 aircraft and 12 fatalities.

Flying the airplane at its limits, aggressively accomplishing the missions for which it is designed, creates the potential for one of these statistics on every flight. There's no easy solution, of course, because that's the business we are in. But well-planned training, following the ROE, knowing the aircraft systems, and knowing your own limits can minimize exposure to these threats.

Thirty-six Class A mishaps have

resulted from material failures, maintenance problems, or design deficiencies. Leading the list of these "logistics" factors is TF41 engine failure, which has resulted in the loss of 20 aircraft and many other close calls.

In recent years, most engine failures were due to second-stage high pressure turbine-2 (translation: The engine quits because it's breaking up inside) problems. The fix is a new turbine wheel/blade design which has been retrofitted into engines. The mod is called the High Pressure Turbine Extended Life Program (HELP), and I said, "has been retrofitted" because at the time of this printing, all base level engines will have been modified, leaving only a few engines to be modified at depot level.

While this should solve many old problems, a good rule of thumb flying a 20-year old airplane is: "It's always something." Be prepared to discover and survive the next major system problem.

As I mentioned earlier, 1986 was a great year for the A-7 community. As far as specifics, we had one Class A, one Class B, and several close calls. In fact, that's enough "pats on the back," because last year, we actually had some pretty hairy situations! Both the Class A and the Class B were (cringe) *gear-up landings*. No, neither involved a logistics factor — strictly pilot error.

That's 3 in the past 2 years, and while the hydraulic system design and the absence of any aural gear-up warning can set the pilot up for this, disciplined checklist compliance and a personal habit of checking "gear, flaps, and hydraulics" on short final for *every* approach can ensure this never happens to you.

Several of the close calls in 1986 should also get your attention. Two A-7s performing a DACT mission collided when both pilots became engrossed in an attack and stopped clearing their own flightpaths. Neither aircraft was seriously damaged, which has to be credited more to luck than skill or design.

The bottom line on this one: 86 percent of all *midair collisions* suffered by fighter/attack aircraft since 1980 involved another fighter during ACM or tactical maneuvering. In other words, the guy you are paying to check your six is probably the one who will hit you if you don't check 12!

The last hair-raiser was a *flight control problem* that occurred as an A-7D was climbing out after weapons delivery. The stick first stuck in a nearly full aft position. After the pilot disengaged yaw stab, the aircraft pitched up and rolled right into a 30 degree nose low dive. Because he couldn't release the stick pressures to eject, the pilot tried a rudder roll that recovered the aircraft — at 500 AGL.

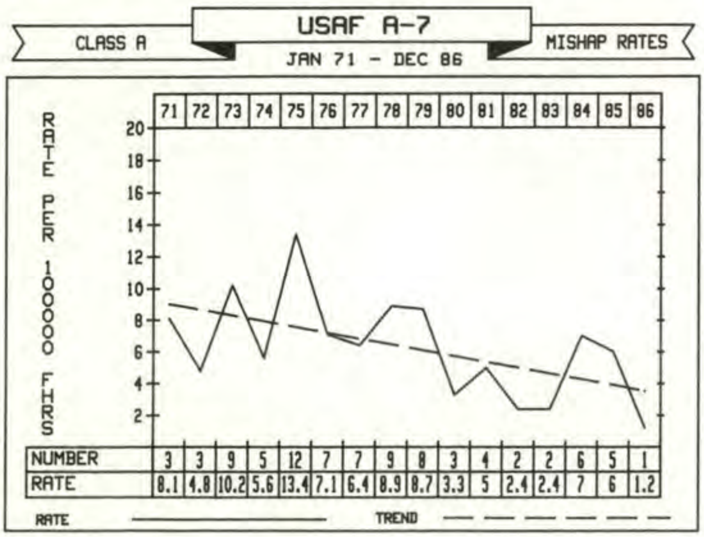
On the first approach to landing (after a controllability check confirmed an approach could be flown) as the power was reduced for landing, the aircraft again pitched up and rolled violently right. Again, the pressure the pilot was exerting on the stick and the aircraft attitude (110 degrees bank) and altitude (100 feet) combined to necessitate a fly out instead of ejection. He recovered and was able to make an approach end barrier engagement on his next attempt.

The cause of the control jam isn't as important to this article as the response; the pilot was ready and used his training, experience, and ability to save himself and the jet. See your safety officer for details on the jam and to find out what your maintenance folks did to keep it from happening again.

That's a brief rundown of the A-7 1986 history. As with all of our systems, there isn't much difference between the mishaps and the close calls. The potential for disaster is inherent in the attack mission, and with the addition of the low altitude night attack (LANA) capability in 1987, it will be even harder to have a mishap free year.

If you had to predict how we might lose an A-7 this year, low level flight, range operations, and engine failures would be areas that deserve special caution. The goal, though, is to make it through the year with *no* losses, and the A-7 community has the experience, the people, and the motivation to make it happen.

If you would like more details, contact your unit FSO, give us a call at AUTOVON 876-3886, or write AFISC/SEFF, Norton AFB, CA 92409-7001. ■



A-10

MAJOR LINN L. VAN DER VEEN
Directorate of Aerospace Safety

■ The A-10A Thunderbolt II has just completed its safest year of flying since the first production flight in March 1975. The seven active wings, a test wing at Eglin, five Air National Guard units, and four Air Force Reserve units flew over 200,000 hours in 1986 for a Class A rate of 1.4. This number is remarkable considering the low altitude, high threat tactics flown by A-10 pilots, and it reflects the excellent safety history of the A-10 fleet.

The last of 713 production aircraft was delivered by Fairchild Republic in March 1984, and since the first flight in 1975, A-10 units have accumulated over 1.5 million hours of flying time with a cumulative Class A rate of 3.2, the lowest of any fighter/attack aircraft in USAF history. See Figure 1 for the annual A-10 mishap rates.

While we do compare favorably with the safety record of any other fighter, our mishaps still represent a great loss of combat capability. As good as the Class A rate appears, it still translates into 50 aircraft and 24 pilots lost. That's a squadron of pilots and two squadrons of jets, and a whole bunch of tanks that will never taste a 30mm API. Figure 2 gives a quick overview of all A-10 Class A mishaps.

A-10 mishaps have established a pattern in recent years — the loss of A-10s due to loss of control at low altitude or flight into the ground, midair collision, and engine failures. In fact, these three categories have resulted in 77 percent of all Class A mishaps and 50 percent of all fatalities in the past 3 years. The three 1986 Class A mishaps covered each of these categories.

■ The airplane stalled as it rolled out on final. Wake turbulence was probably a factor. The aircraft hit 1,500 feet short of the runway, and the pilot ground egressed without injury.

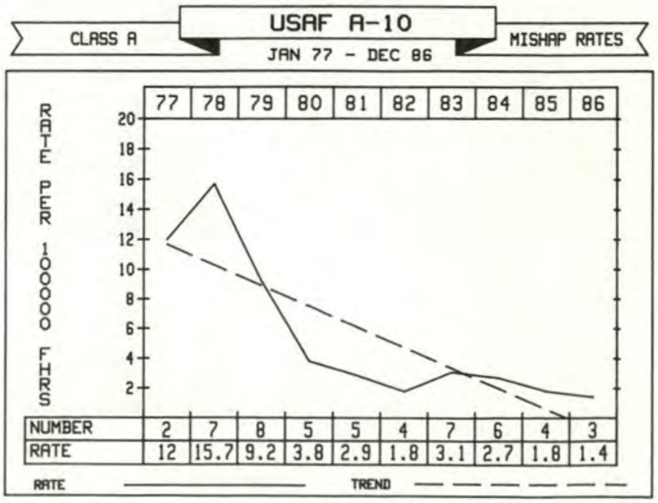
■ Two aircraft in a four-ship box formation collided during a threat reaction turn. One pilot ejected successfully, but the other was killed in the collision.

■ In the third Class A mishap, an engine failed on takeoff; for a variety of reasons, the aircraft would not accelerate to single engine climb speed. Unable to maintain level flight, the pilot ejected successfully.

Engine failures not only cost an aircraft this year, but also caused more Class C mishaps (over-temps, flameouts, in-flight shutdowns) than any other system failure. There is light at the end of the tunnel, however.

The Hot Section Life Improvement (HSLI) Program started in 1986 with the 355th Tactical Training Wing, Davis-Monthan AFB, Ar-

Figure 1



izona, and the 354th Tactical Fighter Wing, Myrtle Beach AFB, South Carolina, getting the first "new" engines. This program will replace many major parts of the engine hot section and should significantly reduce the number of internal mechanical failures that cause overtemps or flameouts.

The Turbine Engine Monitoring System (TEMS) is a computerized system that continually monitors engine performance. It can give early warning of impending failures, and it proved to be very effective in the test program at Barksdale. TEMS is being added to engines as they undergo the HSLI modification. These two mods, in combination, are certain to improve our engine reliability and should decrease the number of engine related mishaps.

An unhappy note is all engines will not be completed until approximately 1990. Additional TCTOs are ongoing that replace the transition liners and the high pressure turbine blades, two other components responsible for much of our single engine experience.

The next most common cause for A-10 mishaps is bird strikes. While the mission demands exposure to this threat, our "operating parameters" (who said "Speed is Life?") tend to minimize the damage. However, one of our two 1986 Class B mishaps was caused by a bird strike to an engine.

Mission planning and a good visual lookout can reduce this threat; systems knowledge and a good controllability check can minimize the effects of bird strike damage. Lift characteristics can be changed substantially by a 4-pound hawk; it's one of the few ways to increase an A-10's drag!

The other Class B mishap occurred when an aircraft lost nosewheel steering and normal brakes after the landing gear control circuit breaker popped. The landing gear system has also accounted for several unplanned gear retractions in the past few years, so the system is receiving lots of attention. Unfortunately, the problems are difficult to isolate and reproduce.

Another problem that has been around for the A-10's entire life is fuel foam fires. While the experts were attempting to solve this problem, Eielson suffered over 50 fuel foam fires between October 1985 and June 1986. Several other types of foam were being tested, but the problem became so severe the decision was made to replace the foam in all of Eielson's aircraft with a beige foam that had tested successfully. That conversion was complete in November and should solve the problem for the 343d Tactical Fighter Wing this winter. The test is officially continuing, though, so the other units who have been finding an occasional fuel foam fire are still waiting.

Controlled flight into terrain has been a leading cause of not only A-10 mishaps, but also those of other fighter/attack systems. We estimate a ground collision avoidance system (GCAS) could have warned the pilot in approximately 70 percent of these mishaps. In fact, a predictive GCAS could possibly

continued

A-10 Class A Mishaps

CATEGORY	77-83	84	85	86	CUM.
OPERATIONS RELATED					
Control Loss	7	1	1	1	10
Collision With Ground	5		2		7
Range	9	2			11
Midair Collision	4	1	1	1	7
Landing (Pilot)	2				2
Flameouts (Pilot)	1	1			2
LOGISTICS RELATED					
Flameouts	1				1
Flight Controls	2				2
Engine Failure	1	2		1	4
Fire (Hydraulic)	1				1
Log Other	1				1
UNDETERMINED					
	2				2
TOTAL	36	7	4	3	50

Figure 2

have prevented 23 of the 39 operator error A-10 mishaps.

Because of the A-10's mission and its record of flight into ground mishaps, the A-10 GCAS effort has been funded and separated from generic GCAS development. The A-10 system is a Fairchild/Kaiser Electronics effort that includes the warning algorithm, a radar altimeter, and a voice warning capability.

Additional benefits will be a constantly computed impact point (bring on Gunsmoke!) and aural warning for gear-up landings, final turn stalls, and some other emergency situations. Flight testing will commence in the second quarter of FY 87, and aircraft modification is scheduled to begin in the first quarter FY 89.

There are lots of other modifications upcoming, many that are the result of lessons we learned the hard way — broken airplanes. For example, you will see high flow G-suit valves, speed brake warning light/tone, formation strip lighting, and a change to the emergency canopy jettison handle in the next few years. For the most part, though, we lose "Hogs" and their drivers due to pilot actions. The good news is this means you're in control; the jet is not going to put you in very many unrecoverable situations.

In 1987, if history holds true, our greatest probability for loss of an A-10 will occur during low altitude or range operations, or possibly a midair collision (between flight members). A bird strike or engine failure could also cause serious problems. The important thing to remember is A-10 history shows if we avoid major "pilot errors," we avoid A-10 mishaps. Think about that before your next brief, flight, or sim — *you* can make every flight end safely.

This discussion has just skimmed the surface of the 1986 A-10 safety record and upcoming safety modifications. If you want more details, contact your unit FSO, give us a call at AUTOVON 876-3886, or write AFISC/SEFF, Norton AFB, CA 92409-7001. ■

A/T-37

LT COL HORST K. KRONENWETT GAF
Directorate of Aerospace Safety

■ In 1986, the A/T-37 community experienced one Class A mishap each. You maintained a low mishap trend. Let us see how you did in the past, what caused the two Class A mishaps, where problem areas linger, and how fixes by the system program manager keep the aging bird safely in the air.

Before we look at each weapon system, let me address a point of concern that has led to two T-37 Class A mishaps (double engine flameouts), the latest resulting in a 1986 T-37 loss. In each instance, the aircraft was operated at less than one G with a failed fuel boost pump, causing a double engine flameout. Due to subsequent cavitation of the engine driven fuel pump, restarts remained unsuccessful.

Your Dash-Ones denote operating limitations without fuel boost pump operating for less than +one G flight; the A-37 Dash-One additionally warns about flameout during 0-G flight. Since both aircraft use the same fuselage tank, the A-37, J85s make flameouts even more likely due to their higher fuel flow rates. Therefore, always recheck your boost pump on and operating before maneuvering to prevent a sudden end of your flight.

T-37

Since the 1950s, the T-37 has flown a total of about 1,000,000 hours, averaging about 350,000 hours per year. There are 644 T-37s still being flown in USAF UPT for both the USAF and NATO countries. In 1986, the T-37 flew 326,000 hours or about 9.5 percent of the USAF total annual flying time. The single Class A mishap in 1986 creates a mishap rate of 0.3, compared to a USAF overall rate of 1.8. Considering the increasing number of Class A mishaps within the USAF, you all deserve special credit for maintaining this all time low rate. Congratulations for a job well done at all levels.

As in 1985, last year's Class A mishap was again logistics related. During initial solo flight, the student pilot (SP) experienced double-engine flameout just after completing aerobatics. The fuel boost pump light was illuminated, and the boost pump circuit breaker (CB) was popped. The CB would not reset and engine restart attempts were unsuccessful, so the SP ejected safely.

No Class B mishaps occurred in 1986. Nearly 210 Class C mishap reports received still show a high rate for engine failures/flameouts (48 Class Cs) and physiological incidents like hypoxia and GLOC (34 Class Cs). We are aware the engine tends to quit close to the edge of the performance envelope. Also, the nonavailability of a pressurized cabin and anti-G suit exposes T-37 crews to strenuous physiological demands.

Over the years, these two mishap trends have carried high rates. To cope with the first problem, stainless steel fuel distributors will be introduced on an attrition basis beginning in 1987. Physiological mishaps, however, will be around until pressurized cabins and anti-G suits are introduced. In the meantime, keep in shape and practice a good L-1 anti-G straining maneuver.

Since the future primary trainer aircraft still has not been decided, the T-37, in its present configuration, will be around for quite some time. Be aware of the aircraft's characteristics as described above. Check the fuel boost pump operation while maneuvering, and also check your personal equipment thoroughly. With care and professionalism, you can maintain the same high level of flight safety for the T-37 you achieved in the past. Keep 'em up.

A-37

The A-37 flew 26,000 hours in 1986 and experienced one Class A mishap which resulted in a rate of 3.6. The fleet has accumulated over 650,000 flying hours since entering the Air Force; 86 aircraft are still flying.

As in 1985, the only Class A mishap occurred during a range mission. The mishap pilot was leading a 2-ship during his flight after initial upgrade training. The aircraft crashed into a canyon at Gila Bend North TAC Range after pull-off from a 30-degree, dive-bomb attack. The pilot made no ejection attempt. No aircraft malfunction or other factors were found. A GLOC during recovery was probably the cause.

There were no Class Bs in 1986.

The majority of Class C reports continue to indicate engine problems/flameouts. The SPM is expecting an analysis and proposal for the J85 engine problem. The following fixes are being evaluated: Use of new technologies for the engine; redesign engine front seal; reshape inlet lip, inlet ducts, heated screen, vortex generators; and speedbrake design change with possible relocation on wing or aft fuselage.

So, until this engine problem is cured, watch the aircraft during flight near the margin of the engine performance envelope. Fly your aircraft safely in 1987, and try to beat the forecast of one mishap. ■

F-4

MAJOR JEROME L. JOHNSON
Directorate of Aerospace Safety

■ In 1986, the USAF saw the fourth best Class A aircraft mishap rate in Air Force history at about 1.79 mishaps per 100,000 flying hours.

The F-4 flew over 320,667 hours in 1986, a decrease of over 25,800 hours from 1985, while the F-4 mishap rate jumped from an all-time low of 2.9 per 100,000 hours in 1985 to 5.3 in 1986. It's not really fair to compare the best year of 1985 to 1986; so let's compare the 1986 rate to the 4.5 rate of the last 10 years. Still, that amounts to one more aircraft lost per 100,000 flying hours. True, aircraft can be replaced, but there were 10 fewer crewmembers in the F-4 community at the end of 1986.

In 1986, the F-4 accounted for 9.3 percent of the total Air Force flying time while experiencing 27.4 percent of the total mishaps. Using only fighter/attack numbers, the F-4 accounted for 26.4 percent of the hours and 35.4 percent of the Class A mishaps.

More than 1,470 F-4s remain in service as it finishes its 23d year as an operational fighter. More than 9.2 million flying hours have been logged in this multi-role, two-place fighter aircraft. Presently, the ANG and AFRES account for over 52 percent of the F-4 inventory.

The 1986 mishaps reveal several problem areas discussed below.

Back To The Basics

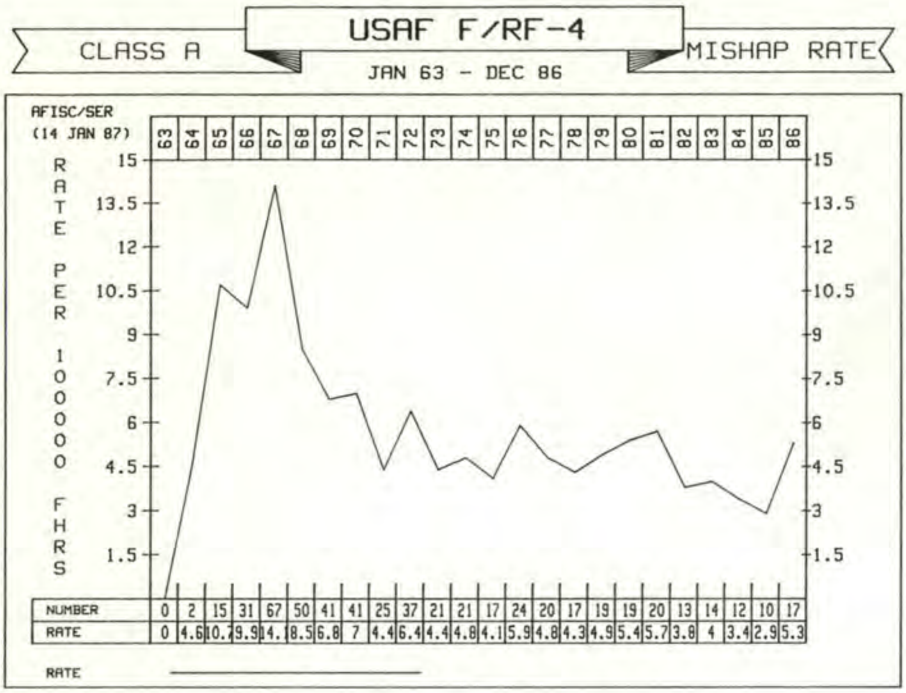
It is very important we remember the three basic rules that apply to all aircraft emergencies:

- Maintain aircraft control.
- Analyze the situation and take proper action.
- Land as soon as practical.

Maintaining aircraft control is first on the above list for obvious reasons and does not only apply to emergency situations. It should be remembered maintaining control starts with a good briefing and preflight and ends with a good postflight and debriefing.

The second rule, also, applies to all phases of flight: Be it correcting back to glide slope on an instrument sortie, aborting a pop delivery when inside the MAP, or getting to the bandit's six o'clock. In the case of an emergency, it takes "situational awareness" to analyze the situation and take proper action.

You must know what phase of flight you are in to "take proper action." Are you still in the takeoff phase of flight (throttles advanced for takeoff until initial climb speed is attained) where the Bold Face has you "jettison the external load (if necessary)?" Have you found yourself in an out-of-control situation where the Bold Face has you "de-



ploy the drag chute?" True, Bold Face items are not a substitute for "common sense and sound judgment"; but, they are developed to cover the most adverse of emergency conditions.

Land as soon as practical has a neat definition in the Dash-1, but it must also be remembered you and your aircraft should be properly prepared for landing.

Expectation

As we all know, the F-4 is starting to show its age. To the crew, that means increased vigilance is required.

The extremely important aircrew preflight can make the difference between a successful mission and a smoking hole off the end of the runway. Each crewmember has to watch out for the "expectancy" syndrome, i.e., seeing what you want to see. How many times on a preflight have you gone back to an item on the aircraft after your subconscious finally told you the item didn't look right.

A good example is in looking at the wing fold lock pin and seeing it is flush (even though it is up) because it has always been flush. How about the centerline tank cap? Was that locking tab really down and aligned with the wind stream? The "expectancy" process of the mind is not selective as to subject matter.

Crew Concept/Survival

At what parameters is the crew going to leave the aircraft? Was this discussed in the crew briefing? A couple of crews might still be around today if the subject of flight parameters requiring ejection had been discussed in detail or if personal minimums had been adhered to. In a crew aircraft, a crewmember can never afford to be "just" a passenger, even if he is incommunicado.

Dynamic CG

The high performance centerline tank (HPC tank) has produced another area of concern in the F-4 community. All who fly the F-4 with the HPC tank need to realize the implications of having a device on board that can change the center of gravity (CG) by as much as 1.1 percent.

Since the HPC tank is not baffled, the fuel can move unconstrained throughout the 21 feet 8 inches of the tank. The center of gravity of the fuel in the tank can shift as much as 8 feet aft. This shifts the MAC of the aircraft aft 1.1 percent, placing the aircraft in the caution zone on the stability charts.

A good example of a worst case scenario is taking off without the HPC selected (transferring fuel from internal wing), then feeding from the HPC tank for about 8 minutes, i.e., HPC tank about half full, and then quickly rotating the aircraft to high AOA. If you throw in low airspeed, the decreased stabilator authority compounds the impending problem.

More important, however, is the rate of pitch change and stick forces which accompany the sloshing fuel. With a minimum flight control input, you could find yourself with a lot more AOA (a pitch-up) than you bargained for and even an out-of-control situation. Say you had to use your "out-of-control recovery" procedures. After deploying the drag chute, a nose low recovery would probably be called for. As your aircraft went nose low and you found yourself hanging forward in your straps, the fuel would shift forward making the nose a little heavier with a CG shift forward.

As you start your recovery, by applying a "bunch of Gs," the CG shifts aft and again the cycle starts of pitch-up, out of control, and recovery. The secret is to apply moderate G, relative to altitude available and airspeed to keep the angle of the fuel as low as possible, and to

continued

F-4 continued

control the pitch rate despite changing stick forces.

The interesting part is the old McDonnell Douglas tank had no baffling and would cause the same dynamic CG shifting. With all the restrictions placed on the older tank, not as much performance was demanded from the tank, and the problems of CG shift were not identified.

A quick search of mishaps since the HPC tank was mated to the F-4 reveals 9 other incidents where a dynamic CG shift may have contributed to the loss of control. Continued emphasis is needed on the use of 5/6 lockout, maneuvering parameters with partial fuel in the HPC, and appropriate tank selection procedures.

A short synopsis of the year's Class A mishaps follows.

Log-Related Class A Mishaps

The eight logistics-related mishaps exceed the predicted five mishaps in 1986. This is the highest number of logistics-related mishaps since 1981. Six of the eight log-related mishaps dealt with a fire, one with the high performance centerline tank and the last with a wing folding on takeoff.

Our log-related mishaps with fire involvement were all a little different. One aircraft had a fuel line installed backwards resulting in a failed disconnect. A fire resulted and an aircraft was lost.

In another mishap, tech data was not sufficient to prevent wire chafing. The resulting electrical arcing started a fire in the door 16 area, and with no fire warning device in that area, the crew was unaware of the problem until it was too late for the WSO ejection system to work properly.

A bad weld on an anti-ice duct splitter vane accounted for yet another log-related aircraft loss. The weld failed, allowing hot air to find a fuel source causing a catastrophic fire in the engine bays. Since there is no audio to alert the crew involved in a developed air-to-air engagement, the fire was detected too late.

The next aircraft fire mishap involved a design-induced fatigue fracture developing in the engine combustion chamber snout. A piece of a deflector vane caused a disruption in engine cooling air. A hot spot was created, which eventually found a fuel cell, resulting in a catastrophic fire.

The infamous loose centerline fuel cap accounted for yet another mishap (third year in a row) as the fuel was sucked up through the aux air doors on takeoff with a resulting engine bay fire. The crew didn't jettison the fire's fuel source.

The last of the fire-related mishaps occurred while the crew was involved in an air-to-air engagement. A fire was started by the ECM pod umbilical cord and burned through the utility hydraulic lines, rendering the slats useless. A quick pull on the pole and the aircraft departed. An audio clue of hydraulic failure might have allowed the pilot a chance to save the aircraft.

The two nonfire log-related mishaps were unique to each other. On takeoff, a wing folded, the aircraft rolled, and the crew ejected. The unlocking of the wing fold had not been documented, and no one noticed the protruding unlock pin.

The mishap involving loss-of-control due to the dynamic shifting of the CG provided by the high performance centerline tank (HPCT) brought to light the aerodynamic problem. The mishap aircraft was placed in a one-G approach to a stall condition. During the recovery from this condition, the aircraft went out of control. During the out-of-control recovery, the aircraft again departed controlled flight. The crew finally had to eject.

Ops-Related Class A Mishaps

In 1986, there were six ops-related mishaps forecast and seven occurred. Five dealt with loss of control while the other two consisted of collisions with the ground.

The first mishap, involving loss of control, found a pilot trying to recover from an overbanked "G" awareness turn. Even with classic out-of-control symptoms such as a slow AOA tone, a rapid ocillatory yaw rate, and the ineffectiveness of stick inputs, the crew failed to use the Bold Face procedures for an out-of-control situation.

Another loss-of-control situation developed during a sortie flown in support of an airshow. After completing a slow speed pass over the airfield, the pilot maneuvered his aircraft into a position from which it could not be recovered.

The next mishap found a crew in the takeoff phase of flight, coping with an engine problem and still trying to complete a rejoin. The Bold Face procedures for an engine fire/overheat or failure during takeoff were not accomplished. While continuing the rejoin, the airspeed and altitude decayed to a point from which recovery was not possible.

The next mishap found a crew in the VFR overhead pattern after having spent over an hour burning down fuel for an intercom failure. The pilot may not have noticed his trimming out a heavy wing, and the WSO was not able to inform him of a trim disparity. The pitchout into the heavy wing was not uneventful as an excessive amount of altitude was lost. Add to that a perceived traffic conflict and an avoidance stick input, and the aircraft departed controlled flight. No ejection attempted.

The last of the loss-of-control mishaps occurred on a transition ride during a high AOA rudder roll. The roll was performed at a higher-than-normal roll rate and with a higher-than-normal pitch attitude. A perfect setup for "inertial/roll coupling" presented the crew with an unusual inverted attitude. The aircraft was out of control but the Bold Face (deploy drag chute) was never completed.

Two ops-related mishaps resulted in collision with the ground. An inexperienced pilot was allowed to fly a crew night weapons delivery (WD) sortie having only experienced night WD in RTU approximately half a year earlier. After a spacer pass under a low ceiling, the mishap pilot and WSO must have become disoriented while directing their attention toward a perceived problem with the lead's altitude. The mishap aircraft was placed in an attitude from which it could not be recovered.

The other collision-with-the ground incident occurred when the mishap aircraft encountered another flight head on in the low level structure and maneuvered to avoid a midair collision. The maneuver placed the aircraft in a position from which it could not be recovered.

Other Class A Mishaps

Two "other" mishaps occurred in 1986 while only one was forecast. A bird strike on a low level accounted for an aircraft fire forcing the crew to eject. A slight interference between knee board rings and seat allowed a loose survival kit strap to become entangled with the seat's "green apple." This entanglement swung the seat around in such a manner as to fatally injure the pilot and sever over half of the parachute shroud lines.

The other mishap occurred on a night mass recovery when ATC positioned two aircraft on final without proper separation or traffic advisories and cleared both to land. Because of poor aircraft lighting in the aft hemisphere, the steepness of the approach, and blanking of the nose, the over-running aircraft pilot could not have possibly seen the other aircraft. After the ensuing midair collision, one crew ejected while the other crew recovered their aircraft at a divert field.

Two extremely positive areas to note are the single-piece windscreen is a lot closer to becoming a reality, and the installation of the aural warning kit for engine fire/overheat conditions is programmed to start in April.

Again, there has been a prediction made as to what mishaps will happen next year — six operations, four logistics, and one miscellaneous. We *can* have fewer mishaps than the "number crunchers" predict. It will take a lot of attention to detail in both operations and maintenance.

FLY SMART and you will FLY SAFE. ■

F-5

MAJOR BOB MULVIHILL, CF
Directorate of Aerospace Safety

■ After coming out of 1985 with a perfect Class A mishap rate of zero, it was only a matter of time before the bubble would burst for the F-5 weapons system. Unfortunately, it burst sooner rather than the much later we were all hoping for. By the end of January, we had already lost one F-5, and by the end of 1986, the USAF F-5 inventory was minus six aircraft and three F-5 pilots had lost their lives. The F-5 weapons system could have done without last year! Six percent of the F-5 fleet was lost in 1986.

The scorecard this year reads ops-related mishaps — three, and logistic-related mishaps — three. One of the logistics-related mishaps involved the loss of power on both engines of an F-5B model. Just after takeoff, power on the left engine was lost and while on downwind about 2½ minutes later, the right engine lost power as well. Both pilots ejected successfully.

The second logistics-related mishap involved the controlled ejection from an aircraft whose right main landing gear would not extend. Again, the pilot ejected successfully, albeit through the canopy.

The third log mishap involved the structural failure of the forward fuselage area and an in-flight breakup of an F-model. Neither pilot initiated ejection, and both suffered fatal injuries.

The operations-related mishaps included one spatial disorientation, one spin, and a final turn collision with the ground. In the first two, the pilots were able to successfully eject, but in the final turn mishap, there was no ejection attempt.

Lessons Learned

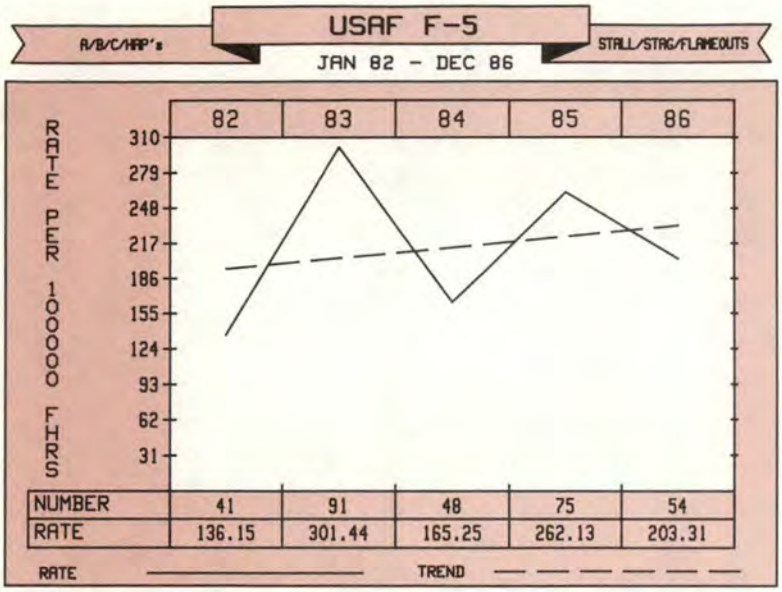
Spatial disorientation (SDO) is an ever present threat and can strike in any aircraft. When IMC, pilots have to keep their head movements to a minimum, avoid distractions which take their attention away from their instruments, and in spite of the confusing illusions they may be subjected to, make the instruments "read right." If the spatial disorientation is so severe the pilot is incapable of recovery, he has to make and carry out the decision to eject. It's bad enough to lose an aircraft to SDO, but an aircraft *and* a pilot are too great a loss.

The F-5E and F, contrary to what was intended, can enter a spin, and once it goes flat, recovery is unlikely. The entry is difficult to achieve, and the aircraft resists spin entry — most of the time. This can lull the pilot into the belief he can manhandle the aircraft as much as he wants, and the aircraft will forgive. And it does — most of the time; but since 1974, there have been eight Class A spin mishaps.

Most were entered from roll coupling due to excessive pitch acceleration, caused by aft stick combined with a rapid rudder roll. Entry is more likely with an aft center of gravity. Nose ballast has now been added to all F-5s so the center of gravity, on the average, is farther forward over the course of a mission.

The departure warning system we mentioned last year is still in the proposal stage. So, it's still up to you F-5 pilots to fly smart and avoid the inertial roll coupling that leads to most flat spins.

Double engine power loss in the F-5 is highly unlikely, but pilots have to be prepared for that eventuality. On takeoff, the most important thing is to keep the aircraft un-



der control and gain some altitude. If sufficient altitude is achieved, enough time may be available to attempt an airstart procedure using the checklist, should the max throttle(s) relight attempt not work. Whatever you do, constantly monitor your altitude — too many pilots have continued relight attempts right down to ground impact!

T-38s and foreign owned F-5s have been successfully belly landed in the clean configuration. F-5 pilots can expect a Dash One change that will allow them to belly land the F-5, provided it is clean.

The final turn is an area where the pilot of an F-5 (or a T-38) can't afford to become distracted or complacent. Loss of attention for a few seconds during the final turn can result in disaster. It's happened too often in the past for us to ignore the danger. Don't let it happen to you!

Other Mishap Classes

There were no Class B mishaps in 1986. As in the past, engine flameouts make up the majority of Class C reports. Although the flameout rate is still very high, the trend line has leveled off somewhat. So, it appears that although the problem isn't getting better, at least it isn't getting much worse. (See figure.)

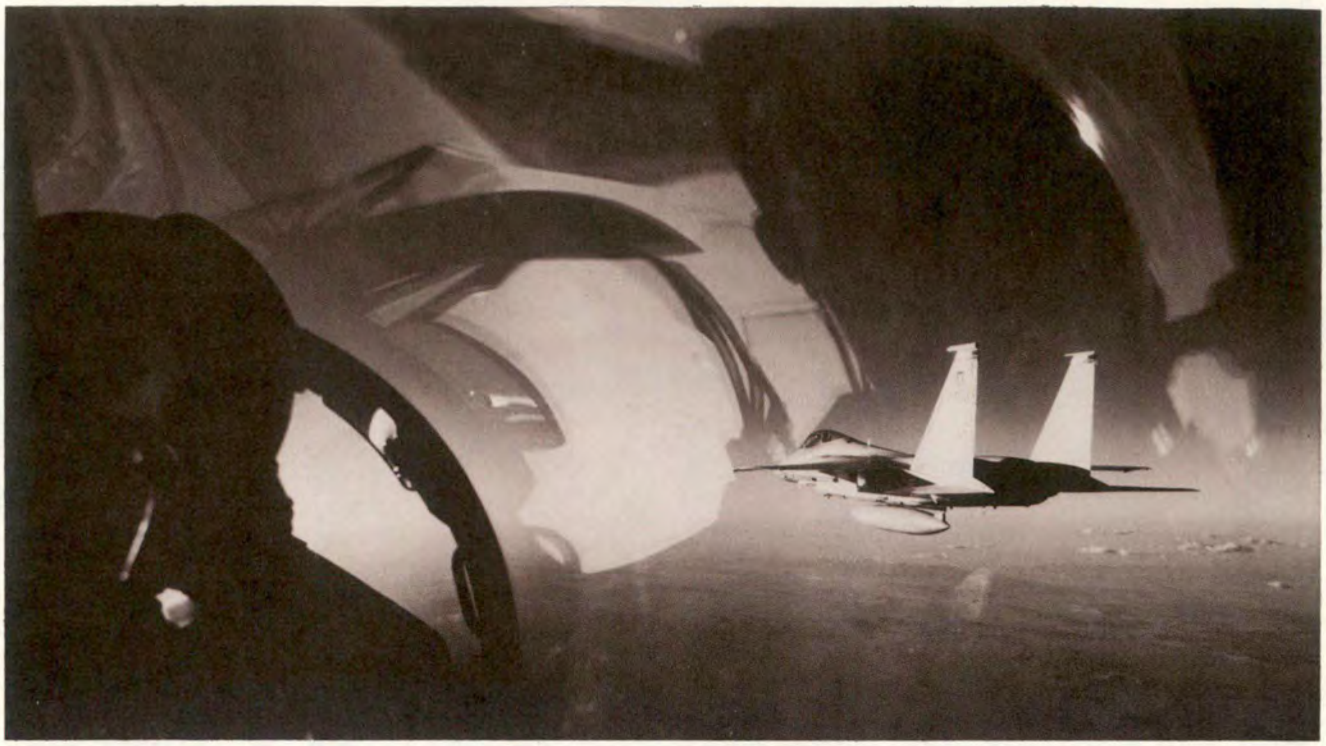
One of the reasons for the change in the flameout trend may be the approved status of support equipment being provided to field units. It now appears further reduction of flameouts will have to come from the field units. Better training, standardized throttle and engine rig procedures, adherence to the technical orders, and attention to detail by the J85-21 maintainers offer the best solution to this problem. In the meantime, pilots are going to have to keep up their knowledge and expertise in single engine recoveries and engine relights.

Modifications

What's being done to make the F-5 safer to fly? An inexpensive "G" warning system, similar to the F-15 overstress warning system (OWS), has been proposed, and the project is being worked at the logistics center. Magnesium flight control components are being replaced by similar components manufactured from aluminum (the magnesium components are subject to corrosion cracking and have a limited lifetime).

The landing gear uplock assembly crank is also due to be replaced by a stronger steel crank. In addition, a hydraulic fluid overtemp detector system is being installed. It will give the pilot an indication something is causing his hydraulic fluid to overheat. Also, the vertical stabilizer attach fasteners are being replaced by new bolts and locknuts.

This may be the last time I'll write the F-5 article for *Flying Safety* magazine. One of the highlights of my tour as the F-5 Project Officer at AFISC was to be able to report last year the F-5 weapons system had a perfect safety record in 1985. Not one F-5 pilot died, and not one aircraft was lost that year. Everyone responsible for keeping the F-5 flying mishap free in 1985 should be very proud of that accomplishment. You've proven it can be done. It's now up to the 1987 crew to prove it can be done again. ■

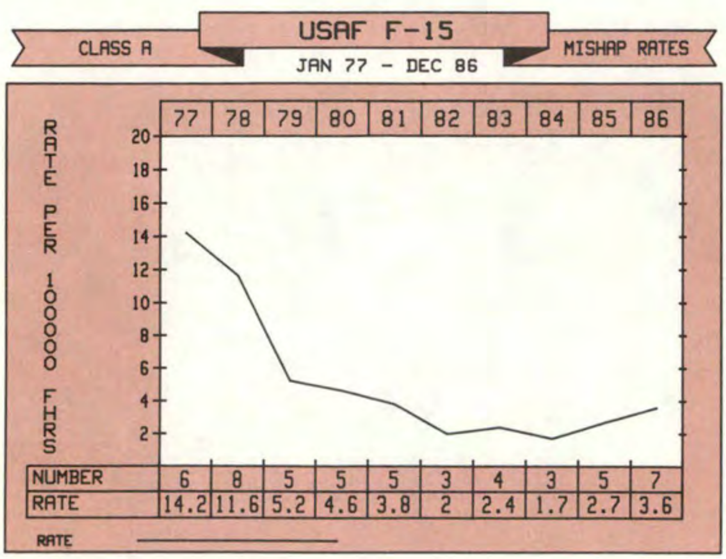


F-15

MAJOR MARTIN V. HILL
Directorate of Aerospace Safety

■ In 1986, the Eagle experienced a disappointing year. While our seven Class A mishaps for this year were still one short of the 1978 record, nevertheless we destroyed an all-time high of eight aircraft, with two more close calls. We also tied the previous 1981 record of four pilot fatalities. These are not the kind of statistics we can be proud of.

Even more disturbing is the reversal of the ratio of operations to logistics causes for these mishaps. In 1978, of our eight Class As, two were operations related and six were logistics, primarily the fuel system. This year, five are operations related, specifically midairs and controlled flight into terrain, and only two are logistics. The bottom line is we have flown six perfectly good jets either into the ground or each other, and lost four irreplaceable lives in the process.



Before looking at the individual mishaps for 1986, let's take a quick look at the overall status of the fleet. At the end of the year, the Air Force owned 747 Eagles, primarily As and Cs, and accumulated almost 1.4 million flying hours in types. F-15s are now flown by 7 different commands, 20 separate units, and 3 foreign nations.

Our lifetime aircraft destroyed rate of 4.0 per 100,000 hours is the lowest of any fighter in the Air Force except for the A-10. Still, this has cost us 50 aircraft destroyed and 25 lives since 1975. We have had 30 total ejections, all but 6 of which have been successful.

The first 2 weeks of January last year has to be a heartbreaking record for any modern weapons system. Half of the jet losses and 3 out of 4 of the fatalities occurred in the first 14 days of the new year. Had we kept that loss rate, we would have destroyed an entire squadron's worth of pilots and jets by April.

Mishap No. 1 occurred during a low altitude awareness training (LOWAT) sortie over water in a conformal fuel tank (CFT) Eagle. A vertical awareness maneuver in this heavy jet was improperly attempted from 10,000 feet AGL as a high speed split S. The result was impact with the water in a 20° dive at 550 knots plus. No survivor, attempted ejection, or wreckage.

Mishap No. 2 was a midair collision during an offensive perch basic fighter maneuver (BFM) setup. The attacker pulled lots of lead and kept his airspeed up, and in close (passing 1,000 foot range) tried to salvage his overshoot with a rapid barrel roll to lag during which he temporarily lost sight. The defender, himself losing sight at the overshoot, reversed to regain tally and perhaps go offensive. There is no evidence he ever regained sight after reversing. The attacker regained tally just prior to impact and could not get out of the way. The airplanes collided top-to-top in 90° of bank and resulted in one fatality at impact (no ejection attempt), and one successful ejection with minor injuries. Two jets were destroyed, and one civilian on the ground was killed.

The third mishap occurred on another LOWAT mission. The situation was a textbook ridge crossing demonstration that got out of hand. It was attempted over terrain with insufficient vertical development for the technique used, and that, coupled with a visual illusion, resulted in insufficient altitude to pull out when the pilot realized he was in trouble. The abrupt end of the flight was a high-speed pancake impact with no attempted ejection.

We had a 2 month respite before our fourth mishap of 1986, but it was another BFM midair that cost us a life and 2 jets. The setup was a slow-speed scissors exercise that got out of control. The exercise entry was from medium altitude, medium airspeed line-a-breast level flight, and it quickly drove to a very slow, close, nose-high nonrolling scissors. When converging flightpaths were realized, neither pilot had enough energy to get out of the way. The result was another fatality at impact with no attempted ejection and another successful ACES II escape with some injury.

June brought our 2 logistics mishaps; back-to-back, 4 days and half a world apart.

Mishap No. 5 for 1986 was a failed stabilator actuator that allowed the left stabilator leading edge to drive to the full nose down position. It occurred during a neutral BFM setup, and the jet promptly departed controlled flight and was considered unrecoverable. After several of these uncoordinated, uncommanded rolls, the pilot ejected without injury.

Mishap No. 6 was one of the few Class As where the jet landed successfully and wasn't totally destroyed. A ⅔-spacer fan knife-edge airseal failed in the left engine during pitchout for landing. Massive engine disintegration followed that started an uncontrollable engine bay fire and severed several flight control cables that caused difficulty in controlling the jet. Superior airmanship and a readily available runway saved the day, for the jet wasn't going to fly very much longer when the pilot wrestled it onto the ground. This was one of our two instances this year where we really could have lost another Eagle, but luckily didn't.

Our last mishap for 1986 was another midair, but no one was killed, and we got one jet back home. It was a 4 v 3 tactical, day VFR intercept, and the No. 1 fighter and the No. 2 target ran into each other head on in the target block altitude. The fighter went out of control after impact when it lost a wing, and the pilot successfully ejected. The target had substantial damage to the wing and nose, but was able to maintain control and recover to base. We were really lucky on this one, for usually the price we pay for this kind of mishap is both jets and at least one life. As I said at the beginning, we have lost a record 8 Eagles this year, but it really could have been 10.

So, why has this been such a bad year for us operationally, and what can we do to get better? We paid a pretty steep price in 1986 for our realistic and effective combat training, so we had better learn from it what we can. In the final analysis, in midairs and flight into the ground, it's not the jets that are letting us down but, rather, we are doing it to ourselves.

A lot of emphasis has been put on midair collisions lately, not only in the F-15 but other weapon systems as well. But it is a danger more inherent in air-to-air training than in other missions. Several key observations stand out from our mishap ex-

continued

F-15 continued

perience this year.

First is our propensity to force that slow speed "knife fight." When you flush that MiG and roll and set your wings, that should not be the first time you have ever been in a scissors. However, always remember, it's a very critical and demanding maneuver, especially when entered in similar airplanes from similar energy states. When you do it in combat, you "throw the meat on the table" and say somebody is going to die, probably very quickly. In training, you also need to look at scissors critically, because people can die there very quickly also. We proved it again in 1986.

A second observation is people need to understand what to do when they lose sight in close. We had a BFM mishap several years ago that resulted from a close in blind lead turn by the attacker. While I don't think we are doing that anymore, we need to remember our first priority is always to deconflict flightpaths.

Attackers should never lose sight when they are trying to go for guns, and should maneuver aggressively away if they do, not reposition. Defenders should not be spring loaded to the "auto-reverse" position if they detect an overshoot. You may get a lot more than you bargained for if you don't know exactly where he is. In 1986, we demonstrated what happens when two pilots lose sight of each other in close and continue to fight. If there is time, a radio call here can work wonders.

And, finally, on the subject of midairs, is the question of from whom do altitude blocks really protect you? The answer is only someone who is aware of you and is planning to merge with you also. They will not protect you from someone merging with you whom you don't know about, or another flight merging completely separate from yours. Blocks are an attempt to impose some order on the dynamics of air-to-air battle so this important and demanding combat training can be conducted with a minimum risk of disaster. The alternative would be to "knock-it-off" prior to the merge if everyone did not have the perfect situation awareness to safely enter the ensuing engagement.

The prime directive is to always clear your flightpath constantly. Blocks allow us to train, make mistakes, and develop situational awareness skills without paying the ultimate price for being wrong, as long as we adhere to the rules and understand their limitations. Effective flightpath clearing will be an invaluable combat skill as well, because even if you believe in altitude blocks, I can assure you the bad guys don't.

Controlled flight into terrain is the other operational area that cost us heavily in 1986. We in the air-to-air business seem to have forgotten the old air-to-mud adage of "there's no turning room available below the bomb circle." Close to the ground it is still a basic BFM exercise to ensure turning room available exceeds turning room required, and adjust your flightpath dynamics and geometry accordingly. If you make a mistake and overshoot an airborne adversary, you get embarrassed; if you overshoot the ground, you die.

There are ground collision avoidance systems (GCASs) and other aids coming to help in this area, yet the biggest step in safety is often just realizing the nature of the threat and respecting it. The ground will kill you quicker than any MiG if you are careless, and it never misses.

Our two logistics mishaps this last year are continuations of two long-term, serious problems with the Eagle. Stabilator actuator input arm failure/disconnection has now cost us two jets and several close calls. Actual breakage of the input arm has been eliminated through new material and redesign; however, there have been further problems with the assembly itself. The true long-term fix, which was identified and started in 1983, is the entire redesign of the system so the CAS can fully compensate for any failure in this area.

It has taken almost 4 years to design, test, fund, and field this fix, called the Dash-16 modification (or TCTO 9H2-5-206-507, if you prefer), and it should be completed on the entire fleet by September 1987. The jet we lost did not have this modification, although kits had arrived on base. The modification should eliminate this problem when completed.

We have lost several Eagles over the years to F100 engine problems; this year was another one. Again, there is a short-term series of inspections to reduce the risk and a long-term fix that replaces the vulnerable knife-edge air seals with a flat plate edge design that is much more resistant to damage. However, as long as we fly jets, we have to be prepared to deal with engine problems, and the fix for this failure should be complete for all engines in the fleet in another 18 months.

In 1986, the Eagle community had a very bad year, and it could have easily been much worse. We lost far too many valuable jets and irreplaceable friends, and we need everyone's best efforts to make 1987 a record year of which we can be proud. Train aggressively and intelligently, and let's have everyone around to pitch-in when "game day" finally arrives. ■

F-16

F-16 SAFETY TASK FORCE
Directorate of Aerospace Safety

■ The F-16 fleet passed a significant milestone in 1986 while flying approximately 250,000 hours as the lifetime flying hours passed the 1,000,000 hour mark. The F-16 was able to achieve a mishap rate of 4.5 based on 11 Class A mishaps. This rate is the lowest to date for the F-16 and continues the downward trend established since 1982 (Figure 1).

The lifetime Class A mishap rate for the F-16 has now been reduced to 7.2 with 73 Class A mishaps in 1,014,955 flying hours. The F-16 destroyed rate is 6.5 with 66 F-16s destroyed. Figure 2 provides a comparison of the destroyed rates of several fighter/attack aircraft at 1,000,000 hours to show where the F-16 stands.

The mishap breakdown for 1986 shows five operations factor and five logistics factor mishaps. The remaining mishap was the result of a bird strike which carried a piece of the intake lip into the engine.

Operations Factor Mishaps

As in the past 4 years, operations factor mishaps in the F-16 have equaled or outnumbered logistics factor mishaps. The breakdown shows:

- Two spatial disorientation (SDO).
- One pilot-induced loss of control.
- One midair.
- One instance of the pilot flying in excess of the published engine limits.

The SDO mishaps were both on short final for night GCAs. The mis-

continued

Figure 1

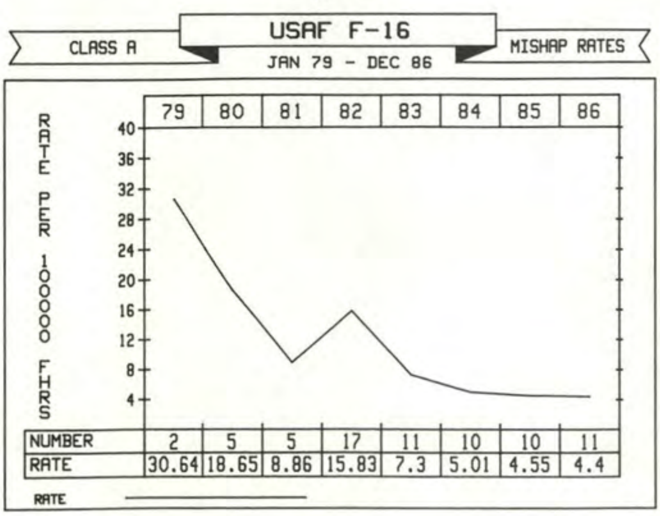
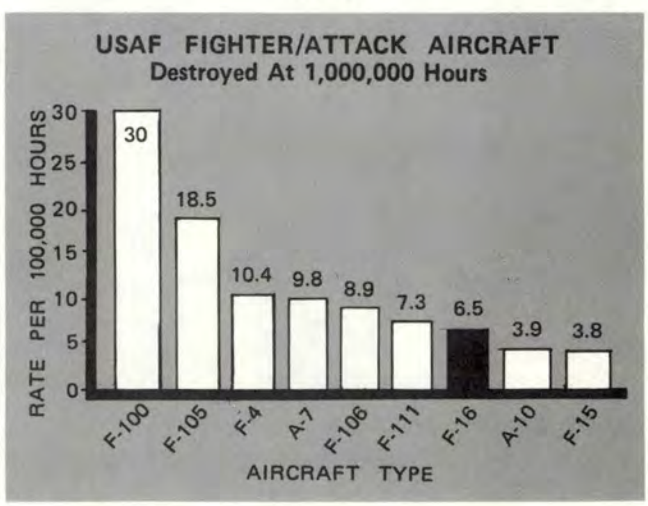


Figure 2



haps could have involved visual illusions caused by approach or runway lights.

Although it is difficult to determine the exact cause of fatal SDO mishaps, task prioritization is a key factor in overcoming many of the problems of SDO, distractions, and task saturation. Visual illusions can often be overpowering and take all of the pilot's willpower to overcome by maintaining the required instrument crosscheck.

The loss of control occurred when the pilot attempted a pull over the top with insufficient airspeed. The pilot did not respond to the low speed tone by concentrating on recovering the aircraft, and he failed to properly execute the recovery procedures by not cycling the aircraft in phase and failing to hold the MPO switch engaged throughout the recovery attempts.

The midair occurred when the wingman thought he had been given the lead, did not respond properly, added power to move forward, and then looked down into his cockpit without checking that the lead change had been properly executed. When the flight lead turned into the wingman, the aircraft collided. One aircraft was lost and one recovered.

In the final mishap, the pilot attempted a descending, high speed run following an FCF profile. The pilot exceeded the maximum engine airspeed limit for an undetermined reason. Duct buzz ensued which led to blade interference and a titanium fire. The fire led to catastrophic engine and aircraft structural failure and an extremely high speed ejection. Injuries from the ejection did not allow the pilot to release his parachute or inflate his LPUs, and he drowned prior to the arrival of rescue people. (Water activated LPUs are now being distributed to the field, and water activated riser releases are under development.)

It is often true that solutions to operations factor mishaps are more difficult to determine and carry out than those for logistics factor mishaps. While pilot discipline and clearly executed lead change procedures may prevent mishaps such as the excessive airspeed and the midair, SDO mishaps are more difficult to solve. Efforts are underway on two fronts to combat SDO and its effect on pilots.

The first area involves studies of improvements to the cockpit in terms of instruments, displays, switches, and lighting.

The other area is pilot training. The entire spectrum including UPT, LIFT, RTU, and continuation training is being looked at for areas where improvements can be made both in quantity and quality of training. Vision restricting devices are a key element since they allow for much more useful instrument training when practice is conducted on VMC days.

There is also a great deal of effort on aircraft systems which can significantly reduce controlled flight into terrain (CFIT) mishaps. These systems include altitude warnings and aircraft auto-recovery systems and are grouped under the heading of a ground collision avoidance system (GCAS). These systems could be effective in instances of lack of altitude awareness or G-induced loss of consciousness (GLOC).

Logistics Factor Mishaps

The breakdown of the 1986 logistics factor mishaps shows the following:

- Four engine mishaps.
  - First stage turbine blade porosity leading to blade failure, severe engine damage, and unrecoverable flameout.
  - An afterburner blowout leading to stall/stagnation. The JFS did not run, and RPM went below the minimum needed for an airstart.
  - A cracked No. 4 bearing race caused by mishandling resulted in bearing failure and unrecoverable stall/stagnation.
  - A rivet left in the engine during depot maintenance blocked a turbine blade cooling hole and led to blade failure. Vibrations caused the RCVV control line to fail, leading to a significant loss of thrust.
- One fuel mishap.
  - A center line tank fuel switch failure. This did not allow the wing tanks to feed, resulting in 4,000 pounds of trapped fuel. Incomplete fuel checks by the pilot, coupled with incorrect analysis of the fuel low lights, resulted in engine flameout from fuel starvation.

Of the four engine mishaps in 1986, two can be directly attributed to maintenance and depot errors which led to the engine failures. Three of the four failures could not have been saved by the pilot. In the fourth, the engine might have restarted if the pilot could have initiated the airstart prior to RPM decay

below airstart minimums. However, the RPM decayed rapidly before he could move the throttle to idle. When the JFS failed to run, the pilot was unable to get the RPM needed to start the engine.

In the mishap involving the cracked bearing race, a pulling tool was improperly used. The Joint Oil Analysis Program (JOAP) had identified a problem with the engine, but no action was taken to stop flying the engine to determine the cause of the problem.

In the case of the rivet left in the engine, existing procedures did not require a check of rivet security on a turbine heater used to work on the turbine. Inspection procedures were not sufficient to detect the rivet.

Corrective actions for engine problems have been initiated and deal primarily with modified production, tech order, and inspection procedures. Changes made in blade production can reduce or eliminate the potential for porosity, and x-ray inspection can detect any remaining problems. Blades currently in service will be pulled at 1,800 cycles and returned for x-ray inspection.

JFS fuel nozzles will be inspected for a minimum spray angle to raise the probability of a good JFS start. Procedures for using the bearing puller tool have been modified, and studies are underway to design a tool which reduces the potential for improper use.

Depot procedures for turbine rework have been modified along with additional inspections to ensure the cooling holes are clear. Also, a study is underway to review the engine fuel and control lines for sensitivity to vibration in the event of turbine blade failure.

Outlook for 1987

By using the information we have accumulated from past mishaps, we may be able to anticipate our future problems. Using this information, we can then ensure we are better prepared to handle contingencies. Through careful study of potential problem areas, one can be ready to execute the appropriate emergency procedures in the correct manner and recover an aircraft which might otherwise be lost.

Operations Factor Areas

- Human factors. Task prioritization is a major key. In simple terms, this generally means following the longstanding emergency procedures guidance of "maintain aircraft control" in all situations. The categories of SDO, GLOC, channelized attention, task saturation, overcommitment, and pressing are all included under human factors.

Other operations factor areas which are often involved in mishaps include:

- Mission preparation.
- Judgment.
- Pilot-induced loss of control.
- Diet and fatigue.

Operations factors are often directly under the control of the pilot or the supervisors. No mission should be considered "routine," and all aspects of the mission must be correctly handled.

Logistics Factor Areas

- Engine failures. Although the failure sequence may give a clue to the severity (explosion, loud bangs, engine parts exiting the aircraft, or engine fire), it is usually not obvious to the pilot if the engine will relight. The pilot must be ready to attempt an airstart and be aware of the potential problems. At low altitude, the time available is very short, and the ground will be an immediate threat. The engine will spooldown quite rapidly, and BUC will normally offer the highest potential for an airstart. With sufficient altitude, setting up a glide towards the nearest suitable airfield may allow for aircraft recovery.

Several programs have been conducted to improve engine performance and to fix known problems. Better inspection techniques can spot defects early and avoid problems. Knife-edge seals should be modified on all F-16 engines by the end of 1987.

Other logistics areas with mishap potential include:

- Leading edge flaps system.
- Landing gear, brakes, and tailhook.
- Electrical system, especially wire bundle chafing.

The pilot is a key player in recovering from logistic failures. Good systems knowledge and emergency response can be the difference between a recovered aircraft and a statistic.

Summary

As the F-16 weapon system matures, we can expect to see a continued overall reduction of mishap rates. Modification programs for known problems will upgrade more aircraft. Improved inspection techniques will find problems earlier. People in operations and logistics will gain more experience on the weapon system and become more aware of system capabilities and limitations.

Key areas in reducing operations factor mishaps include discipline, judgment, physical conditioning, sufficient rest, and proper prioritization of flying tasks. Only through a concerted effort on the part of each of us can we keep the number of F-16 mishaps to a minimum and achieve an even better record in 1987. ■

F-111

MAJOR STEPHEN H. PENDRY
Directorate of Aerospace Safety

■ Some folks believe pilots are a superstitious lot. We know better, right? However, just in case there are some non-pilot superstitious types reading this article, I'm not going to mention how great the F/FB/EF-111's safety record has been during 1986. In fact, I won't even mention it has been over 26 months (combat losses are not included in mishap statistics) since the last Class A mishap (knock on wood). I will mention, though, the Class A rate for 1986 was zero for the second consecutive year and the entire F-111 community should be extremely proud of that accomplishment.

As you read or skim through this edition, you can see other fighters/bombers have not enjoyed the same success story. Part of our job as safety staff officers is to attempt to determine why. What have we in the "Vark" world done differently? Have we flown less hours? No. In fact, the F-111 fleet flew approximately 22,000 hours more in 1986 than 1985 (102,566 in 1986 vs 80,870 in 1985). Has the mission changed? Again, No.

Each wing is still performing the same mission as last year, including deployments, weapons training detachments, exercises such as RED FLAG, and ORIs and NATO Tac Evals. Has the old "Vark" finally matured and is now performing up to its expectations? The answer to that question may be yes, but that factor of maturity is not unique to the F-111. The F-4, for example, has been in operation longer but did not enjoy a very successful 1986. (See F-4 article, this issue.)

What then, you may ask, has led to this enviable mishap record? We have asked ourselves that same question. Unfortunately, we have not been able to identify any specific action, initiative, or program which has given us this result. If we could do that, we would apply the same actions to other aircraft and wipe out all our mishaps.

At the risk of sounding trite, I can only repeat those well used words and expressions we almost take for granted nowadays, "The hard work and professionalism of everyone associated with the F-111 fleet have produced this record." In this case, that phrase cannot be taken for granted.

Those are the exact reasons for our success. That is not to say those associated with other weapon systems do not exhibit those same traits, I know they do. I just want to emphasize that those of you in the F-111 world should pride yourself on the results of your efforts.

As we bask in the warm glow of success, however, we can't allow ourselves to doze off into that treacherous state of mind called "false sense of security" or "lackadaisical attitude." I hope you are aware there are still problem areas and peculiarities in the "Vark" which can awaken you very quickly. Unfortunately, if you have "dozed" too deeply, you may not awaken soon enough to handle one of those problems.

For example, one of the most critical problems with the fleet in 1986 was AB fuel pump and hydraulic fuel pump failures. In all cases but one, the correct and timely reaction of the aircrews resulted in safe aircraft recovery with little or no damage.

In the one case of Class B damage, the crew attempted to help maintenance troubleshoot the aircraft after landing by cycling the afterburner. Unfortunately, the incident occurred at night, and no one could see the raw fuel draining from the aircraft. When the pilot selected AB, the fuel ignited. The crew ground egressed successfully, and the aircraft was saved. None of the crews in those incidents were lackadaisical or had a false sense of security. Had they been, we would not be enjoying this success.

Another peculiarity about the F-111 we haven't heard much about since 1982 is the TFR. After two TFR mishaps, we took a long, hard look at the system hardware, maintenance procedures, and operational procedures. That long, hard look has paid off, but the same, old hardware is there, and failures do occur. Don't let one of those failures catch you "dozing."

These examples of problems and/or peculiarities are real and potentially dangerous. Your system knowledge, hard work, and professionalism are also real. If you maintain those, all of us in the F-111 community can continue to bask in that warm glow.

I realize this article has not been filled with charts, graphs, numbers, and statistics. Those things are important to safety in that they let us see where we've been so we can set goals for where we want to go. However, I believe in the idea that safety is an attitude, and my intent is to commend you on the results of the safety attitude of the F-111 community.

I will be leaving this position and the F-111 community soon. I encourage you to maintain your professionalism, keep up the hard work, and above all, keep promoting that safety attitude. And for those of you who may be a little superstitious, *keep rubbing that rabbit's foot.* ■

OV-10

LT COL HORST K. KRONENWETT, GAF
Directorate of Aerospace Safety

■ The USAF has not experienced any Class A/B mishaps with the OV-10 in 4 consecutive years. The OV-10 community deserves compliments and much credit for this flying safety achievement. Looking back into its history we find the OV-10 has been with the USAF since 1966, the fleet average is about 8,300 hours per aircraft, and about 650,000 hours have been flown in total.

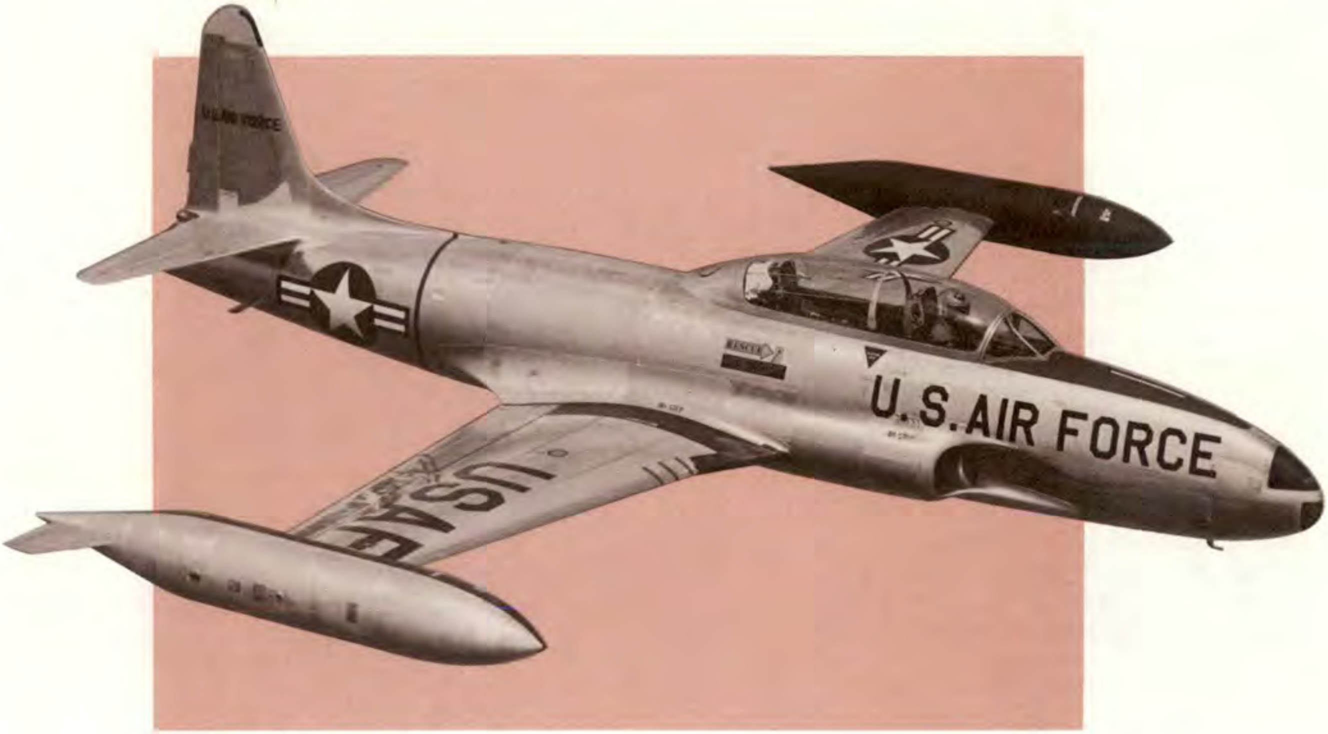
Eleven Class A mishaps occurred during the past 10 years resulting in a cumulative mishap rate of 3.7. The zero rate since 1982 compares very favorably to this. I want to mention that due to the low total annual flying time of about 28,000 hours, a single mishap creates a high rate, proving once more how safely the OV-10 community has operated its aircraft.

Class C mishap and material deficiency reports (MDRs) indicate we live with a propeller blade losing its tips occasionally as well as electrical shorts within the stick grip causing inadvertent loss of external stores/ordnance. The system program manager (SPM) tells us the latter will be cured during 1987 by rewiring and introduction of a new bomb button for better insulation.

The prop blade problem has been considered a high priority item since the prop plane intersects the rear seat. Fixes are being studied by the SPM in close contact with the Navy. To keep you flying safely, a TCTO has been implemented as an interim means which zero-timed all props by October 1986 and requires additional inspections evey 50 full prop reversals or 50 flying hours.

Your complaints about too far aft location of all communication radios have been heard. The SPM has just opened a new action item to have a set of lights installed underneath the glareshield to display which radio has been selected.

Dreams of an upgrade to the Marine OV-10D model will not materialize due to lack of funds. So keep flying the old Air Force Bronco in 1987 as safely as in the past, and proudly maintain your present safety record. ■



T-33

MAJOR BOB MULVIHILL, CF
Directorate of Aerospace Safety

■ The T-33's time is growing short. The plan is to retire the last T-33 before the first day of 1989. Folks have forecast its demise before, but the old T-Bird contradicted them, so I'll wager there will still be a T-33 with USAF markings flying somewhere in 1989. Even when the USAF retires all her T-Birds, other countries will continue to fly them, so for those who love the old Bird, there will still be the occasional glimpse of an airborne T-33.

The T-33 has been in the USAF inventory since 1949 and has logged ove 17 million flying hours in the USAF alone. There are good reasons why the T-33 has been around so long. It's a rugged, uncomplicated, mature aircraft which is easy to fly (once you acquire the knack), and it's a forgiving aircraft (provided you treat it right).

It wasn't always so. In the fifties, it was not uncommon to lose 300 T-33s per year. That was when it was one of the first jet trainers in the world. Pilots and maintainers had to get used to having such a high speed and complex aircraft. Having only one engine didn't help its safety record either. Even today, if you lose that engine, you've only got two options — eject or force land. We've been fortunate lately to have our flameouts in a position from which forced landings could be made.

The T-33 can also bite you if you mishandle it in yaw, especially if your energy state is too low. Too much rudder can produce a vertical fin stall which leads to a tumble guaranteed to water your eyes. In fact, those who have experienced it can attest that you'll be severely spatially disoriented for 3,000 to 5,000 feet of altitude loss. The best way to handle a tumble is to avoid it in the first place.

If you are unfortunate enough to get into one, you have to get your power to idle, neutralize your ailerons and rudder, get the control stick aft, clean up the aircraft, and *wait*. A recognizable spin should develop, then you can follow the rest of your emergency procedure and fly on home. Always remember, if you find yourself below 10,000 AGL, without a definite recovery established and a pullout initiated, it's time to eject.

Did I mention spatial disorientation? It's as valid in the T-33 as in the newer fighters. Perhaps even more so. When the T-33 was built, the needle and ball, altimeter, and airspeed were considered the backup to the attitude indicator. Standby attitude indicators and two colors on the main attitude indicator were future developments. T-33 pilots have to be capable of reverting to needle, ball, and airspeed or they shouldn't be flying in instrument meteorological conditions.

The key is practice, practice, and more practice. It's a real challenge for someone who has always had a standby attitude indicator to rely on, but when you master it, there's a great feeling of accomplishment and a confidence that, if necessary, you could fly back home and do an instrument approach without an ADI.

In 1986, we weren't able to retrofit the T-33 with a standby attitude indicator. There just wasn't enough time available to justify a program that would be expensive and require a lot of lead time. What has been arranged, though, is to equip some of the T-33s with a 28-volt, DC powered, two-toned attitude indicator. Approximately 50 aircraft will be modified with the improved attitude indicator so at least those aircraft will have a better system than the old J-8. Being DC powered, it will provide a measure of protection in the event of an AC power failure.

In 1986, we got more than halfway through the year without losing a T-33. The good news is the pilot ejected successfully; the bad news is we'll probably never know precisely why the aircraft nosed over and went out of control. The aircraft wreckage is on the bottom of the ocean in deep water and salvage wasn't economically feasible.

This mishap demonstrated when you eject from a T-33, unless you get yourself in the ideal ejection posture, there's a good chance you'll sustain injuries. This pilot was subjected to negative G and was lucky to be able to reach the handles. The introduction of the LPU 9 life preserver should give you more room for your elbows, but it will still take a conscious effort to tuck them in.

There were no T-33 Class B mishaps in 1986.

A review of Class Cs indicates two predominate areas which should be of concern to T-33 pilots. First, the physiological incident rate is very high. T-Bird pilots should take extra care ensuring their oxygen masks and regulators are functioning properly. In addition, they should be constantly on the lookout for their personal hypoxia symptoms.

Their second obvious concern should be the engine. Engine incidents in a single engine aircraft almost always have the potential to result in a Class A. In the past year, pilots have demonstrated their ability to successfully fly flameout patterns. Just as sure as there are T-33s flying, there will be occasions to demonstrate that skill. A solid knowledge of the emergency procedures and plenty of practice simulated flameout patterns will give the T-33 pilot the edge he needs to handle an engine emergency.

Another area demands mention. In 1986, there were two occasions when T-33s flamed out due to fuel starvation — one in the air and one after landing. Hindsight being what it is, we can say these mishaps should never have happened if the pilots had been more conscious of their fuel state. But they did happen and will happen again to the T-33 pilot who lets his guard down.

In 1986, I had the opportunity to visit four T-33 units and fly with three of them. The hospitality was absolutely superb, and my special thanks goes out to my excellent hosts. What most impressed me was the professionalism and enthusiasm displayed by the T-33 pilots (young and old) I met out there. It left me with the confidence that the old T-Bird is in good hands for the rest of its service life.

Last year proved to be a year free of operations factor Class A mishaps, and it's mainly due to the expertise of the pilots who fly them and the leadership provided by their squadron commanders, ops officers, and flight commanders. The T-33 has less than 2 years left. I urge all operators and maintainers to continue to keep the T-33 flying mishap-free for the rest of its service life.

The T-33 has had a number of mishap-free years. All we have to do is put two of them together, and we'll be able to say farewell to the T-Bird in style. ■

T-38

LT COL JIM TOTHACER
Directorate of Aerospace Safety

■ If there is anything monotonous about the T-38, it's how well it performs year after year. Once again, in 1986, the Talon proved to be a remarkably safe and extremely reliable aircraft. Combining solid performance with aesthetically pleasing lines, the "white rocket" is the perfect aircraft to cement young pilots' love of jet aircraft.

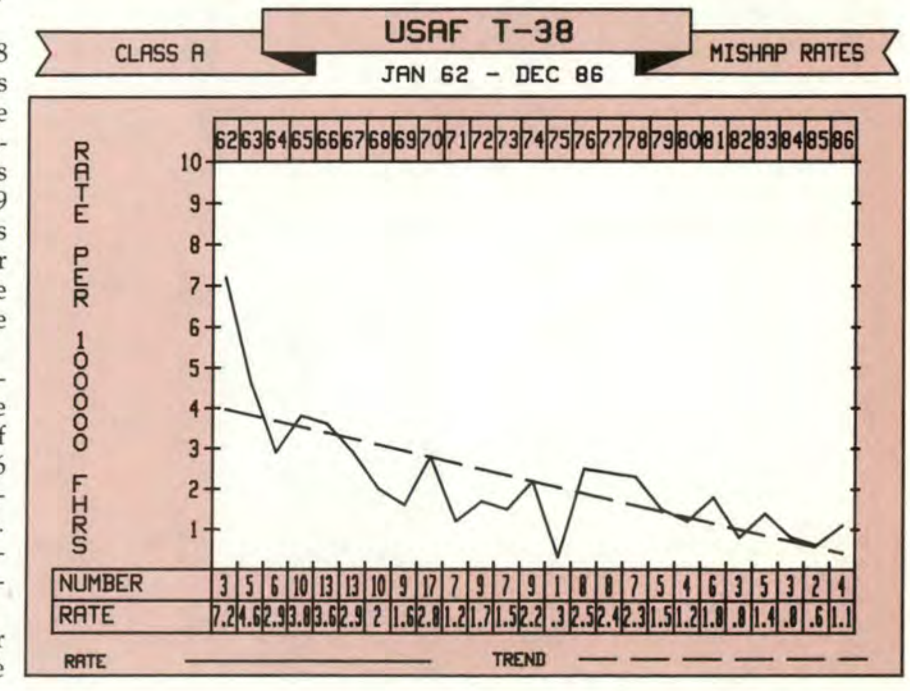
Since its introduction, the T-38 has experienced a total of 174 Class A mishaps through 1986. These mishaps have resulted in the destruction of 167 aircraft and the loss of 72 aircrew members. With over 9 million hours flown, this translates to a Class A mishap rate of 1.88 per 100,000 flying hours, an incredible figure given the training/experience environment. (See Figure.)

The total number of operations-related mishaps is almost double that of logistics-related mishaps. Of the 174 total Class A mishaps, 106 are categorized as ops-related compared to 56 log-related mishaps. The remaining 12 mishaps are classified as undetermined or miscellaneous.

In 1986, we experienced four Class A mishaps in the T-38. Three of these were operations-related, and one was a logistics-related mishap. These four mishaps caused the destruction of four aircraft and the loss of three aircrew members. A brief review of the 1986 Class A mishaps follows:

■ The mishap aircraft was on a single-ship training sortie. While performing aerobatics in the training area, the left wing failed, and the aircraft violently departed controlled flight. Both crewmembers ejected successfully, although the rear cockpit pilot incurred major injuries when he was unable to obtain proper body position due to the violent tumbling.

■ The mishap aircraft was on a dual contact training sortie. The mishap instructor pilot was demonstrating a split S when he perceived an uncommanded input on the control stick followed by a sensation that his control inputs were not effecting aircraft response. Cycling the control stick fore and aft in a short period of time, the mishap IP



	62	63	64	65	66	67	68	69	70	71	72	73	74
NUMBER	3	5	6	10	13	13	10	9	17	7	9	7	9
RATE	7.2	4.6	2.9	3.8	3.6	2.9	2	1.6	2.8	1.2	1.7	1.5	2.2

	75	76	77	78	79	80	81	82	83	84	85	86
NUMBER	1	8	8	7	5	4	6	3	5	3	2	4
RATE	.3	2.5	2.4	2.3	1.5	1.2	1.8	.8	1.4	.8	.6	1.1

determined the aircraft could not be controlled. Both crewmembers successfully ejected with the IP incurring major injuries during parachute landing fall.

▪ The mishap aircraft was on a dual low-level navigation training sortie. The first segment of the low-level route was completed without incident. With weather rapidly deteriorating, on the second segment, the mishap aircraft impacted the ground in an area of rapidly rising terrain, nearly wings level, and approximately 3.5 degrees nose low. Both crewmembers were fatally injured with no attempted ejection.

▪ The mishap aircraft was on a dual contact sortie to provide review training for the student pilot prior to a final progress check. After completing straight-in patterns and area work, the mishap aircraft entered the overhead pattern. During the flare of a no-flap touch and go, the left wingtip contacted the runway, and the aircraft departed the left side of the runway. The mishap aircraft briefly became airborne and then impacted the ground. The instructor pilot was fatally injured when the ejection sequence was interrupted by drogue chute/seat entanglement with the wing. The student pilot's uncommand ejection sequence was initiated and interrupted by impact forces. The student, in the seat, was forcibly thrown from the fuselage at final breakup and suffered a dislocated elbow.

As you probably all know, the T-38 will undergo extensive modifications over the next few years to keep it "young." Not to "cry wolf," but sometimes modifications create unforeseen problems of their own. In addition, T-38 systems not currently scheduled for modification can develop problems with age.

Again, I'm not trying to say, or even hint, that the "sky is falling;" quite the contrary. All I'm saying is keep your guard up. Make sure you are absolutely prepared for every mission you fly, in case your trusty machine somehow fails you. The T-38 probably won't let you down, but if it does, you must be ready. Your life depends on it.

Good luck and good flying in '87. ■

Low Altitude Time Sharing

CAPTAIN CHUCK LOUISELL
HQ USAF/IGF
Washington, DC

■ It's your first RED FLAG mission, and you've got to go deep into Red territory to hit a well-defended fuel storage area. Are you ready? You've got a lot of responsibilities combined with strange ranges, unfamiliar terrain, and lots of threats. You need to have a plan for accomplishing a lot of tasks in a dynamic environment. This article presents a plan for low altitude time sharing that will allow you to be successful. Time sharing requires two things — knowing your responsibilities and having a game plan for accomplishing them.

Responsibilities

The first thing the flight lead needs to do is outline responsibilities for each flight member. Dividing responsibilities is the key to giving each guy a manageable number of tasks to perform. The second key to success is that each flight member stick to *his* responsibilities. Since the basic fighting unit is the four-ship, a good breakout of responsibilities looks like this:

▪ No. 1 — get the flight to the target and back. Primary planner and decision maker — primary navigation and radar lookout responsibilities for the flight. Visual lookout for mutual support of No. 2. No. 1 should also be the primary engaged fighter, if practical.

▪ No. 2 — support No. 1. Visual lookout and capability to support No. 1 in an engagement. Keep up with navigation and monitor the radar.

▪ No. 3 — support No. 1. Assist No. 1 with planning, and act as alternate decision maker. Maintain a position of support for the lead ele-

continued

Low Altitude Time Sharing continued

ment. Secondary navigation and radar lookout responsibilities. Visual lookout for the flight. Should be the secondary engaged fighter, if practical.

■ No. 4 — support No. 1. Visual lookout and capability to support No. 3 in an engagement are the primary responsibilities. Monitor position on the flight plan and keep your radar turned on. Don't devote time to the radar that should be spent doing your primary job of visual lookout.

Notice that four-ship responsibilities are not outlined as two two-ships put together — we are going to employ as an *integrated four-ship* so we can *maximize* our effectiveness through division of labor.

Time Sharing

Our eyes and brain function as an information gathering and processing device, but they can only gather and process one thing at a time. Therefore, we have to develop a time sharing plan so we can quickly and efficiently accomplish many tasks.

Just like the fire control computer, we have to prioritize tasks and make a plan to do them all in a limited amount of time. This means we need to assign a frequency for accomplishing each task based on its priority. Basically, we build a "computer program" to systematically direct our efforts in gathering and processing information.

So, what does this scientific stuff have to do with checkin' six and shootin' MiGs? Well, remember the priority list from the responsibilities section? If we combine that with the idea that all those tasks require information gathering and processing — which we can only do one thing at a time — we see we have to time share our brain/eyes computing device. Almost every fighter pilot has come up with some system for time sharing, but I'll throw this one out as a technique younger guys can use to develop their own in 150 hours vs the 500 hours it took me.

Building The Time Share Plan

Since most of our responsibilities involve visual lookout, we need to make a plan to cover the airspace around our aircraft. The first thing we'll do is divide the airspace into sectors and assign a priority to each as shown in the figure.

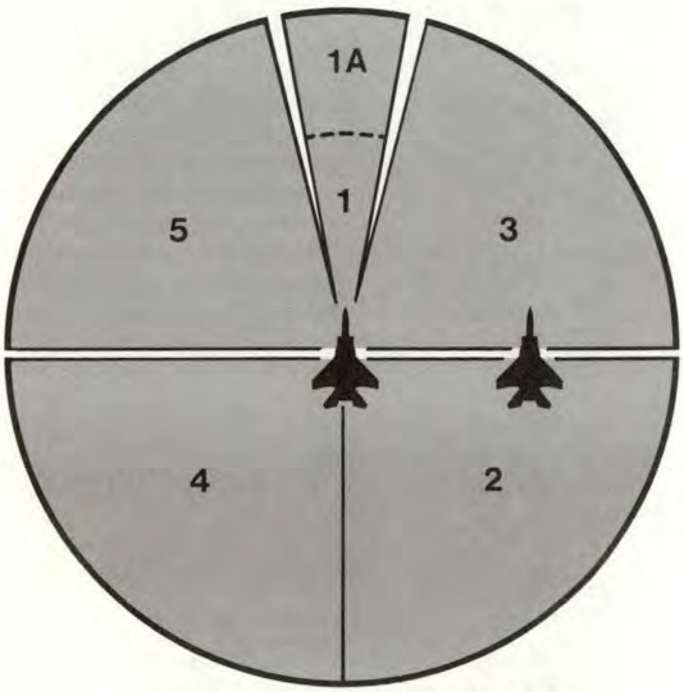
This plan will be developed from the point of view of No. 2 of a four-ship, but it applies to all the positions in the flight.

Sector 1 Sector 1 is the hub of our cross-check. It is divided into two parts. Sector 1 is *Near Rocks*, the rocks that will affect our flightpath in the next 5 to 10 seconds. This sector is the highest priority and is the center of the cross-check. *Near Rocks* are the ones that will bust your butt. Sector 1A is *Far Rocks*, the terrain ahead that will affect our future maneuvering. Guys that look ahead at the *Far Rocks* are the ones that are smooth in their maneuvering to maintain position or navigate, because they see the mountain peaks and valleys in time to make small corrections. The smaller your corrections are, the more time you will have to check six, and that's what it is all about.

Sector 2 Besides not busting your butt, the next most important area for lookout is inside the flight six. Sector 2 allows you to monitor your position and check your leader's six o'clock. Sector 1, 1A, and 2 make up the basic cross-check — *Near Rocks, Far Rocks, — Check Six.*

Sector 3 Once you have the basics down, it's time to pick up more areas of visual lookout. In keeping with your mutual support contract, the next area you would want to pick up is inside the flight ahead of the 3-9 line. By searching this area, you can pick up bandits in a conversion, as well as SAMS that may be fired from the front quadrant. You can take this area and integrate it into your basic cross-check. Remember, Sector 3 is a lower priority than Sectors 1, 1A, and 2, therefore, it should be searched less frequently. Also, don't forget you need to come back and reference *Near Rocks* and *Far Rocks* between each sector search.

Sector 4 After you have Sector 3



VISUAL LOOKOUT SECTORS

in your lookout, you should strive to pick up Sector 4. Sector 4 is outside the flight six o'clock. Once again, remember the priority listing in setting the frequency for searching this area.

Sector 5 When you are really on top of things, you can go to 360 degree lookout by picking up Sector 5. Sector 5 is outside the flight ahead of the 3-9 line. When you get this into your cross-check, remember it is your lowest priority — you owe it to your flight lead/wingman to provide inside-the-flight lookout in accordance with your mutual support contract.

Building And Breaking Down the Cross-Check

Your goal on every low level mission should be to fully develop your cross-check. This will take practice and discipline, but the ability to quickly set up your lookout will pay off when the shooting starts. On each mission, start with the basic *Near Rocks, Far Rocks, Lead — Check Six* pattern and build it up to your full capability before you get to the threat.

Your cross-check will break down for various reasons such as extremely rough terrain, defensive reactions, navigation turns, etc. When this happens, start dropping out the lower priority items in order. There will be times, such as hard turns, when you'll drop all the way back to *Near Rocks*. The key is to quickly re-establish the cross-check one step at a time when you roll out.

Radar Integration and Cockpit Tasks

Where does the radar fit into the picture? The answer to this question is in the responsibilities section listed above. Your position will determine where to incorporate radar lookout. As Nos. 1 and 3, it should be put at the same level as Sector 3. As No. 2, the radar should fit in after Sector 4. As No. 4, the radar would come after all visual lookout has been put into the cross-check.

Performing cockpit tasks is the next problem. The best plan is to do as many of them prior to hitting the low level as you can. Cosmic switch change plans are often forgotten in the heat of battle, so the best plan is a simple one. When switch changes are required, they should be substituted for a sector search in the cross-check. This will keep us on track with the idea we never stagnate our efforts — we do one task, then reference our flightpath before moving on to another task.

Summary

This technique for setting up a systematic low altitude time sharing plan is not *the* answer — it is just a guide. It will not work in all situations, but it provides a starting point from which to develop your own method. The successful fighter pilot will take advantage of peacetime to develop the discipline and skills to be able to kill *and* survive when the opportunity comes. ■

MAJOR	MAJOR	CAPTAIN	MAJOR	MAJOR
James M. LaSalvia	**Dean J. Hodgson**	**Fredrick R. Strain**	**William J. Fier**	**Dave B. Holmes**

96th Bombardment Wing
Dyess Air Force Base, Texas

■ On 10 March 1986, Major Holmes, instructor pilot, and crew were flying a combat crew training sortie in a B-1B. It was the initial sortie for Major Fier, pilot; Major LaSalvia, offensive systems officer; and Captain Strain, defensive systems instructor. Major Hodgson was the offensive systems instructor.

The No. 3 engine accessory drive system caution light illuminated while the wings were swept full aft. Major Hodgson, Major LaSalvia, and Captain Strain referred to the tech order procedures and advised the pilots the No. 3 engine would have to be shut down. The pilots decided to sweep the wings forward prior to shutting down the engine.

The wingsweep was started forward from 67.5 degrees, but failed at 55 degrees. While the pilots concentrated on shutting down the No. 3 engine and flying the aircraft, the other three crewmembers researched the problem and monitored the aircraft position. The crew exhausted all tech order procedures trying to restore wing sweep movement. They also contacted the unit command post and requested technical assistance.

The B-1B was designed to land with the wings swept to 20 degrees or less and approach speed data, landing ground run data, and brake energy limit data for landing with the wings swept to 55 degrees had not yet been developed. The decision was made to divert to Edwards AFB to use the 15,000 foot runway.

This diversion made air refueling necessary. Air refueling is normally done with the wing sweep at 25 degrees. With the wing sweep stuck at 55 degrees, it was necessary to refuel at 330 knots and that required using afterburner.

Captain Strain continued to coordinate crew actions with Rockwell engineers, the B-1B Combined Test Force at Edwards, and Dyess instructors and maintenance people through an emergency telecon. The experts determined final approach speed would be 246 knots and the maximum brake application speed after landing would be 230 knots. Flaps and slats could not be used and speed brake effectiveness would be reduced with the wings swept.

Major Holmes completed a controllability check at altitude and then flew two practice approaches down to 50 feet AGL. While Major LaSalvia called out height above touchdown based on the radar altimeter, Major Holmes flew the three-engine approach and landed in the first thousand feet of the runway.

After touchdown, Major Fier called out ground speed so Major Holmes could begin braking at 230 knots. Ground roll was about 11,000 feet. Captain Strain monitored brake temperatures on the Central Integrated Test Set. Brake temperatures entered the danger zone as the aircraft turned off the runway, and several brakes caught fire.

The professional reactions to a potentially catastrophic emergency, combined with exceptional flying skills in an untested landing configuration, prevented the loss of a valuable aircraft. WELL DONE! ■

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UNITED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Mishap Prevention Program.

CAPTAIN

Frank Strasburger

325th Tactical Training Wing
Tyndall Air Force Base, Florida

■ On 6 March 1986, Captain Strasburger was flying an F-15 on a 4V4 dissimilar air combat tactics mission. After the first engagement, a flight member noticed fuel streaming from Captain Strasburger's aircraft. A fuel check at that time indicated 4,600 pounds of fuel remaining. Captain Strasburger declared an emergency and began a climb to conserve fuel. As the flight began a return to Tyndall, he contacted the SOF.

Fuel was streaming from both sides of the aft fuselage, and a fuel check 3 minutes after the leak was discovered showed only 2,200 pounds remaining with the aircraft still 55 miles from Tyndall. Captain Strasburger shut down the left engine to isolate the leak and jettisoned the centerline tank to reduce drag.

The engine shutdown had no effect, and he decided to land at an inactive civilian airfield at Apalachicola, Florida, 35 miles southeast of Tyndall. No time remained to restart the left engine. As Captain Strasburger made the turn to final approach for the 5,200 foot runway, his fuel gauge now indicated 300 pounds of fuel remaining.

He made a difficult, single-engine approach over trees, touched down 400 feet from the runway threshold, immediately lowered the nose wheel, and began maximum wheel braking. The aircraft stopped with 1,500 feet of runway remaining and was shut down just as the right boost pump light illuminated, indicating imminent flameout from fuel starvation. His fuel gauge read zero. Total time from discovery of the fuel leak to shutdown on the runway was less than 8 minutes.

Captain Strasburger's calm professionalism and superb flying prevented possible civilian property damage and casualties and saved a valuable combat aircraft. WELL DONE! ■

USAF SAFETY AWARDS

THE SECRETARY OF THE AIR FORCE
SAFETY AWARD

STRATEGIC AIR COMMAND

The Strategic Air Command equaled the fewest number of Class A aircraft mishaps in its history during 1986 and, for the first time, completed two consecutive years without a Class B aircraft mishap. While flying more than two-thirds of a million hours performing a demanding worldwide strategic reconnaissance, bombardment, refueling, and Airborne Command Post mission, there was not a single B-1B, B-52, FB-111, or KC-10 Class A or B mishap.

Accomplishments in ground safety and weapons safety were equally impressive. The command experienced the fewest ground mishap fatalities in its history during 1986. The military injury rate was reduced 25 percent, and civilian injuries were reduced more than 30 percent. The command recorded only one operational Class A mishap while deploying two of the most complex weapons systems in Air Force history — the Peacekeeper and the B-1B. At the same time, 15 Titan II missiles were deactivated without a significant mishap.

These impressive achievements reflect strong command support, supervisory involvement, and commitment to safety by all members of the command.

AIR FORCE LOGISTICS COMMAND

The Air Force Logistics Command's safety program reflected strong command support, supervisory involvement, and adherence to safe operational procedures and standards. The command did not experience a Class A aircraft mishap and, for the third consecutive year, did not have a Class B aircraft mishap.

Accomplishments in other safety disciplines were equally impressive. Ground mishap fatalities equaled the fewest in the past 6 years, military injuries were reduced significantly, and the civilian injury rate was below the Air Force average. The command has not had a Class A or Class B explosives or missile mishap in 7 years and did not have a single Class C explosives or ground launched missile mishap in 1986.

THE MAJOR GENERAL
BENJAMIN D. FOULOIS
MEMORIAL AWARD

UNITED STATES AIR FORCES IN EUROPE

For the second consecutive year, the United States Air Forces in Europe reduced its Class A aircraft mishap rate to the lowest level in the history of the command. The 1986 rate was more than 12 percent lower than the previous record low which was established in 1985 and was the lowest rate in the Air Force for a large fighter command.

This impressive achievement was compiled while flying more than 200,000 hours in high-performance fighter and attack aircraft in a complex international environment, limited airspace, and poor flying weather. The command participated in demanding exercises, deployments, and special missions.

This success proved beyond a doubt that safe mission accomplishment stems from strong command support and leadership, supervisory involvement, and personal commitment by everyone.