flying

SAFETY FEBRUARY 1990

SPECIAL ISSUE

1989 Mishap Review

THE FIGHTERS

THERE I WAS

■ There I was—in a 60-degree spiral going down!

I was scheduled for an IFR-VFR-IFR mission a couple of years ago in good old Germany. I still remember that day because I learned about disregarding fundamentals of instrument flying even with a flying experience of more than 18 years and about 3,000 hours in fighter aircraft.

The mission layout was IFR departure at home base up to FL 200 for a TACAN penetration at a nearby airfield following a couple of GCAs. After that, a SID to get on top for some airwork in the Temporary Reserved Airspace 207 (fighter's playground), followed by a TACAN letdown into home base and full stop.

The weather was not too bad–some low clouds up to 5,000 feet, haze above, and clear from FL 200 on. Everything went fine up to the IAF for my first penetration.

Contact was established with GCA for monitoring. Hitting the IAF, I called and told them I was coming down. The letdown plate on my knee, I followed the procedures. I was flying into this base on TACAN penetration so often that I knew it by heart—I thought! The book says shortly after leaving the IAF, I should have turned left onto ARC 16. Instead, I heard somebody from downstairs asking the controller, "Where the hell is he going?" The mike must have still been hot from the last transmission. That moment I reckoned he meant me because I forgot to turn onto the arc, and was still flying outbound on the radial at about 16nm.

Instead of starting a 30-degree bank turn—as the book says—to get on the arc through the back door, I cranked the aircraft around with about 60 degrees of bank (plus a little!) to get on that arc as quickly as possible.

The visibility wasn't so bad, just a little haze and—was there a horizon? No.

There was this altitude restriction at FL 140, but what radial?

Let's take a look at the book. By the time I got back on the gauges again, I found myself and my aircraft in a nice downward 60-degree spiral, passing 12,000 feet with a pegged VVI. The recovery was easy, although I was shook up. The final approach was just slightly erratic, and the touchdown might have been a bit smoother, but it ended safely.

I don't think I have to give you any explanations. I was just lucky there was enough space between me and the ground. I wonder how it would have come out in the GCA pattern. ■

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SPECIAL ISSUE

FY89 was another great year! We had 55 Class A mishaps in FY89 and for the sixth fiscal year in a row, our Class A mishap rate remained below 1.8. Our fighter/attack aircraft had their best year ever. It was the first time their rate was below 3.0.

In this issue, we take a look at how we did in FY89 in our fighter/attack aircraft. Next month, the magazine will be devoted to the heavies.

FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, OSAF

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A-7

LT COL NATHAN T. TITUS
Directorate of Aerospace Safety

■ I'm happy to report A-7 pilots did much better in FY89 than in FY88, with three mishaps and no fatalities. What is even more impressive is none of the three were ops mishaps. Considering the majority of USAF Class A mishaps are ops caused, this is a significant accomplishment. Equally important was a decrease in "near misses" like our two, tree strikes in FY88. Overall, A-7 jocks did a superb job flying the aircraft smartly and tactically. In FY88, AFISC predicted four losses, so we were wrong by one. (We love to be wrong in this direction!)

The A-7 is getting along in years but still has a few surprises up her sleeve. Low altitude night attack (LANA) has added night attack capability, and the possibility of an A-7F Strikefighter would breathe new life into the system. Regardless of the future of the A-7, Air Force policy is to maintain and fly an aircraft as safely as possible until the end of its service life. Therefore, it is our responsibility to use every safety program available and keep the mishap rate as low as possible. Let's take a look at the A-7 mishap history and the FY89 Class A mishaps.

FY89 Mishaps

The A-7 inventory is down to approximately 365 A-7D and K model aircraft flown primarily by the Air National Guard. The US Navy continues to fly the A-7 but has begun to phase them out, with complete phaseout sometime in 1991. They currently have about 400 in service. Greece and Portugal also fly the A-7. The USAF A-7 fleet flew about 80,000 hours in 1989 and is approaching the 1.6 million-hour cumulative milestone. Since 1970, the A-7 has had 96 Class A mishaps for a lifetime rate of 6 aircraft destroyed per 100,000 flight hours.

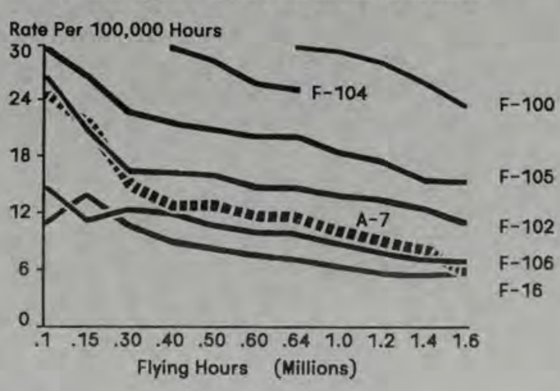
In spite of all the mishaps, the A-7 currently ranks with the F-16 as the safest single-engine fighter the USAF has ever flown (figure 1). The F-16 is ahead on flying hours by virtue of having four times as many aircraft, but the A-7 has 8 more years in service. The fact that we maintain a safety record commensurate with a much newer aircraft speaks very highly of the pilots and maintainers of the A-7. Let's see what we can learn from the three FY89 mishaps.

During FY89, the A-7 had one of the most interesting Class A mishaps in many years. The mishap aircraft was performing a popup attack when the right wing failed at about 16 inches outboard of the fuselage. The pilot was slammed against the side of the canopy but somehow managed to reach the handle and initiate ejection. He underwent surgery for a broken leg but suffered no other serious injuries. The wing failure was due to a large pre-existing stress crack which unzipped during the popup maneuver. More about wing cracks later in this article.

Our second mishap in FY89 was an engine seizure resulting from an improperly installed oil quantity indicating system. After takeoff, when the pilot pulled his first high-G turn, the oil drain plug fell out. The master caution and engine oil quantity lights alerted the pilot to the problem, and he pulled the power back and started a climb towards the nearest airfield. Approximately 8 minutes after the caution lights illuminated, the engine started to vibrate and then seized. The pilot began a controlled descent, maneuvered the aircraft away from populated areas, and successfully ejected at 2,700 feet AGL. An interesting sidenote to this mishap is that neither maintenance nor ops knew the new oil quantity system was designed to indicate no lower than half full when oil quantity is from half full to empty! The mishap pilot would have had a better idea of the impending disaster if he had known this.

FIG 1. A-7 One Of The Best In History

Single-Engine Fighter/Attack Destroyed Rates



The third mishap in FY89 was also credited to the logistics side of the house. It resulted from a bleed air leak which led ultimately to loss of control. From an operator's viewpoint, this one had an interesting sequence of events. As we review this mishap, think about how you would have interpreted these indications.

The mishap aircraft was lead of a two-ship instrument qualification and range familiarization sortie. On climbout from a practice approach at another base, the pilot noticed sluggish flight controls, automatic flight control system (AFCS) lights, and generator off line. He was able to reset the AFCS light and the generator but then got a hot microphone, an altimeter failure, HUD failure, uncommanded radar presentations, and the hook down indication. Returning to base, he heard "popping" noises and noted the pitch and roll trim was inoperative. Climbing through 16,000 feet MSL, PC2 dropped to zero, and the hook extended a second time. The flight declared an emergency and began a divert to the nearest field with a cable. Thirty seconds later, the mishap pilot saw the main and transfer needles drop to zero and the fuel totalizer at 9,500 pounds. The aircraft then pitched up violently and departed controlled flight. The wingman commanded bailout, and the mishap pilot successfully ejected.

Investigation revealed a bleed duct failure behind the pilot's seat which was burning through several wire bundles and control linkages. The A-7 was designed before the Air Force requirement for a bleed air leak detect system, and the only maintenance requirement was a cursory 200-hour phase inspection. As a result, the seventh and eleventh bleed ducts were inspected on all aircraft, and the development of a bleed air detection system is being studied.

continued

A-7 continued

Safety Concerns

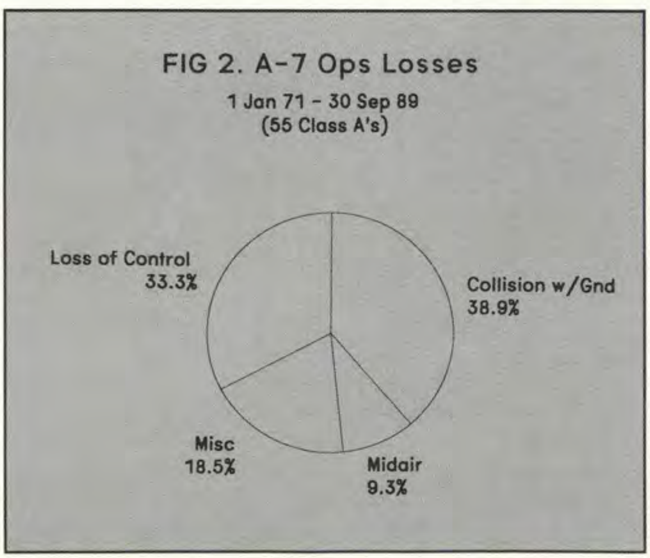
In last year's version of this article, we examined closely the mishap history of the A-7. Even though this year's mishaps are being tallied to log causes, ops mishaps still account for the majority of mishaps. Collision with the ground and loss of control are still our two biggest loss areas. Figure 2 pretty much tells the story—we must continue to work at reducing these preventable ops losses.

The biggest "safety" news this year for the A-7 was wing cracks. During FY89, we pulled the wing off an airplane during a popup attack. The failure was due to a preexisting fatigue crack at the second intermediate spar. This particular point on the wing was not predicted by engineering models to be a potential problem area. This fact, plus the other cracks that were found during the subsequent TCTO inspections, were of great concern for both operators and maintainers. Sacramento ALC (the new depot for the A-7) was a very busy place! Then, just as we thought we had a handle on it, a second major crack (13 inches long) was found in the aft portion of a wing. This crack was in a high-stress area predicted by the model.

Overall, the problem is not as catastrophic as it may seem. The entire fleet has been inspected, and we have found many small cracks and a few larger ones. Several aircraft will have to have new lower wing skins installed. The rest are being repaired by drilling out and installing bushings. The inspection requirements have been tightened considerably, and a lot of engineering study has been done to better understand the dynamics of the problem. What's extremely interesting is the Navy does not appear to have near the cracking problem on their aircraft in spite of having about twice the airframe hours. The only logical (but unproven) theory is that the Air Force flies their aircraft considerably harder than the Navy.

Sacramento ALC, and the maintenance community in general, have done a terrific job in handling this serious problem. I have been involved in the wing crack problem from the start and am extremely pleased with the actions that have been taken to correct this situation.

With the LANA mission expanding, there is an increase in the mishap potential. Our goal, however, is to eliminate preventable mishaps. We have never had a Class A mishap-free year in the history of the A-7. Wouldn't it be great to make FY90 the very first one? ■



A-10

LT COLONEL PETER H. SCHALLER - KALIDE, GAF
Directorate of Aerospace Safety

■ The Warthog took a step back in FY89, closer to the old average of about six mishaps per year experienced in the late '70s and early '80s. With six Class A mishaps, including three fatally injured pilots and five civilians killed, the rate jumped from 1.37 in FY88 to 2.71 in FY89. That's slightly better than the rest of the fighters (see figure). Their rate was 2.99. A-10s had their fifth best rate since 1977 when the Hog community had its first Class A mishap.

Five of the six Class A mishaps in FY89 were ops related. Three of those six were collision with the ground (CWG). All CWGs proved fatal.

Since becoming operational, the A-10 has averaged three CWG mishaps per year. Reviewing the A-10 CWG mishap causes leads to the conclusion that a ground collision avoidance system (GCAS) would have helped to avoid at least two mishaps per year. Where is GCAS?

If everything runs on schedule, the first A-10 will have GCAS installed by April 1990. With an installation rate of 55 aircraft per quarter, the fleet will be completed by 1993.

Unless A-10 pilots change how they fly, we will continue to lose two to three A-10 fighter pilots and their flying machines each year. Knowing that, you aviators out there in the units, take your eyes off your flightpath only when necessary. You have all the skills you need in your hands to complete the mission safely and keep those other people in your life happy, like your family, friends, supervisors, maintenance people, and taxpayers.

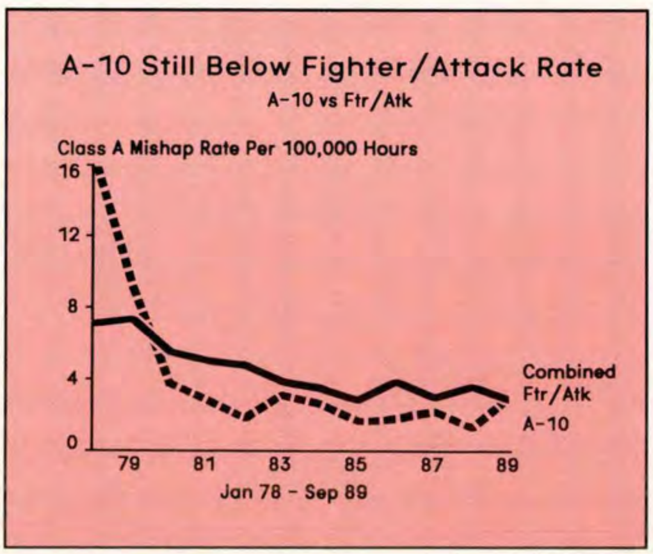
Class A Review

As I mentioned above, there were five ops mishaps and one log-related mishap in FY89. Let's have a look at them.

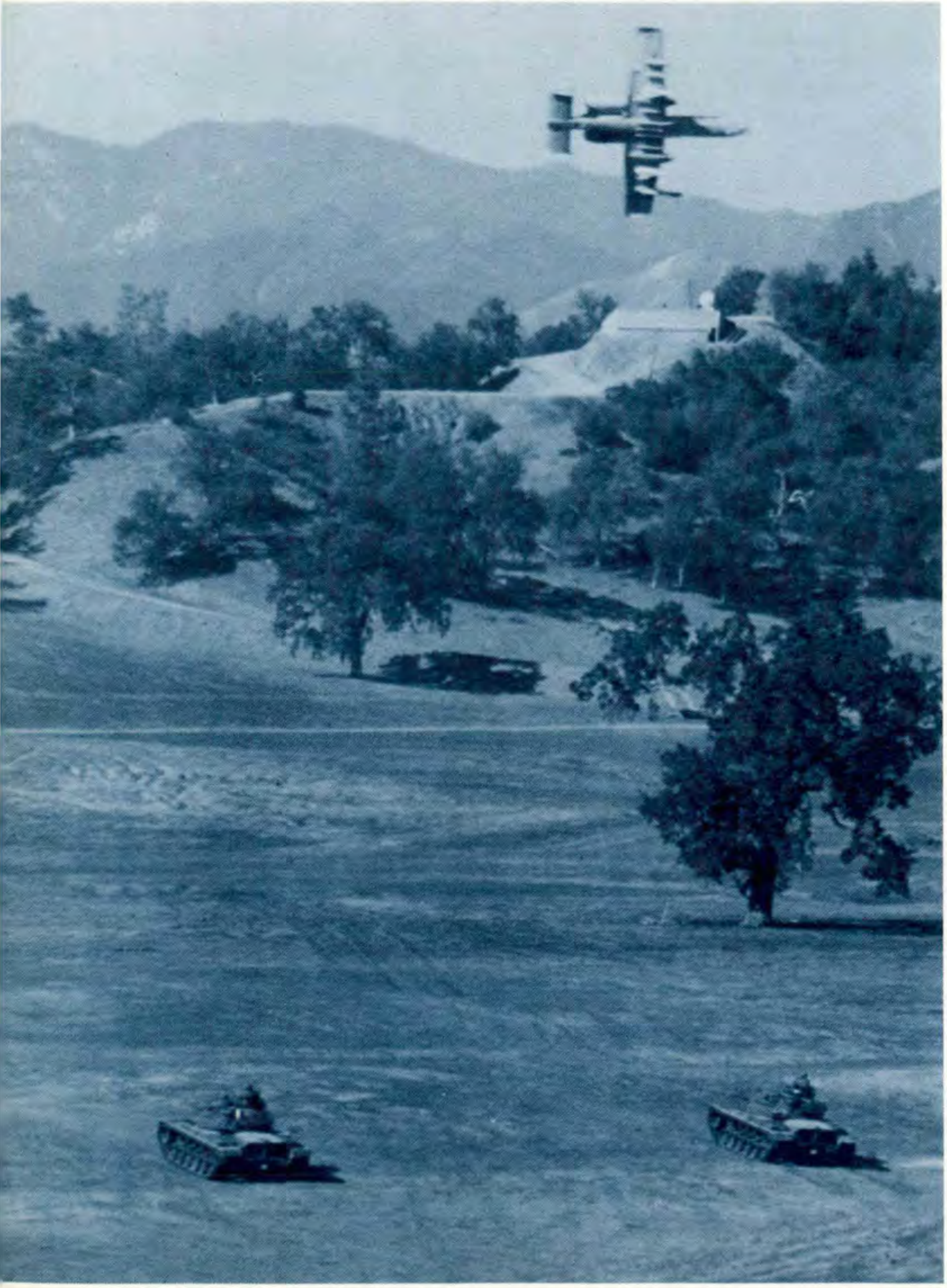
There were three CWG mishaps.

- One mishap occurred on an air-to-ground range. Lead stayed low after pulling off the target to watch no. 2 strafe. His aircraft impacted the ground, and there was no attempt at ejection.
- Next involved a two-ship. After being weather delayed several

continued



The A-10 continues to be needed at the leading edge of battle. We must be prepared to meet the need with aircraft ready to fly and pilots trained in the proper tactics for the local terrain, whatever it happens to be.



times, they finally got airborne in VMC. Shortly after takeoff, they encountered IMC conditions. No. 2 went lost wingman and impacted in a town. The pilot and five civilians were killed.

- The third CWG mishap occurred during simulated forward air control work. The mishap pilot (MP), on flight lead upgrade, flew into the ground while egressing from the target.
- No. 4 ops-related mishap involved loss of control. Flying trail formation, the MP, while trying to get back in position, stalled his aircraft, could not regain control, and ejected successfully.
- Last of the ops mishaps was a departure from the runway with shearing of the nose landing gear. The MP encountered reverted rubber hydroplaning.

There is one common thread running through the A-10 mishap reports since they were put into service: "CHATT" (channelized attention). From 1983 to date, 24 out of 34 mishap reports had CHATT identified as a cause condition. Almost every one ended as a fatality.

How Come?

Is CHATT caused by the aircraft which gives you very little references to the ground and the horizon because you sit so nice and high above everything with this beautiful panoramic view? Does CHATT let you forget you have big wings close to the ground in a turn?

Is it the mission you fly . . . close air support in pairs knocking out

The A-10's design simplicity allows it to be serviced from bases with limited facilities.

tanks? Searching for the target and watching your wingman at the same time has ended in a CWG. In almost every mishap, the MP's attention diverted from his flightpath, for whatever reason, or he got distracted in a low-level environment and made contact with the ground. Very few pilots survive this contact.

Or is it you are just not paying enough attention? Do you remain too long in one distraction? Are you overloaded, overtasked, or just complacent?

Review everything I have mentioned and make your own decision. How do you fly now, and how will you change so as not to get involved in a CHATT mishap?

GCAS will help a lot but is not the all-healing solution. Ask the psychologists about target fixation and channelized attention.

The same is true with the midairs the A-10 had in its past. Here, in addition, situational awareness was part of the game and a cause.

Log Mishap

The only log-related mishap caused the MP to leave the aircraft by his rocket-boosted comfort chair after a double-engine flameout. What happened? Being confronted with the tank unequal caution light and performing checklist procedures, the MP got widely varying fuel indications. So he continued with fuel imbalance checklist procedures. While trying to recover at a nearby base, the engines flamed out due to fuel starvation.

Two simultaneous fuel system malfunctions caused this situation. First, the intermediate device (ID) sent erroneous signals causing the tank unequal light to come on and giving those widely varying fuel indications. Second, the defuel valve failed to the open position. That caused all the fuel being pumped by the operating boost pump to go into the wing tanks which did not gravity feed to the main tanks as advertised in the Dash 1. The engines, starved for fuel, flamed out.

All A-10 fuel system emergency checklist procedures start with "crossfeed—switch—crossfeed." A known routine practice in the A-10 community is if there is a fuel system problem, "crossfeed—switch—crossfeed," and *then* start analyzing and acting. Most of the time it works fine, but in this case, with an unknown defined valve open, it was disastrous.

So always remember the three basic rules which apply to emergencies while airborne—*and in this sequence only:*

- Maintain aircraft control.
- Analyze the situation.
- Take proper action.

Class B Review

In FY89, only one Class B mishap occurred. A forgotten flashlight stopped one of the throttles from moving further forward than 85 percent. After knocking off the mission, it was decided to land straight in, flaps up, at single-engine speed. Touchdown and initial braking were okay. Shortly after touchdown, the MP noticed the deceleration was less than normal. Changing from normal to emergency braking did not clear the problem. Departing the runway at the end caused first the nose gear to collapse and then the main gear. After cutting the engine, the MP abandoned the aircraft unhurt.

Channelized attention? Complacency? Task saturation? What caused a fairly routine landing to end in collapsed gear?

To overheat the A-10 brakes, in this particular situation, there must have been some thrust output from the engines because nothing was found to be wrong with the brakes and throttle system except the flashlight blocked the throttle from being advanced.

Summary

So you A-10 fliers and supervisors, it's your turn to improve on last year's score. Keep "CHATT" on your mind and you have a good chance of making it through FY90. You maintenance folks, keep your eyes on the known weak points of the A-10, and we all will be happy at the end of FY90.

Good luck to you all out there. Many happy landings, but save your hide if you get into trouble. Pull the handles! That is why they are there. Safety boards would rather talk to the pilot of a mishap than his widow. ■

The A-10 Thunderbolt II is the first Air Force aircraft to be specifically designed for close air support of ground forces. The aircraft has excellent maneuverability at low airspeeds and altitude and a wide combat radius and short takeoff and landing capability.

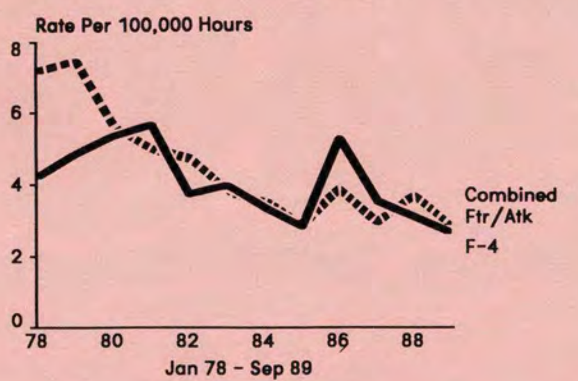
F/RF-4

MAJOR JEROME L. JOHNSON
Directorate of Aerospace Safety

■ FY89 was the BEST YEAR EVER for the F/RF-4 community with six Class A mishaps for a 2.74 Class A mishap rate (figure 1). Credit goes to the RF-4C community which had NO Class A or B flight mishaps, a year that can never be bettered. The F-4 part of the community had its sixth best year with a 3.88 Class A flight mishap rate (six mishaps). They experienced two Class B mishaps. Congratulations to all the Phantom Phlyers and Phantom Phixers!

With 26 years of service in the USAF and almost 10 million flying hours, approximately 970 F/RF-4 Phantom IIs were still flying in the USAF at the close of FY89. Retirement of F-4s and transition to other aircraft highlight the need to continue to fly only the aircraft YOU deem airworthy. Transition is a time YOU cannot accept lower standards just to get a sortie airborne. YOU have used strict standards up until now, and they have proved themselves. Don't change your high standards.

FIG 1. USAF F/RF-4 Has Best Year Ever
Class A Mishap Rates



Very Fortunate!!

The excellent FY89 record was helped out by many "close calls" not becoming a smoking hole or two. One F-4 crew maneuvering at low altitude entered a steep dive from which they recovered in time to avoid hitting the ground but not in time to avoid hitting a tree. Another F-4 crew recovered from a low altitude (below 10,000 feet AGL) out-of-control situation at around 1,000 feet AGL after deploying the drag chute. A powerline got in the way of one Rhino. Fortunately, after eating the shattered fiberglass remains of the radome, the J-79s kept running. A midair cost Blue Two only a wingtip while lead lost part of his leading edge flap and the seeker head from his inboard pylon-mounted AIM-9. An engine-out (not just one; both) landing was accomplished on a convenient dry lakebed. Several flight control problems could have been disastrous if they had happened at low altitude.

These crewmembers were very fortunate!

Lives Lost

In FY89, the F-4 community lost three crewmembers along with one administrative specialist.

- One crewmember lost his life to an ejection outside the envelope, while the other crewmember in the same ejection sequence survived because of down-sloping terrain and a tree that grabbed his chute.
- One crewmember lost his life when a nose gear collapsed, initiating an out-of-sequence ejection which resulted in parachute and aircraft canopy entanglement.
- One crewmember drowned after he had a successful ejection, suffered extensive flail injuries, and was either incapacitated or could not inflate his LPUs. A water-activated LPU-9/P most probably would have saved his life.
- An F-4 crashed during takeoff and impacted a ground vehicle, fatally injuring an administrative specialist seated within.

Aircraft Lost

Four of the six FY89 Class A mishaps resulted in destroyed aircraft. The lifetime total of destroyed F-4s is now 1,064.

Log Mishaps

HQ AFISC forecast three log mishaps for FY89. Only one log mishap occurred. A synopsis of this mishap follows.

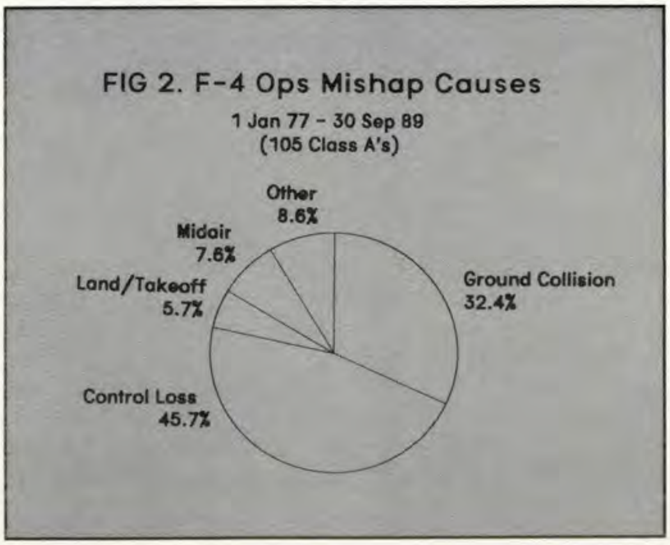
- During tactical maneuvering, a bag of screws left in the flight control area resulted in the right aileron being jammed in the full-down position. Using maximum opposite aileron and rudder, the crew found themselves with a marginally controllable aircraft. Instead of ejecting from the crippled aircraft, the crew made a successful landing. During the landing, the airframe sustained substantial damage.

Ops Mishaps

HQ AFISC forecast five ops mishaps for FY89. The projected ops mishaps included three loss of control, one midair collision, and one collision with the ground. The forecast was quite accurate, considering there were three loss-of-control mishaps. There was one midair collision and one collision with a tree that fell into the "very fortunate" category. These two almost-Class A's could have fulfilled the prediction. The other operations mishap would have been just as hard to predict since it concerned pilot incapacitation.

Historically, as seen in figure 2, loss-of-control mishaps dominate the causes of F-4 ops mishaps. Loss of control continued to be the largest ops factor in FY89, accounting for three F-4 aircraft losses and costing two lives. The following is a short summary of the ops mishaps.

- During a BFM engagement, the mishap aircrew experienced a violent aircraft dig-in with the corresponding rapid "G" increase as the aircraft decelerated through the transonic region. The pilot called for an immediate bailout at approximately 21,000 feet. Both crewmembers experienced extreme flail injuries. The WSO did not get his LPUs inflated and drowned. continued



F/RF-4 continued

■ After experiencing a takeoff emergency and getting set up for an approach end arrestment, the mishap pilot, who had not disclosed a medically grounding disability, lost consciousness on final. The WSO assumed control of the aircraft and set up for a night wing landing. After touchdown and a cable skip, the aircraft left the runway, and the nose gear collapsed as the aircraft came to a stop. The collapsing nose gear initiated an out-of-sequence ejection resulting in the pilot receiving fatal injuries.

On takeoff roll, the mishap aircraft overrotated and got airborne prematurely. With the aircraft out of control and the right wing scraping the runway, the WSO initiated a successful dual-sequenced ejection. The mishap aircraft impacted the ground and slid into a parked vehicle fatally injuring one of its three occupants.

■ During a low altitude aileron roll, the aircraft ended up in an extremely nose-low attitude. Not perceiving a successful dive recovery in progress, the WSO initiated a successful dual-sequenced ejection.

Mishap

One miscellaneous mishap, possibly an unknown, was predicted for FY89. A summary of this undetermined mishap follows.

The mishap aircraft was being repositioned from a tactical line abreast position to a loose fighting wing position using a rolling maneuver. During the rolling maneuver, the aircraft went out of control for an undetermined reason. The crew was unable to recover the aircraft and initiated an out-of-the-envelope ejection. The pilot did not survive.

Human Factors

Human factors is an area we, the aviators and maintainers, hate to look at or hate to give much validity. Why? Easy. WE either could never do something so "incredibly stupid" or WE see something in ourselves we don't like and certainly don't want to be reminded of. There is no intent for this section to provide you with any philosophical answers. The following is only for you to reflect upon.

FY89 for the Phantom Phlyers and Phixers was a year of human factors. Why would a person forget to remove a bag of screws from a flight control area before putting the panels back on the jet? Was it habit pattern interruption, shift

Like they have done for so many years, F-4s stand ready to do whatever mission the Air Force requires.

change, fatigue, or . . . ? How uncomfortable do you have to be in an air-to-air low-altitude environment to turn an aileron roll into a barrel dive? After having been uncomfortable for several of these sorties, would any of us have stood up and said "No" to another of this type of sortie? The question of why a person would cover up a medical grounding disability is somewhat understandable to an aviator; but, to put another at risk is NOT so understandable. How do habit patterns from one aircraft transfer into the aircraft you are now flying? Couldn't happen to ME! Remember, a good portion of the F-4 community is transitioning to a different aircraft or are already dual-aircraft qualified.

As previously mentioned, loss of control is the biggest piece of the F-4 ops factor mishap pie (figure 2). In the newer fighters, loss of control is not as dominant in the ops factor mishap causes. Let's face it, the Rhino demands more respect as it uses older technology and likes to keep the pilot honest.

There are a few things to think about before you get the opportunity to go out of control. First, your situational awareness (SA) can't be left in the map case. A flyable airspeed is a must before a recovery is attempted or a new stall will be encountered. Just because the nose is very low doesn't mean the airspeed is building rapidly. If the drag chute has been deployed and the throttles placed in idle, the F-4 is *very* slow at accelerating. After passing the magic 200 knots, the stick can be moved aft. How fast and how far it is moved requires more SA. Slowly and not too far are good answers. Altitude (AGL) is the stick movement determiner. Remember, an entire loop only takes 8,000 feet. So, if the altitude is available, recover accordingly. At 15,000 feet AGL, there is no reason to go immediately to onspeed indications. After all, the AOA gauge can lag actual AOA by as much as eight units with as much as a 7-second delay. If onspeed indications are pulled to at a high pitch tracking rate, chances are the aircraft is actually seeing 27

units and the wings are stalled again—a perfect setup for "loss of control." Then you may get to try another recovery or see if all the good things they said about Martin-Baker are true.

Fire, Fire

"Fire, Fire" has remained a common phrase used by "Bitching Betty" throughout FY89. False fire/overheat lights, which result in engines being shut down, have continued to plague the F-4 community. The good news is aircrews have been shutting the engine down when called for in the checklist. Why is that good news? Since January of 1988, there have been 25 times in which the fire or overheat condition was REAL. Each incident could have resulted in an aircraft loss. By shutting the engine down when the checklist calls for it, we continue to avert an aircraft or aircrew loss.

Safety Modifications Update

TCTOs 1548 and 1549, designed to eliminate most of the false fire/overheat indications, should be in the field by mid-January 1990.

Installation of single-piece windscreens should start in late March 1990. Forecast completion is for the second quarter FY92. The high performance centerline tank modification, which moves the fuel cap aft of the aux air doors and baffles the tank preventing CG shift, is under way. Fifty tanks are being modified each month. All the tanks should be modified by mid FY91.

Bottom Lines

In an out-of-control situation, the **BOLD FACE** is easy. It's the recovery that's difficult.

- Know when YOU need to eject. Historically, we wait too long.
- Always treat the fire/overheat lights in accordance with the checklist.
- Be extra careful when your unit transitions to a different aircraft.
- The F-4 community hasn't lost an aircraft to a centerline tank-fed fuel fire on takeoff for a while. It may be time to re-emphasize the jettison portion of the **BOLD FACE**.

Maintain aircraft control.

Analyze the situation and take proper action.

Land as soon as practical.

Fly tactically sound and you'll fly safe. ■

F-15

LT COLONEL R. JOHN DICKINSON
Directorate of Aerospace Safety

■ FY89 was not a year the F-15 community looks back on with pride—five Class A mishaps, four aircraft destroyed, and two pilot fatalities (see figure 3). But it wasn't our worst year either. There have been four other years when the F-15 fleet had at least five Class A mishaps. In retrospect, FY89 was a more typical year for the Eagle than was FY88 when we had only one Class A mishap. In fact, FY88 was our best year ever.

FY89 Review

Let's take a look at FY89 and see if we can improve on our "typical year." Of the five mishaps experienced last year, four were operations and only one logistics.

This comparison between operations and logistics is slightly higher than the Eagle's lifetime rate.

Figure 2

	FY89	Lifetime
OPS	4 (80%)	37 (60.7%)
LOG	1 (20%)	24 (29.3%)
Totals	5	61

The lifetime F-15 operations rate very closely parallels the Air Force overall operations rate with the majority of all mishaps falling into the operations category.

For the serious number crunchers, FY89 mishaps work out to an estimated 2.6 mishaps per 100,000 flight hours for the F-15 community. That's still pretty good considering the 15's lifetime rate is 3.2. A rate of 2.6 is also better than the fighter/attack rate of 2.99 for FY89. So even with five Class A's in FY89, we're still doing our part to reduce the Air Force rate. Enough numbers, let's review operations.

Within operations, the mishaps break out like this:

Fig 1. F-15 Still Keeping Rates Low

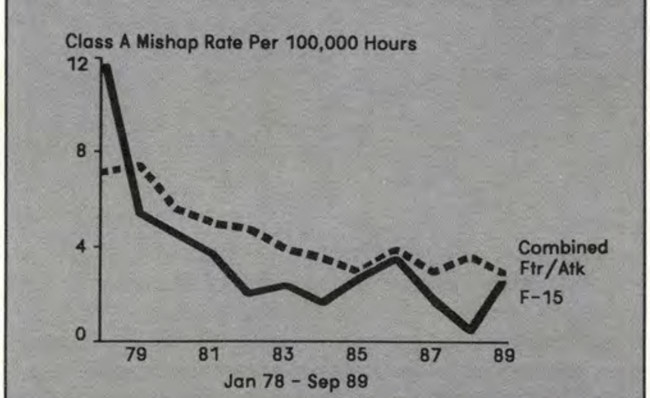


Figure 3	FY89	Lifetime
Loss of control	1 (25%)	14 (30%)
Collision w/ground	2 (50%)	10 (27%)
GLC/structural fail	1 (25%)	1 (2%)

Loss of Control

As you can see, loss of control has claimed more Eagles over the years than any other operations mishap—not an unusual occurrence for an aircraft flown in the air superiority mission. Let's look at the FY89 loss-of-control mishap.

■ The mission was a scheduled BFM mission. On the mishap engagement, the mishap pilot (MP) was maneuvering defensively, looking over his shoulder at his wingman. The MP had just changed his stick position while attempting to reverse his flight direction when the aircraft roll coupled into an auto roll. The aircraft continued in the auto roll for an extended time with the nose falling steeper with every roll. When the auto roll was finally stopped, the aircraft was in a 60- to 85-degree dive well below 10,000 AGL. Not yet recovered from his out-of-control situation, the MP ejected. The pilot received significant head injuries during the ejection sequence preventing an accurate accounting of the events leading to the ejection decision.

Collision With the Ground

Two of our 1989 mishaps resulted from aircraft colliding with the ground or things attached to the ground. As seen in the previous summary, collision with the ground (CWG) accounts for a surprising 27 percent of all F-15 operations mishaps. Even more chilling is the fact that CWG almost always results in the death of all crewmembers aboard the aircraft. The first mishap in this category resulted in the death of the pilot.

■ The mission called for a single-ship alert changeout at an outlying airfield. The pilot filed for a delay to a commonly used divert field for some practice approaches. En route to the divert field, the pilot was advised the weather was deteriorating at the alert base where the aircraft would full stop. The pilot elected to continue to the divert base for the planned practice approach. Deteriorating weather now at the divert base forced the pilot to rush his approach and ultimately go missed approach. During the missed approach, the pilot did not comply with published procedures and impacted 250 feet below the top of a 2,250-foot peak located 1 mile from the departure end of the active runway.

■ Our other CWG resulted from the aircraft striking the support wire of a 1,500-foot tower while flying at 500 feet AGL. The tower, located in a low altitude intercept area, is well marked on the maps and was an often-used ground reference by the unit. The MP was serving as target on a low-altitude intercept mission on a head-to-head pass. (The MP struck the guy wire 500 feet from the ground while practicing his canopy code locating technique on the attacking aircraft, after having locked-on with his radar.) The left engine, intake duct, wings, and centerline tank were all extensively damaged before the wire broke. The pilot shut down the left engine, conducted a controllability check, and engaged the approach end cable because the left main landing gear would not extend. Following a successful ground egress by the pilot, the fire department had to enter the cockpit and shut down the right engine.

GLC/Structure Failure

Our final operations mishap involved structural failure of both wings of an F-15 that occurred when the MP overstressed the aircraft during a high speed dive recovery. While performing a high-to-low intercept, the MP most likely blacked out from G-induced loss of consciousness (GLC). After regaining consciousness, the pilot pulled too hard during the recovery, ex-

continued

ceeding the structural load limit of the aircraft. Although the pilot initiated ejection following the wing failure, a shielded mild detonating cord failed to fire following canopy separation, preventing the ejection seat from firing.

Logistics Mishap

We had but a single logistics mishap this year. The mishap occurred during DACT maneuvering. The MP, while attempting to overshoot his opponent with a nose-high reversal, heard the yaw warning tone. The aircraft rapidly transitioned to an auto roll. The pilot quickly applied proper recovery controls, and the rolling stopped. However, after neutralizing the controls, the aircraft immediately entered a flat spin. Unable to stop the spin, the pilot successfully ejected. A malfunctioning fuel transfer pump was discovered which prevented fuel transfer from an internal tank. This caused a shift in the aircraft's center of gravity which increased the aircraft's susceptibility to departing controlled flight in certain airspeed and high angle-of-attack regimes. Additional testing is underway.

Summary

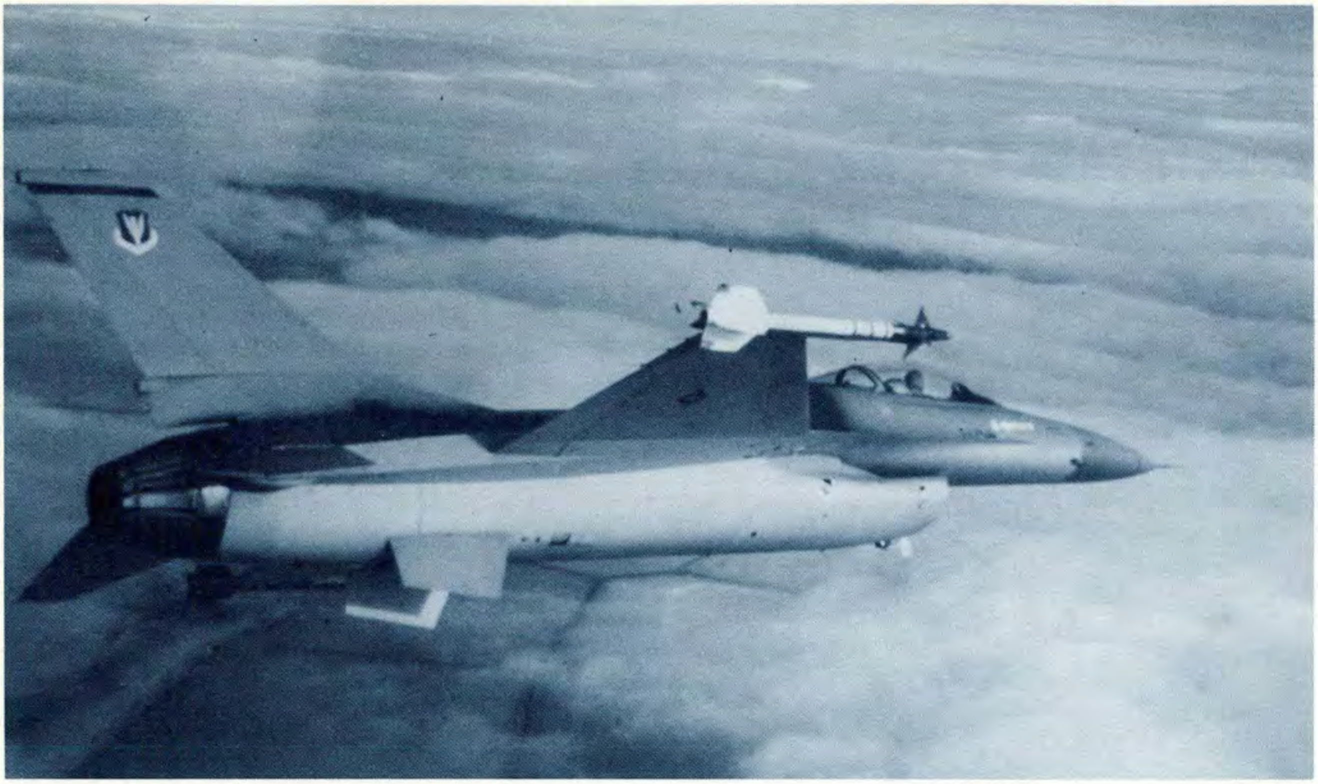
The real tragedy of these mishaps is that four of the five were clearly preventable. They should not have happened. In looking for clues on how to prevent these mishaps from occurring again, we closely examined the causes of each mishap. We were surprised to find complacency listed as causal in three of the five mishaps. Channelized attention, task saturation, and discipline were also listed. These are all factors over which we have direct control—factors each flight lead, flight commander, ops officer, and squadron commander are charged to eliminate or enforce.

An Air Force-wide review of FY89 mishaps showed the mishap causes of complacency, task saturation, judgment, and supervision were not unique to the F-15. In fact, they occurred to crews in all commands, flying all types of aircraft. We may be able to reduce CWG mishaps by installing ground collision warning devices and even eliminate GLC mishaps with a pressure-breathing G-suit. But our human factor causes cannot be engineered away. A big step in the direction of eliminating human factor causes is admitting they exist. They are not pilot error, and they can happen to anyone at any time.

The Future

In its day-to-day flying, the F-15 is doing well. Wingtips and stabilator boxes continue to delaminate. A damage checkout of each ACM mission is good insurance against a low-speed, out-of-control condition. Any damage to the aircraft should be followed by a controllability check. Warning lights are in the "mod mill" for wing transfer pump failures, cockpit depressurization problems, and windshield overtemp due to the deice switch being on too long. Robins AFB, Georgia, is also pressing ahead as hard as they can to build redundancy into the F-15 ejection system. Failure of the ejection sequencing system mentioned earlier has us all concerned. The reason the line failed to fire is unknown, but there is a maximum effort underway to support a simple, redundant seat firing system.

Is it all bad news? Not by a long shot. The F-15 has the second best safety record in the Air Force behind only the A-10. This excellent record is a direct result of professional pilots who fly the Eagle and professional maintainers who let the pilots fly their jets. A big pat on the back also goes to the program manager at Robins who juggles too many mods against not enough money to fix the problems we find. But let's not rock back now. Let's push hard to eliminate those operator mishaps and bring our pilot fatality rate to zero. I've never seen a mission flown by the F-15 worth the loss of an aircraft, and I've never seen an aircraft worth the loss of a pilot. Fly smart. ■



F-16

LT COLONEL JERRY R. PERKINS
MAJOR GRAHAM A. LARKE, CAF
Directorate of Aerospace Safety

■ FY89 was an impressive year for the F-16. In fact, it was its best year ever. AFISC analysts had forecast 24 Class A mishaps for the year, which equates to one squadron of fighter aircraft. In the 368,000 hours (approximate) logged, we had 14 mishaps, giving us a 3.80 Class A rate. The overall fighter/attack rate was equally impressive (2.99) for an all-time low. Hats off to all you Falcon drivers and maintenance and support personnel for your outstanding achievement.

Despite the vast improvement in FY89, we still need to look at the mishaps and reduce the rate even farther. We need to find out where we went wrong, how we compared to other years and other aircraft, and finally, to see if there are any lessons to be learned to prevent further mishaps. Figure 1 shows the F-16 rate against the fighter/attack rate. As you can see, the F-16 rate almost matches the fighter/attack rate, and the C/D is approaching the A/B rate, demonstrating a more mature weapon system.

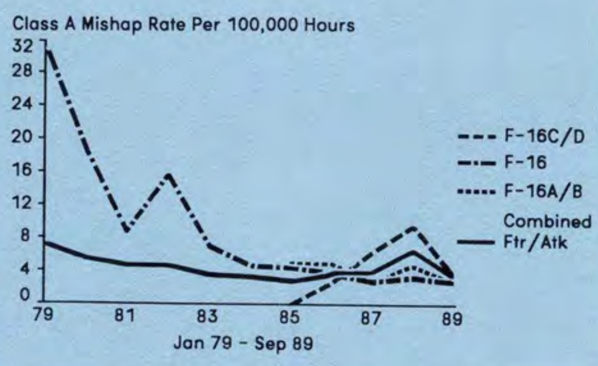
Statistics for weapons systems are usually broken down into ops, log, and environmental. FY89 figures, when compared to the previous year, looked like this:

Figure 2

	FY89	FY88
Ops	9	14
Log	4	8
Environment	1	1
Totals	14	23

From these statistics, it is rather obvious the ops factor remained relatively high (compared to log), and the log factor has reduced significantly. In fact, analysts forecasted nine engine mishaps for FY89, and we had only four. continued

FIG 1. USAF F-16s Score Safest Year Ever



Let's now take a closer look at the FY89 statistics. They look like this, compared to FY88:

Figure 3

Category	FY89	FY88
Engine	4	8
Collision with ground	3	6
Out of control	2	1
Midairs	1	3
Environment/weather	1	1
Takeoff/landing	2	3
Other (ops)	1	1
Totals	14	23

Figure 3 depicts the mishap causes for all FY89 F-16 Class A mishaps. As you can see in this distribution, ops accounts for 64 percent of all F-16 mishaps (Figure 4). Since day one in the F-16, ops has accounted for only 50 percent of the Class A total. We can view this comparison from two different ways. First, we can say the people responsible for reducing the log mishaps are making great strides. Or secondly, we can say ops needs to reduce their percentage of the total number of mishaps. As we compare the various ops factors, we can see we have held our own on CWG, midairs, and others, but we have almost doubled the percentage of out-of-control and takeoff-and-landing mishaps.

Comparing ops versus log mishap history (Figure 5), we saw a 50-percent reduction in the number of log mishaps and a 35-percent reduction in the number of ops mishaps during FY89. Just as we took an in-depth look at the ops mishaps for FY88, we will do likewise for FY89.

There is an old saying in the flying business that goes something like this: THERE ARE NO NEW MISHAPS—JUST NEW FACES MAKING THE SAME OLD MISHAPS. Our review will reveal exactly that.

Collision With the Ground

Running into the ground again proved to be our most common ops mishap for FY89. Usually these mishaps involve a fatality, but, fortunately, this year, one of the three mishap pilots (MP) survived when he made a timely decision to eject.

In one mishap, the MP was returning from a night air-to-air refueling sortie (formation flight of two). Just after separating for individual ILS recoveries, the MP crashed when he failed to level off while being radar vectored.

In another mishap, the MP maneuvered his aircraft from straight and level route formation at 3,000 MSL to a high route position. The MP interpreted his high position as a formation right turn. The element lead then rolled into a left 30-degree bank turn. The MP did not perceive the turn and still believed he was in a right turn. The MP lost sight of lead, rolled left in an attempt to regain sight, and became disoriented. He then transitioned to instruments and recognized an unusual attitude as the altimeter was unwinding through 1,000 feet. Realizing there was insufficient altitude to recover, the MP ejected safely.

Clearly, both of these were classic SDO situations, and we were, indeed, fortunate one pilot lived and was able to talk about his experience. SDO is insidious. All of a sudden—you are there—involved. SDO affects everyone from the junior wingman to the highly experienced command pilot. How do we prevent it? One way that can help I strongly suggest is when the outside weather conditions are not 100 percent VFR, you get your head inside the cockpit from time to time and look at your instruments.

And finally, the last mishap resulted in a fatality. Egressing off the target, the MP flew his aircraft into an area of rapidly rising terrain which was partially obscured by clouds. The aircraft impacted the ground in controlled flight while IMC and was destroyed. The MP

FIG 4. F-16 Cause Factors

FY 89 Class A Mishaps

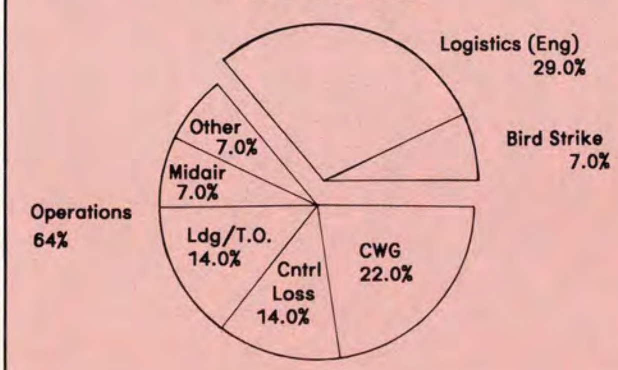
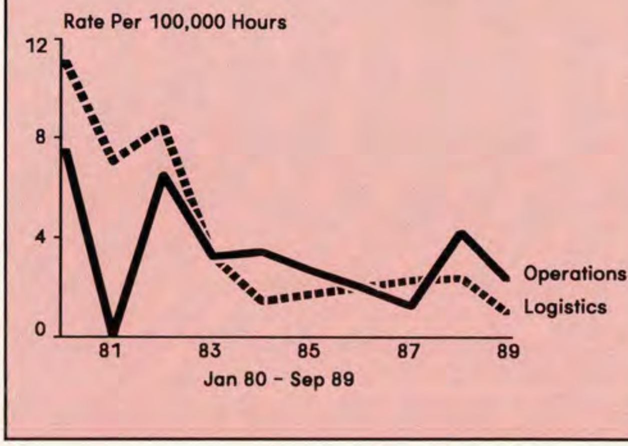


FIG 5. USAF F-16 Mishaps



made no attempt to eject. Possible reasons for this one include degraded situation awareness (SA), confusion caused by an unannounced deviation in the egress direction due to poor weather in the target area, diversion of attention, and a false sense of security caused by following other aircraft.

Any one of us could be involved in a similar situation. How do we stay on top of it? It starts with good route and target area study. If this wingman had known the clouds were hiding a mountain, he would never have flown his aircraft into the clouds. To you flight leads, you owe it to your wingers to call major changes to the briefed mission, especially when weather is a factor. Minimum communication procedures never override radio calls that affect safety of flight.

Takeoff and Landing

In FY89, we experienced two takeoff and landing mishaps. During a formation takeoff (beyond refusal speed), lead aborted as he saw some birds pass under his radome and go into the intake. During the abort, the MP did not attempt to lower the tailhook until too late to catch the normal departure end barrier and inadvertently turned off the antiskid switch. With heavy braking, the wheels locked, tires failed, and wheels ground down. When the mishap aircraft crossed the E5 arresting system (in the overrun), the cable cut a hole in the centerline tank, and the spilled fuel was ignited by hot wheels. The pilot safely egressed, but the aircraft was destroyed by fire.

If everyone interpreted the "hook as required" to mean put the hook down early and every time you abort, and then raise it back up if it isn't needed, we might not be talking about this mishap. This change in habit pattern would not make a big difference on an abort from 50 knots, but what about the abort at, or near, refusal speed? In this case, any delay in deciding whether the hook is required will bring you closer to, or maybe past, the departure end barrier.

The other mishap occurred in the landing phase. During a practice SFO pattern (IP upgrade sortie), the MP allowed the aircraft to slow below minimum airspeed and develop a high sink rate on short final. The crew was slow to recognize the situation, and the aircraft touched down hard in the overrun, sustaining damage to the main landing gear, speed brakes, and hydraulic system. During the go-around, the jet's A system hydraulic pressure dropped to zero. A conference hotel phone call to General Dynamics was initiated. During the discussion, the B system hydraulics began to drop, and the IP turned immediately to final for a straight-in approach end arrest. Just prior to touchdown, the B system hydraulics depleted. The trailing edge flaps retracted, and the flight controls moved to the neutral position. The aircraft sank rapidly and impacted the runway prior to the approach end cable. The aircraft pitched up out of control, and both pilots ejected safely. The key to preventing this one is to know the proper airspeed for your aircraft's weight, and don't fly below your minimum airspeed.

Bird Strike

In FY89, we lost one F-16 to a bird strike. During a tactical egress, the mishap aircraft struck a turkey vulture on the canopy. The MP was

continued

F-16 continued

temporarily blinded and partially incapacitated by the wind blast, making aircraft control impossible. The MP was, indeed, fortunate to eject from this situation. Flying with the birds is a known hazard. Keep a sharp lookout for our fine-feathered friends, and try to avoid known bird hazard areas.

Midairs

We continue to run into other aircraft. In FY89, we had one midair. More often than not, as was the case in this mishap, it is with someone we had just sat down with and briefed. Last year we had one midair. During a BFM engagement, two F-16s collided with each other. One pilot ejected safely, and the other pilot made an unsuccessful attempt to eject. Both aircraft were destroyed. Violations of training rules were committed (1,000-foot bubble), and maneuvering was continued to a point where a collision was unavoidable. Good flight lead supervision and adherence to the training rules could have prevented this one.

Loss of Control

We experienced two loss-of-control mishaps in FY89. One involved an RTU student who lost SA and flew his small tail F-16 into a nose-high, low-airspeed condition during a defensive BFM sortie. He was unable to recover the aircraft and ejected (6,400 feet AGL).

The other one involved a large tail F-16, which has historically been much less likely to depart. During a defensive engagement, the MP entered a nose-high pitch attitude, and the slow speed warning horn came on. The MP attempted to recover by rolling to the nearest horizon; however, the aircraft did not respond to his inputs. After attempting to perform the critical action procedures (CAP), he successfully ejected at 7,000 feet AGL.

On the positive side, both pilots recognized an out-of-control situation, attempted a recovery, and safely ejected. TACR 55-116, F-16 Pilot Operational Procedures, does not specify a minimum airspeed for recovery (except RTU students), but instead, ties recovery to the slow speed warning horn. But we may all have to operate with a minimum airspeed unless we stop putting the airplane out of control.

Ops Other

While performing a practice SFO at the end of the mission, the MP detected an unsafe nose gear indication accompanied by a red light in the gear handle. A go-around was accomplished, and another aircraft joined to visually check the gear. Gear lowering emergency procedures were accomplished, and the MP set up for a straight-in landing. During the straight-in approach, the SOF asked the pilot to extend the IFR door and to go tank inerting. Shortly after this, the pilot transmitted that his engine had quit, and he ejected. The MP performed three additional emergency procedures while he was on final, flying his straight-in. The fuel shutoff valve was found in the closed position. The cockpit switch controlling the valve is right next to the tank inerting switch.

This mishap should never have happened. If you have not completed your emergency procedures before setting up for a straight-in, go around and complete them in an orbit—then complete your recovery. SOFs: Rethink when you should be talking to a pilot with an emergency. If the gas isn't critical and you haven't been able to confirm all checklist procedures are complete, tell him to accomplish another orbit, and make sure his act is together before he starts his final approach.

Logistics Factors

For the last 4 years running, all logistic factor mishaps have been engine problems. In FY89, we lost four aircraft due to engine failures. In two cases, the pilots safely ejected and in the other two (takeoff and landing phase), the pilots were able to get the aircraft on the ground or safely abort. In all four cases, the MPs performed CAPs to the best of their ability and made sound decisions. Keep up the good work, guys.

The engineers have truly worked hard in an attempt to eliminate engine mishaps through the use of TCTOs, improved inspection procedures, and better QA procedures. The people who work on the engine to a great extent have been controlling the risk factor by the quality work they have been doing. The efforts of both the maintainers and engineers have given us the best log rate ever this year.

Almost a Class A

After analyzing all the Class C reports, high accident potential

FY89 was an impressive year for the F-16 Fighting Falcon. It was its best year ever!

(HAP), and hazardous air traffic reports (HATR), it became intuitively obvious we were very fortunate we didn't have more Class A's.

Let's look at the close calls. One was the classic fuel management problem common to the F-16. After forgetting to close the IFR door (after air refueling), the MP did not recognize his trapped fuel condition until there was 900 pounds of internal fuel remaining and full external wings. Once the MP realized his status, he attempted to correct the fuel problem using checklist procedures and correctly decided to divert. The aircraft flamed out, 18nm short of his new destination, due to fuel starvation, and the MP successfully flew a flameout approach pattern.

How often was he performing an ops check? Traditionally, 7 percent of our mishaps each year are caused by fuel mismanagement. This is the one that didn't happen. This reminds me of a quote I would like to share with you. "A superior pilot is one who stays out of trouble by using superior judgment to avoid situations which require the use of superior skill."

The next two involved an element of luck. One involved an engine fire and the other an engine seizure. Both happened on air-to-air sorties. The MPs were high enough and close enough to homeplate that SFOs could be successfully accomplished. Had these been low-altitude missions, both would have had insufficient altitude and would have had to step over the side. In both cases, the pilots did a great job with the situation presented to them and saved an airplane. Great work, guys!

Concerns

I am concerned over some other Class C's, HAPs, and HATRs. These include the following:

- Cases of left yaw accompanied by uncommanded roll to the right (both undetermined).
- Aircraft flamed out while taxiing in after a mission (both undetermined).
- Cases of rotary actuator failure with sections of LE flap coming off in flight.
- Cases of auto accel (one on the ground and one in the air).
- Near misses involving F-16s (some as close as 50 feet).
- Partial power interruptions due to wire chafing problems.

The undetermined ones are very disturbing. Our maintenance personnel, General Dynamics personnel, and AFLC people are working hard on these issues at the moment, and let's hope they can get to the bottom of it. Until then, know your aircraft, know your CAPs, think clearly, and above all else, maintain aircraft control—and you will more than likely get you and your aircraft home. Auto accel situations could hurt somebody on the ground, so be prepared for it. Near misses will always be part of the flying business, but they can be minimized. The real disturbing ones involve F-16 pilots who obviously had their heads buried in the cockpit. That's scary! Remember TIME SHARING. Look outside once in a while, guys.

Summary

In summary, FY89 was a good year. The total number of mishaps was reduced significantly. While we can pat ourselves on the back, we still have a long way to go. We still seem to be making the same old mistakes of running into the ground, departing controlled flight, running into one another, and experiencing takeoff and landing phase mishaps.

We saw a 50-percent reduction in the logistics factor mishaps last year, and the credit goes out to General Dynamics, AFLC, AFSC, General Electric, Pratt and Whitney, and maintenance personnel for their exceptional efforts. Let's see if we can reduce our ops factor by at least 50 percent in FY90. There's the challenge. Can you meet it? ■

F-111

LT COL NATHAN T. TITUS
Directorate of Aerospace Safety

■ The mishap record of the Aardvark in FY89 was better than FY88, with three Class A's versus four. More importantly, we had only one ops mishap versus three in 1988. The numbers are small, but represent a mature fighter weapon system approaching the 2,000,000 flight-hour milestone. As you can see in figure 1, the F-111s' Class A mishap rate is right at the average for the rest of the fighter/attack community.

The ops and log category is about even with 55 total log mishaps and 53 ops. Air Force-wide, ops mishaps have surpassed log mishaps for the last few years. Collision with the ground has accounted for half of all F-111 ops mishaps for the last 12 years (figure 2). When loss of control is added (33 percent), these two causes account for 83 percent of our ops losses. Clearly, we, as crewmembers, can still do much to reduce these losses. F-4s have almost the same total loss rate for these two areas.

Turning to logistics, it won't

FIG 1. F-111 Holding Their Own

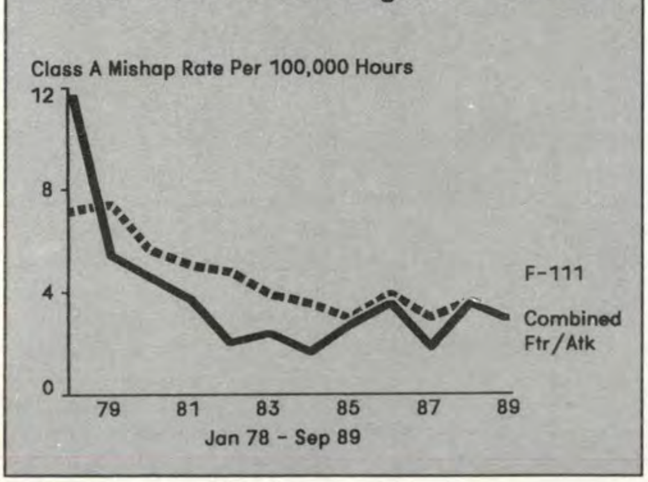
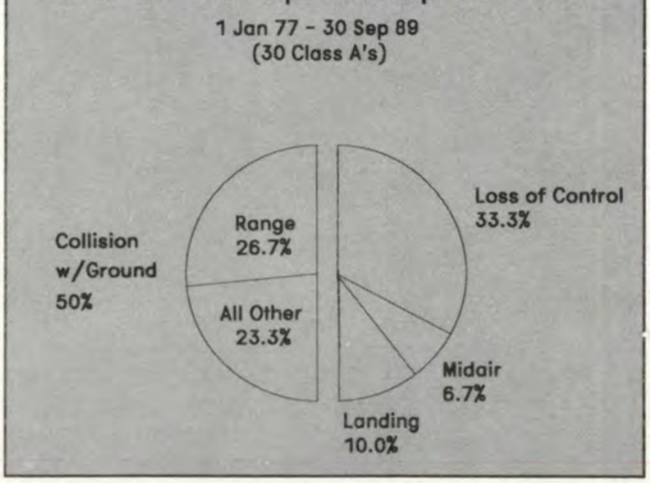


FIG 2. F-111 Ops Mishap Causes



surprise many F-111 drivers or maintainers that engines and flight controls cause more than three-quarters of our log mishaps (figure 3). The upcoming digital flight control mod may someday help us in the one area, but engines are likely to continue as our number one log cause (as they are the cause in all fighter aircraft).


The F-111 is a mature weapon system approaching its 2,000,000 flight-hour milestone.

FY89 Mishaps

The first mishap in FY89 occurred during takeoff. Lead had raised his gear and flaps to 15 degrees when he heard a loud bang. The right engine RPM and EPR began dropping, followed immediately by the illumination of the right fire light. The aircraft then started an uncommanded left roll. The fire light was confirmed over the radio by the SOF, tower, and the wingman. The crew completed the BOLD FACE and shut down the right engine, but the fire light remained on. As the wingman joined to a chase position, the mishap aircraft pitched up, and the crew ejected in a 60-degree nose-high position. The crew was not injured, and the aircraft impacted 5.5 miles off the end of the runway.

Investigation revealed an 8- by 2-inch section of the third stage turbine disk had broken free and penetrated the aft fuel tank. The catastrophic fire and control difficulties left the crew no alternative but to eject. Their airmanship and timely decision making resulted in a successful ejection. Doesn't this all sound like an emergency procedures sim check you've had sometime in your career?

Our second mishap was a loss of control when a pylon-mounted fuel tank turned sideways in flight. This was a unique mishap, but one which we should have predicted from past incidents of pylons turning due to improper installation. We were lucky in the past we didn't have a store loaded with as much drag as a fuel tank!

Here are a few things to think about if you had to handle the above emergency.

- Would you send your wingman or lead on his way, or keep him for mutual support, i.e., to watch what that cocked tank was doing?
- Would you use pitch and roll autopilot with an aircraft that had an uncommanded roll?
- Would you consider jettisoning the tank if the aircraft went out of control? (This is against Dash 1 guidance.)
- Would you consider sweeping the wings aft (against Dash 1 guidance) in an effort to regain your control?

CAUTION, before you say "yes" to the last two, the jury is still out on what exactly happens when a tank turns sideways. Simulation was unable to accurately duplicate the flight control inputs the pilot described. A proposed wind tunnel study would be very useful but probably won't happen due to the high cost. In the meantime, steps are being taken to change the maintenance TOs to ensure we never have this one happen again. Remember: Check your external stores thoroughly using your checklist!

The last mishap for FY89 is the most tragic because we lost the crew. It occurred during a four-ship exercise sortie with the mishap aircraft flying as number four. A telemetry pod was a great aid to investigating this mishap as all flight parameters were recorded.

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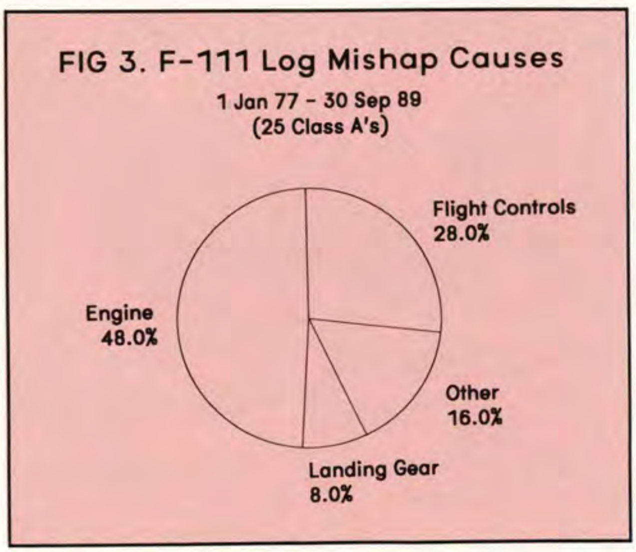


F-111 continued

The mission went as planned until just after weapons delivery.

During the turn off target, the mishap pilot made a turn hard enough to bleed off almost 200 knots of energy. While in the turn, the stall warning angle of attack (AOA) was exceeded for an extended period of time. Now well behind the flight, they accelerated in afterburner to a high subsonic speed to catch the flight. Entering the electronic combat range, the mishap pilot began a series of defensive reactions against simulated threat sites. These reactions continued unabated while the airspeed began to decay, and the stall AOA was again exceeded on several occasions. Crossing the final ridgeline, the pilot attempted a low-airspeed, right-rolling pullout. The aircraft departed controlled flight, and just prior to impact, an ejection was attempted out of the envelope. The capsule functioned normally, but the main recovery chute did not have the time to fully deploy.

What can we learn from this one? First of all, the Stall Inhibitor System (SIS) won't save you from flying the aircraft out of control. It has limitations, and you can exceed them. Remember, 33 percent of all our ops mishaps for the last 12 years are due to loss of control. We've had SIS for a good many of those years. Using the stall warning horn to fly the aircraft and not checking AOA and airspeed will get you into trouble. Command augmentation will mask the "feel" of where you are in the flight envelope. Lastly, right seaters need to diligently monitor what the left seater is doing. Wing sweep and airspeed are critically important in the F-111. This mishap may seem almost unbelievable to some (it did to me at first), but we are all susceptible to distraction and inattention. The mishap pilot had 440 hours in the jet and the WSO had 950—not "old heads" but getting there.

Safety Concerns

In last year's version of this article, I was pleased to report funding for the new capsule recovery parachute had been reinstated, and the testing was back on track. That was good news. The bad news now is the tests have not gone well, and the entire program is in serious jeopardy. After all the years of waiting, we may have to abandon the concept of the triple canopy system. The ray of hope in all this is from a recent proposal to manufacture a larger single canopy that will decrease the descent rate and still pack in the existing space. In the meantime, we will continue to live with the potential of serious back injury during landing. We've been lucky lately and not hurt anyone in our last few ejections. The fix for this problem is still a long way off.

My second concern is with the force restructuring that's coming for the F-111. I can only discuss what's been published in the newspapers, but at some point, TAC will acquire some or all of the FB-111s, and logic says there will undoubtedly be some aircraft moved around. My concern is that anytime people and airplanes are relocated, there is an increase in the mishap potential. It is incumbent on all of us in the F-111 community to keep mission risk awareness high in our daily business to prevent an increase in mishaps. We have worked too hard to bring our rate down to equal the rest of the fighter force.

Human factors have become the largest single area where more can be done to lower the mishap rate. Logistically, the F-111 has not had a sterling history, but ops mishaps will probably continue to be our largest mishap category. The pressure is on us as operators to help lower the ops mishap rate by doing a better job of controlling the risks associated with flying our mission. If you consider the cost of new fighter aircraft and the fiscally constrained times we operate in, we can't afford to do business any other way. ■

The F-111 is a tactical strike aircraft that can fly at supersonic speeds and operate from tree-top level to altitudes above 60,000 feet.

Once Again Thanks for Your Support

. . . AND THE WINNERS FOR THE OCTOBER 1989 DUMB CAPTION CONTEST ARE . . . (IN ALPHABETICAL ORDER)

Lt Col
Bill Bounds
The Pentagon, Wash D.C.

AND

SSgt
Henry R. Harlow
Rickenbacker ANGB, OH

We once again learned many of you were able to beat us at writing "dumb captions." Our panel of experts had fun selecting the top captions. After much deliberation, they chose the winners (winners—yes, we had two captions that were so close we must award *two* cheap little prizes)—our congratulations to Lt Col Bill Bounds and SSgt Henry Harlow. Your cheap little prizes are in the mail!

Now take a look at the honorable mentions to see how tough the competition is getting. If you really want to be stumped, look at our latest contest on the back cover and see if you can beat it.

Honorable Mentions

1. **Won't maintenance be happy we put part numbers on the noses for them?** SSgt Henry R. Harlow, USAFR, 907 CAMS/ MAAA, Rickenbacker ANGB, Ohio

2. **I still think we should have waited for the crew chiefs to park us.** SSgt Henry R. Harlow, USAFR, 907 CAMS/MAAA, Rickenbacker ANGB, Ohio

3. **Don't show fear! We'll get out of this yet.** MSgt Bill Beard, 155 TRG/SEG, Nebraska ANG, Lincoln, Nebraska

4. **This is the third time we've been out here, *Sir*. I really don't think going over the briefing again will help. Let's just back them out.** Detachment 11, Twenty-Fourth Weather Squadron (MAC), Randolph AFB, Texas

5. **I also have trouble finding my car in the parking lot.** TSgt Charlie Brown, 27 LGS/LGSR, Cannon AFB, New Mexico

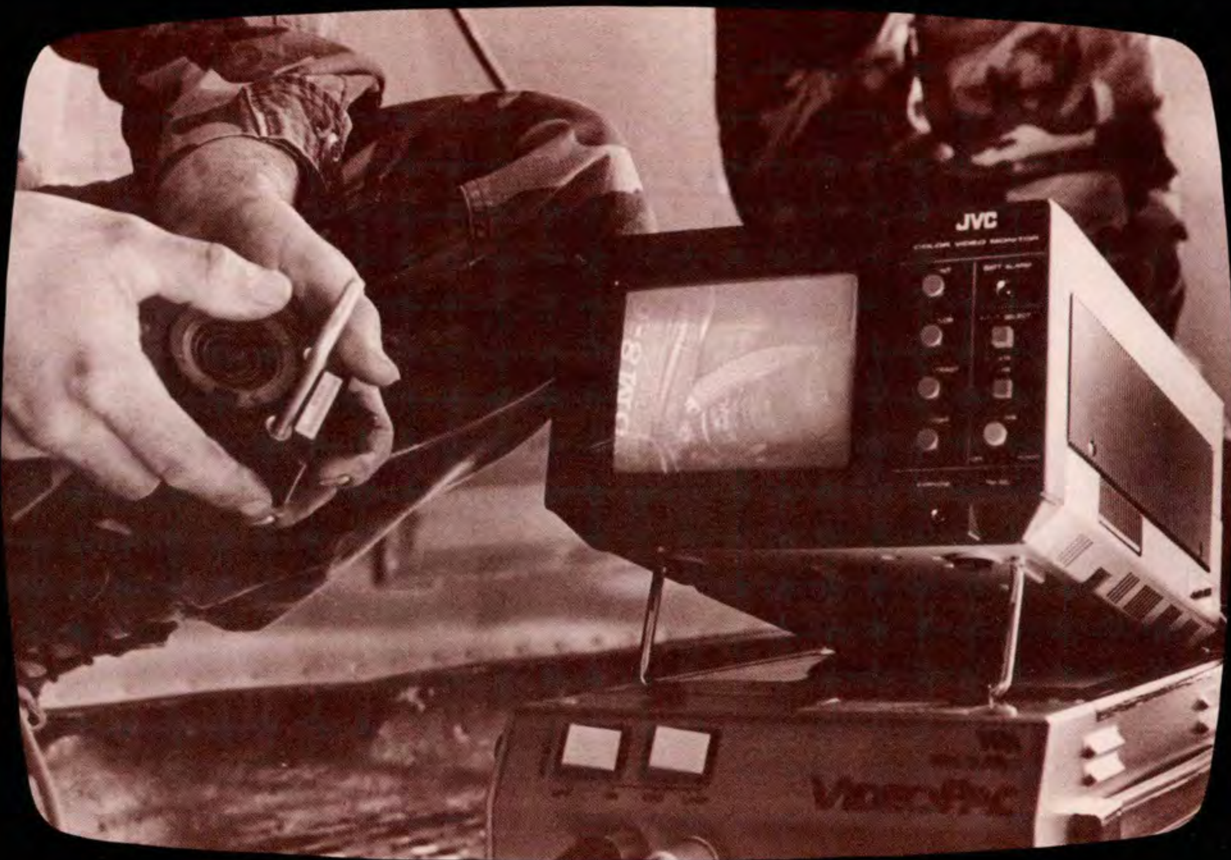
6. **No! You're out of step!** SSgt Henry R. Harlow, USAFR, 907 CAMS/MAAA, Rickenbacker ANGB, Ohio

7. **Are you sure this is what HQ meant about angle parking the alert aircraft?** CMSgt Joe King, HQ ATC/IGFF, Randolph AFB, Texas

8. **The other guys think we oughta test drive 'em all.** SrA Rowdy J. Lienhart, 27 CRS/MACBL, Cannon AFB, New Mexico

9. **This looks serious. PN-343 said they're not releasing any of us until all of their demands are met.** Lt Col Kent Lee, HQ MAC/IGFF, Scott AFB, Illinois

10. **Just keep walking and look straight ahead . . . maybe they won't attack us!** Matt Sprague, ALD/LTQI-AFOLTA, Wright-Patterson AFB, Ohio



VIDEO IMAGERY: A NEW EYE

Going several steps beyond fiber optics, our new video technology is offering maintenance specialists the methods for looking around in previously impossibly remote aircraft and engine recesses — even making a tape of the entire inspection tour.

CMSGT ROBERT T. HOLRITZ
Technical Editor

■ Video imagery is an innovative technology which has added a new dimension to the borescope as a tool in aircraft maintenance. The borescope has been used by engine specialists to inspect the inner workings of jet engines for years. The first generation of borescope consisted of a light source and a simple rigid probe which provided the technician with a rather limited, straight-ahead view of the various sections of the engine.

By 1955, the production of glass fiber bundles led to the concept of fiber optic technology and, consequently, to the development of the flexible borescope. The quality of the image was not as good as the rigid borescope's; however, the flexible borescope (fiberscope) was superior to the rigid borescope because it allowed deeper penetration of the engine and also provided a limited degree of dexterity. Although the flexible borescope permitted much better inspection capability, its monocular eye piece provided limited visibility, and this usually caused the user considerable eyestrain.

To combat eyestrain, in the late '70s, several companies coupled the fiber optic cables to a video camera and a TV monitor. This not only eliminated the eyestrain, but it also allowed more than one technician to view the inspection area. Unfortunately, the resolution of the video left much to be desired. The picture was grainy and looked as if it were being viewed through a window screen. In addition, the glass fibers were delicate, and after continued use, they would break and create voids in the picture, diminishing its quality further.

Unlike the fiberscope, video imagery does not use fiber bundles to transmit the image to the video camera. Instead, it employs a technology developed in the early '70s called the charged-coupled device (CCD). A CCD is essentially a solid state chip that converts light into electrical signals much the same as the tube in a conventional TV camera. CCDs are now used by almost all manufacturers of commercial portable video cameras.

When used in a borescope, the CCD chip is located at the end of the probe and actually functions as a small video camera. As I mentioned before, this chip converts light images to electrical signals. These are then transmitted through the probe via a conductor (shielded wire vs fibers in the fiberscope) to a video processor and then to a conventional TV monitor. The result is an amazingly high resolution picture, in living color!

In spite of this capability, the video chip is small enough to fit into the end of a probe less than 1/4 inch in diameter. This is smaller than some of the fiber probes. As with the video capable fiberscopes, videoscopes—as they are called—also have the capability to record the image on videotape, providing a permanent record of the inspection. These tapes can be stored for future comparison or even be sent to depot for evaluation.

An important feature incorporated in most of these video systems is articulation, the ability to move the tip of the probe as one would point a finger to pan around the area. The articulation is controlled by the operator with a joystick, similar to the kind used with

continued

The tip of a videoscope probe is actually a small color TV camera. It is small enough to fit into an opening only 1/4 inch in diameter.

Unlike fiber optic borescopes, the videoscope can be manipulated by the observer using a remote joystick similar to those used with home video games.

Video Imagery: A New Eye continued

home video games. Typically, the end of the probe can be turned as much as 90 degrees in any particular direction.

Video imagery provides engine specialists with extremely detailed inspection capabilities. With the high resolution picture and the 90-degree field of view provided by a videoscope, an engine specialist can easily detect even the slightest flaw, crack, or nick in a compressor blade which could easily be missed using a conventional borescope.

Borescopes have come a long way since the days of the hand-held single eye piece type.

FO Finder

But improved engine inspection is not the only advantage of the videoscope. I took a trip to George AFB, California, to see some of the innovative uses the maintenance folks of the 35 TFW have found for their new videoscope. Any crew chief knows that suspected cockpit FO can lead to a time-consuming search. Quite often the search for a warning light lens or an indicator light bulb required extensive depaneling and even the removal of an ejection seat.

With the videoscope, this situation is practically a thing of the past. Their videoscope, which weighs less than 30 pounds (including carrying case), can be dispatched to the flight line and set up in less than 5 minutes. In fact, it is easier to set up and operate than a home VCR. The probe can quickly search under the seats and look inside normally inaccessible areas. Its probe is small enough to enter any area with an opening of 1/4 inch or larger. With a little practice, a technician can use the joystick to snake the probe around corners and between components, tubing, and wire bundles, for a distance of 10 feet or more. The unit can operate on its 12-volt battery for about an hour, but according to the folks at the 35th, the FO is usually found within minutes.

An Eye for Maintenance

Video imagery may be the most significant innovation in aircraft maintenance in a decade. According to a phase dock specialist, "We find new uses for our videoscope all the time." It has been used to inspect just about everything from chafing to corrosion. It can even be used to inspect fuel cells and find elusive fluid leaks. And it does all of this without time-consuming depaneling or disassembly!

During one demonstration, I watched as a specialist probed inside an F-4 throttle quadrant. The monitor provided an amazingly clear picture of the area. As the probe made its way deep into the inside of the jet, it was possible to read part numbers of components, count the threads of a bolt protruding through a nut, and even read numbers on a wire bundle.

Costs

While video imagery is the answer to many maintenance problems, it has one drawback—it is expensive! The price of videoscope systems range between \$14,000 and \$40,000, depending on the options and accessories that are purchased. While the price is high, these systems are cost effective because they provide better inspection capability. They are also less manpower intensive and generally more durable than conventional borescopes. According to CMSgt Jim Thomson, Chief, Propulsion Branch, 35 TFW, "The videoscope provides us with a virtually flawless inspection of an engine in about a third of the time required by conventional borescopes. Ours will pay for itself within 2 years."

The Future

Research in the field of video imagery indicates future developments will be equally as impressive as those of the past few years. For example, in the not-too-distant future, we will be able to transmit inspection images to the depot or factory via satellite, and computer interfacing is already in the mill.

With the advent of video imagery, the borescope has evolved from a crude device for inspecting the bores of military rifles and guns into the videoscope, an extremely versatile tool for use throughout the entire spectrum of aircraft maintenance. As units discover more uses for videoscopes, we can certainly expect more of these units in the field. ■

MAIL CALL

EDITOR
FLYING SAFETY MAGAZINE
AFISC/SEPP
NORTON AFB, CA 92409-7001

Dear Colonel Koshko

■ In your Flying Safety magazine of September 1989, I noted an error in your caption on page 3, bottom photo. Yes, I agree with you—the F-15 is one of the finest fighter aircraft in the world. But our Wolfhounds squadron is not located in West Germany. The 32d Tactical Fighter Squadron (USAFE) is assigned on the Royal Netherlands Air Force Base Soesterberg in the Netherlands. Small difference, you may say, but a big difference to the Dutch. I will include for you a fact sheet on our history. Sorry, sir, but I cannot help but use an Ann Landers line: "Ten lashes with a wet noodle." If you ever intend to visit the Netherlands, and to see our Soesterberg-based squadron, I will be happy to show you around.

With kind regards

MIEKE G. E. J. BOON
Community Relations Adviser
Public Affairs Office

Thank you for taking the time to write and point out our error. My apology to the Royal Netherlands Air Force and the 32d Tactical Fighter Squadron. If I am ever fortunate enough to visit the Netherlands, I will definitely take you up on your offer. Ed.

Editor, *Flying Safety*

Reference your article, "Reintroducing the FODfather," on page 25 of your September 1989 issue.

I realize the subject is FOD and the control thereof; however, safety is the name of the game. It would appear the maintenance troop might need a restraint harness to prevent a fall. I really can't tell the actual height he may be, but it does look as though the aircraft is in a hangar where a system may be available. Perhaps you can enlighten me? Back in the old days of my wrench-bending, I seem to remember it was a no-no to set a tool box of the size illustrated on an aircraft surface.

Have I sniffed too much MEK, or do I have a case?

CMSgt Burl L. Cox, Jr.
Oklahoma Air National Guard
5624 Air Guard Drive
Oklahoma City, Oklahoma

Your letter brings up several important points. According to AFOSH Std 127-66, General Industrial Operations, personnel working on aircraft at heights above 10 feet are required to wear safety restraints. However, the specialist in our photo is working at a height of 7 feet. You are also correct that tool boxes should not be set on the surface of an aircraft. This can not only damage the aircraft's surface, but in most units, it can bring the wrath of the aircraft crew chief upon you. Although it cannot be seen in this photo, the tool box is resting on a vari-ramp cover especially designed for use during major phase inspection.

Thanks for taking the time to read ***Flying Safety****. I'm sure you will be interested in our article on the effects of MEK in a future issue.*

Ed:

Re your "What's Wrong in This Photo?" on page 13 of your September 1989 issue. I don't know much about wash rack operation. No need to. But I do know an unlocked wheel on a maintenance stand when I see one.

Bernie Bryant, Civilian
443 AMS/MAAT
Altus AFB, Oklahoma 73523-5000

Right on—your eyes are sharp! Thanks for supporting safety. Ed. ■

Flying Safety Honored

■ The National Association of Government Communicators honored *Flying Safety* magazine with first place in their prestigious Blue Pencil Competition. The award was in the category of technical periodicals printed with two or more colors and was judged by a distinguished panel of 23 respected professional communicators selected from nationally renowned newspapers, magazines, educators, and publishers. The award was presented at ceremonies held at the Rosslyn Westpark Hotel in Arlington, Virginia, on 7 December 1989.

The staff of *Flying Safety* is especially proud of this award and will rededicate themselves to continue to produce the best possible magazine.

We wish to extend a special thanks to all of you who have contributed your ideas, articles, and photographs. ■

The *Flying Safety* Magazine Staff: CMSgt Robert T. Holritz, Peggy E. Hodge, Dorothy Schul, Bob King, Dave Rider, David C. Baer II, Lt Col Kent Koshko.

MAINTENANCE MATTERS

F-4 Pitot Problems

■ The Phantom was climbing through 20,000 feet on a familiarization flight when the indicated airspeed dropped from 350 to 250 KCAS and the altimeter stuck at 20,000 feet. The pilot correctly diagnosed the problem as a malfunction of the pitot/static system and began a descent using known pitch and power settings. The F-4 was joined by a chase aircraft for an uneventful formation landing.

On final, the pilot noticed the pitot system returned to normal. A postflight check of the pitot/static system by specialists found a large amount of water in the lines. The F-4 is prone to moisture accumulation in the pitot/static system. While the TO requires only the system to be drained during inclement weather, it is a good idea to check for moisture each preflight, since maintenance people are not always aware of the weather conditions in which the aircraft has flown. This incident occurred in a desert climate but, unknown to the crew chief, the jet had encountered severe rain showers on the flight prior to the mishap sortie.

OC-2's Revenge

"It all starts with AGE." This slogan is well known by both flight line maintenance and AGE people. Yet, in spite of the reverence this motto seems to impart, the abuse of AGE on the flight line remains high. It is an unfortunate fact, but the misuse of AGE is often at the cost of mission effectiveness.

Of the different kinds of AGE, the oil servicing cart is probably the most abused. Perhaps because of its small size, it is often run over, backed into, and generally beat up and left, forgotten, in some dark corner of the maintenance complex. It is not surprising that OC-2 (OC stands for oil cart) was found by a traveling maintenance expediter parked in a sandy field next to an engine runup pad. OC-2's new paint job and its newly acquired 6-inch dent were hidden beneath an oily, sandy film. Because there was a shortage of serviceable oil carts, the expediter placed OC-2 in his step van and brought it back to the flight line to help support the morning launch.

The first go went off without any problems. All of the aircraft were launched without a hitch. But the maintenance superintendent became concerned when two of the oil samples from the morning fliers came back with extremely high silicon readings. The decision was made to ground these jets pending further investigation. At the advice of the engine shop, the oil was drained and replaced. After engine runs and analysis of the oil showed no abnormal presence of silicon, both aircraft were returned to mission- capable status.

Up to this point, the silicon contamination of these aircraft was considered a pure coincidence. But when two more aircraft engines had abnormal concentrations of silicon in their oil, it became apparent—especially to the now very upset DCM—that something was wrong. Somehow, somewhere, something was contaminating engines. The propulsion branch NCOIC suggested all oil carts be checked for contamination. At the same time, a conscientious AGE mechanic saw OC-2 and brought it in to the shop to be washed. Luckily, she brought the obviously abused condition to her supervisor's attention. He had been notified of the contamination problem by maintenance control. When OC-2's oil was sent to the lab, it was found contaminated by silicon.

Where did the silicon come from?

Well, it seems that sand shows up as silicon during spectrometric oil analysis. An informal team of investigators believe OC-2 was backed into and knocked over into a sandy place next to the trim pad, causing the 6-inch crease in the tank and coating the oily surface with sand. Sometime during the night shift, it was serviced with oil, and somehow some of the sand that covered its exterior contaminated OC-2's oil supply.

The lesson to be learned here is that the abuse of AGE eventually costs sortie production, and, as in this case, could have caused the loss of an aircraft. The abuse of this single oil cart cost this unit 15 sorties and lowered its combat capability. Clearly, OC-2 had its revenge. ■

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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.

MAJOR

William P. Robinson

150th Tactical Fighter Group
Kirtland AFB, New Mexico

■ During recovery after a defense systems evaluation mission, Major Robinson confronted severe compressor stalls in his A-7. At the same time, his wingman reported sparks out of the exhaust. The stalls were accompanied by a rapid rise in turbine outlet temperature (TOT), and since he was at 490 KIAS and about 2,000-feet AGL, the pilot immediately started a climb and reduced power to idle. He leveled at approximately 13,000-feet MSL at 200 KIAS and attempted to advance the throttle.

At about 70-percent RPM, the stalls recurred, and the TOT went above 800 degrees with the RPM decaying as the throttle was advanced. The pilot again reduced to idle in an effort to control the TOT. This time, he was descending so as to maintain 230 KIAS, and he had deployed the ram air turbine. With the throttle in idle, TOT stayed about 400 degrees, but stalls and TOT rise would occur as the throttle was advanced to about 70 percent. The pilot went to idle again and selected manual fuel, but at about 70 percent, the stalls recurred, the TOT rose, and the RPM started to decay. As he approached 3,500-feet AGL and with the airspeed now at 170 KIAS, the pilot began to prepare for ejection.

As a last-ditch effort, he briefly shut down the engine. After an estimated 2 to 5 seconds, he brought the throttle back around the horn to idle while simultaneously holding the air ignite button. Idle indications were the same as before, but this time, the pilot was able to advance the power without getting stalls. Power was advanced to 80 percent and the aircraft accelerated to 200 KIAS in level flight. The throttle was not touched again until short final out of a precautionary landing pattern.

Inspection revealed bird remains in the engine although neither Major Robinson nor his wingman had seen any birds.

Major Robinson showed extraordinary poise under the most stressful of circumstances in his last-ditch effort of shutting the engine down and getting a restart. WELL DONE! ■

Write A Dumb Caption Contest Thing

Okay, so you guys are good! Time after time, you've come up with great, real live "dumb" captions. So, here's another one. See if you can beat our resident humor caption geniuses here at AFISC and win the legendary cheap little prize to hold and cherish forever.

Write your captions on a slip of paper and tape it on a photocopy of this page. DO NOT SEND US THE MAGAZINE PAGE. Use "balloon" captions for each person in the photo or use a caption under the entire page. Entries will be judged in May by a panel of experts on humor. All decisions are open to bribes.

Send your entries to: **"Dumb Caption Contest Thing" • Flying Safety Magazine • HQ AFISC/SEPP • Norton AFB CA 92409-7001**