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SAFETY

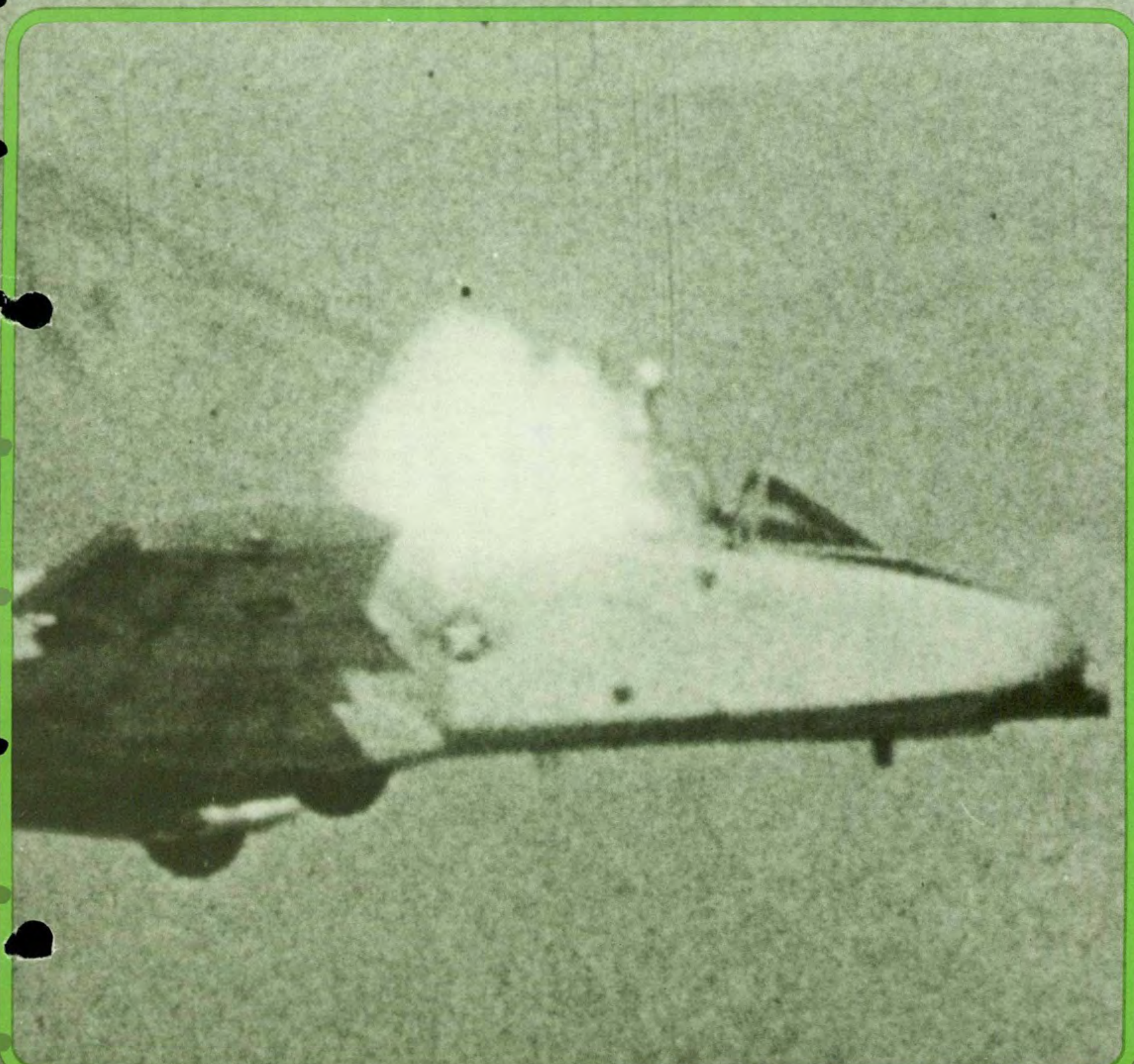
MAY 1983

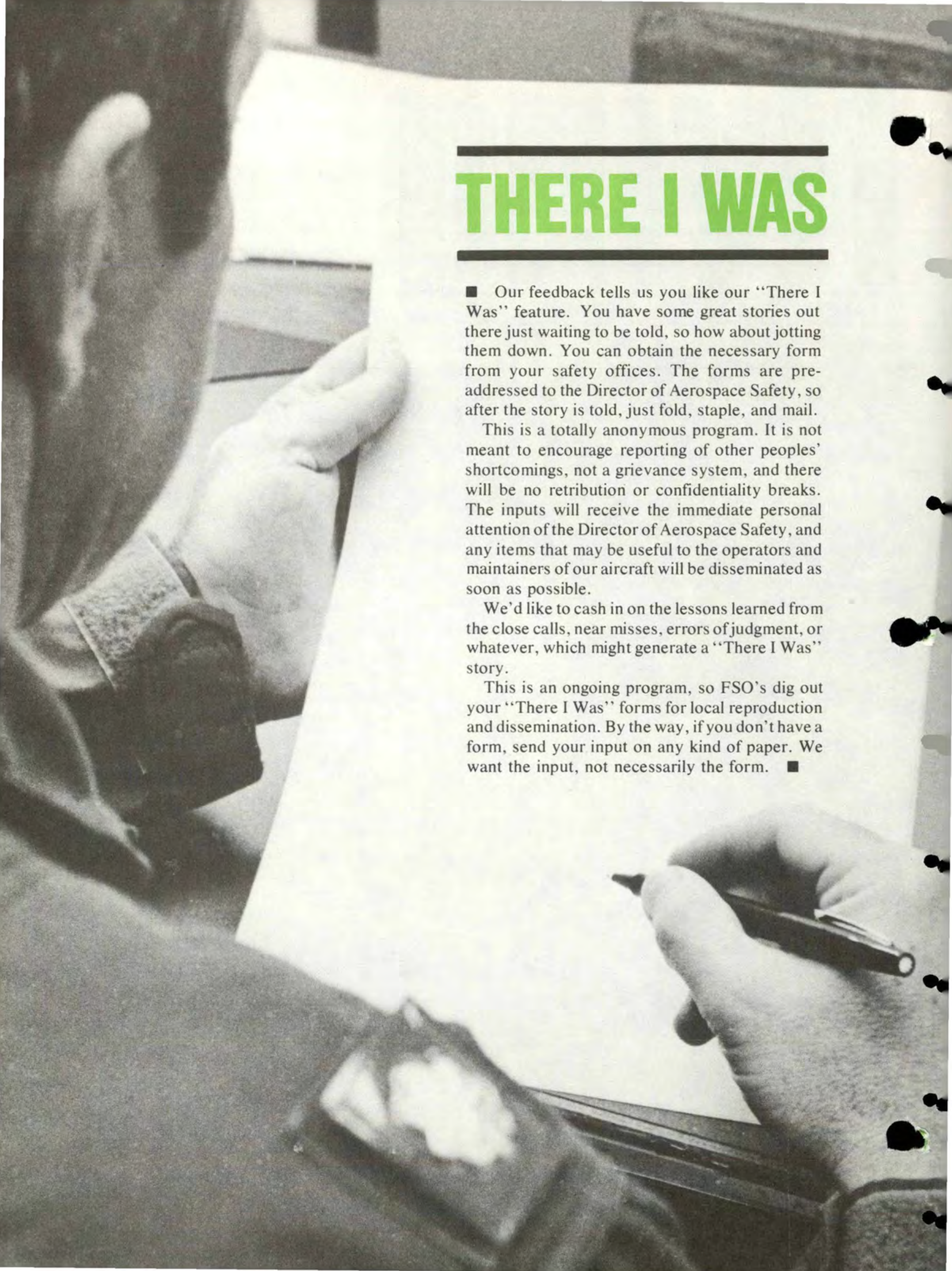
You're On Fire, EJECT!

Ejection Update

PAPI, PLASI . . . A new generation of Aviation Lighting Systems

LIGHTNING . . . Out of the blue?





THERE I WAS

■ Our feedback tells us you like our "There I Was" feature. You have some great stories out there just waiting to be told, so how about jotting them down. You can obtain the necessary form from your safety offices. The forms are pre-addressed to the Director of Aerospace Safety, so after the story is told, just fold, staple, and mail.

This is a totally anonymous program. It is not meant to encourage reporting of other peoples' shortcomings, not a grievance system, and there will be no retribution or confidentiality breaks. The inputs will receive the immediate personal attention of the Director of Aerospace Safety, and any items that may be useful to the operators and maintainers of our aircraft will be disseminated as soon as possible.

We'd like to cash in on the lessons learned from the close calls, near misses, errors of judgment, or whatever, which might generate a "There I Was" story.

This is an ongoing program, so FSO's dig out your "There I Was" forms for local reproduction and dissemination. By the way, if you don't have a form, send your input on any kind of paper. We want the input, not necessarily the form. ■

UNITED STATES AIR FORCE

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SPECIAL FEATURES

REGULAR FEATURES

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You're on fire, EJECT!

"My next recollections w… extremely sore right arm…

LTJG K.J. HETTERMANN
VA-146

■ I recently had the opportunity to save my own life (thanks to my survival training). As Dash 2 in a three-plane formation of Corsairs, I was about 50 miles from the ship when my trusty old TF-41 announced its impending failure with severe vibrations. A quick glance in the cockpit showed the ENGINE HOT light on and turbine outlet temperature out of limits. I deployed the Emergency Power Package (ram air turbine), turned back to the ship and pulled the throttle to idle. Idle didn't help, so I shut down the engine (my one and only)!

After about a minute of windmilling, I attempted an airstart in manual fuel control. Encouraged by positive indications, I transmitted to my wingman that I had a good airstart. He told me to set 80 percent rpm, and as I advanced the throttle, the shaking and rumbling returned. The temperature once again climbed out of limits. With the throttle at MRT, the engine rpm was at 75 percent and unwinding. It was at this point that I first considered ejecting.

As I passed 5,000 feet, I made the decision to attempt one last relight and if that didn't work — eject. Going through the airstart procedures, I was interrupted by my wingman's transmission of "You're on fire, eject!" Pure reaction took over, and I initiated an immediate (vice a controlled) ejection. I grasped the lower handle with my right hand, sat back in the seat a bit, and yanked on the handle for all I was worth.

My next recollections were of an

: of an aircraft very close to me, an nd a mouthful of blood and chipped teeth."

aircraft very close to me, an extremely sore right arm, and a mouthful of blood and chipped teeth. My wingman later told me I had a full chute right behind my A-7's tail section. Now, information from numerous survival lectures started paying off as my thoughts turned to IRSOK (inflate, release, snap, oxygen, Koch). I *inflated* my LPU but had to pull both beaded handles with my left hand since my right arm was incapacitated. Next I fumbled between my legs for two minutes in an attempt to *release* my raft (I was evidently reverting to my first survival training in T-28s). A combination of wearing my lapbelt a bit loose and the opening shock had suspended the seat pan lower than I expected. I was unable to release the seat pan handle because of my sore right shoulder. The inflated LPU precluded using my left hand to reach across and open it. I decided to move on and complete the rest of the IRSOK steps.

I *snapped* my LPU lobes together and, upon getting to the "O" in IRSOK, I realized that my mask and helmet had been ripped off during the ejection. I now saw my wingman flying in front of me, and this keyed me to try my survival radio and tell him I was all right, but as I looked down, I saw that it was gone (I believe I failed to button the snap down and attach the lanyard).

Deciding not to worry about my Koch fittings until I descended, I turned my attention to my seat pan again. Failing to open it, I felt I had to get rid of its excess weight before hitting the water. I released my lower Koch fittings, causing the pan to drop about five feet and to the left. It was hung up in the left hand riser. I pulled it up and attempted to open it again, with no success. Then I tried to pull the strap away from the left riser — also no go. Approaching water entry, I used my left hand to position my right hand in the upper right Koch fitting. As my feet hit the water, I released both fittings. Surfacing, I saw the parachute about 10 feet away. My wingman was flying nearby, so I assumed he had me in sight. Pulling out my day/night smoke, I awaited the arrival of the helo. While my wingman circled above during the waiting period, I waved at him to let him know I was all right but kept my movements to a minimum with thoughts of "Jaws" in the back of my mind.

Hearing the helo coming, I tried to crack open the day side of the flare with negative results. I opened the night side and pulled the cap away to ignite it — nothing happened. By this time, the helo was passing me by, so I started kicking, splashing and waving. They turned back toward me and executed a water pickup. Upon my return to the ship, I was admitted to the medical ward where I used the time to review the events of the day.

Lessons brought home to me during this incident were:

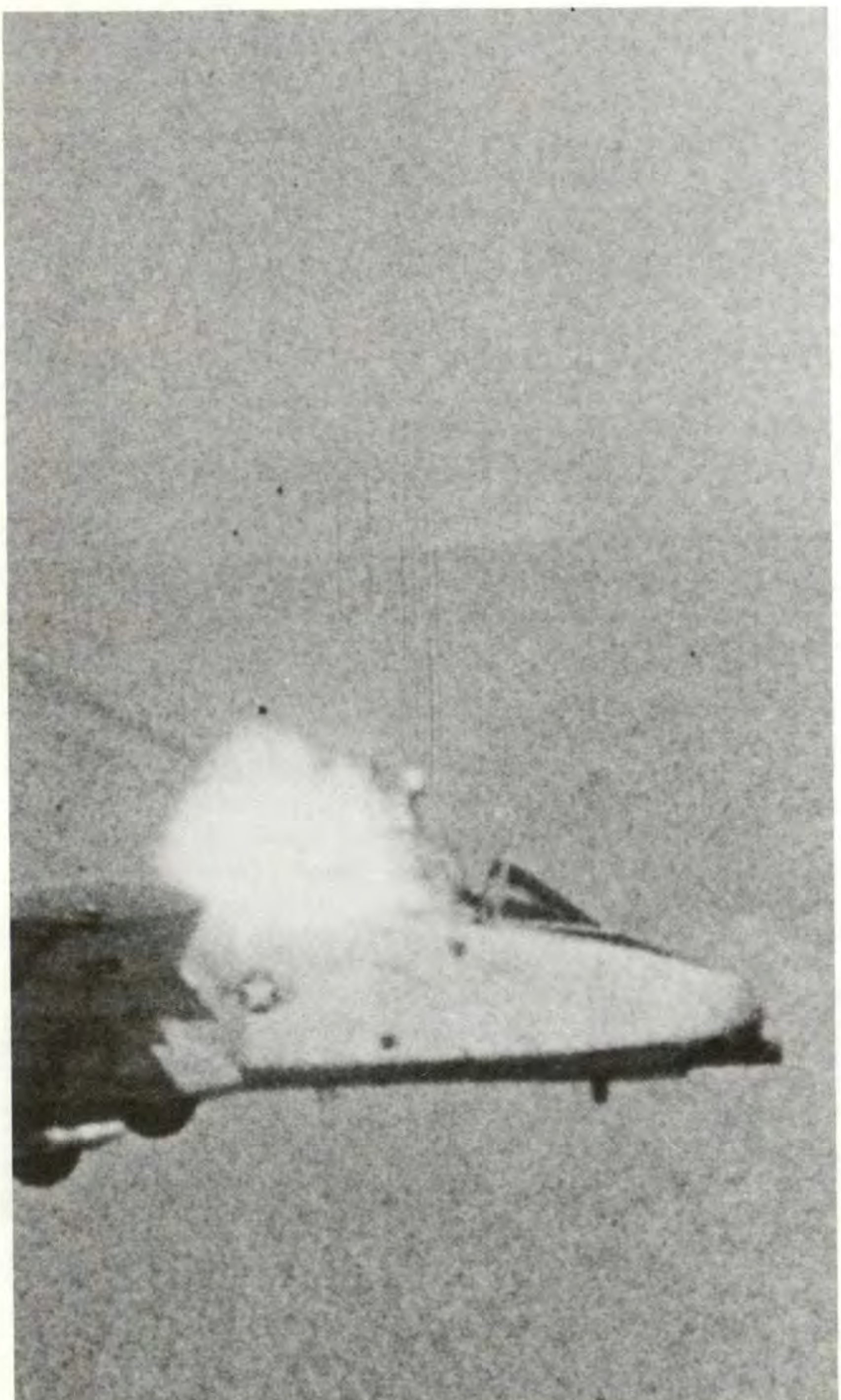
- I hadn't planned on an incapacitated arm in my survival training.
- Never assume someone has sight of you in the open ocean — in my case, he didn't.
- Although distracted by the thought of fire, I still had time but failed to grasp my right hand with the left (which would have reduced my flail injury).
- I wasn't as familiar with my survival gear as I should have been.
- My decision to release the raft turned out to be smart considering the entanglement. However, in the event of a prolonged stay in the water, it could have been a disastrous decision.

I was busy during this ejection. First of all, my wingman did an outstanding job as on-scene commander. (How many crewmen know their SAR procedures?) He gave the helo a good vector from the crash site to where the parachute had splashed. I was also lucky that the incident happened during the day, because with my lack of signaling devices, it would have been difficult to locate me at night.

I also learned the importance of checking for parachute entanglement, since it would have further complicated water entry. My squadron took action on these problems by having all pilots participate in a "parachute hang" while being confronted with various incapacitations. I was dazed throughout the evolution until water entry, and the endless training and survival lectures proved their worth. Finally, I believe in being physically fit, and it paid off. I sustained no major injuries, and although I was really stiff and sore for several days, I was back in the cockpit the third day after the mishap, grateful for a safe past and determined to have an even safer future. — Adapted from *Approach*, February 1983. ■

EJECTION UPDATE

CECILIA PREBLE
Assistant Editor



■ The mishap aircraft was number 2 in a three-ship flight of F-5s scheduled for a dissimilar air combat tactics mission against two F-15s. The fourth engagement involved only the mishap aircraft and the lead F-15. During this engagement, the F-5 came under attack and the pilot attempted to defeat the attack. The F-5 subsequently departed controlled flight and entered a flat spin. The pilot ejected at 10,000 feet AGL and sustained no significant injuries. The aircraft was destroyed.

■ A flight of F-16s was proceeding toward the working a[rea] for a two-ship basic fighter maneuvers flight. After accomplishing tracking exercises, the flight positioned for a perch set-up with the mishap aircraft as the defender in front. Prior to the attack, the mishap aircraft called a knock-it-off because of a flight control warning light. A recovery from the area was initiated for the landing at the auxiliary airfield. During the recovery, numerous warning lights illuminated which included the following as recorded by conversation on the wingman's video tape: Air data computer, flight control system discharge, pitch-roll-yaw, leading edge flaps, left and right horizontal tail servo lights, right flaperon servo light, standby gains, and electrical system light. During the descent, at approximately 400 knots and 14,500 feet MSL, the pilot lost control authority and successfully eject[ed] at approximately 10,000 feet MS[L].

■ The unlucky A-10 was number 2 in a two-ship flight on a close air

support mission flown from a deployment location. The visibility in the target area was poor, and the flight flew the briefed alternate mission. Tactical formation and fighting wing maneuvers were flown, followed by tactics engagements. For the sixth engagement, number 2 was defending against a gun attack. During a turn, both engines lost power. Adequate engine operation could not be regained, and the pilot ejected at an altitude of 500 feet AGL. The aircraft impacted the ground and was destroyed but there were no significant personnel injuries.

These are but a few of the examples of successful ejections in 1982 — a good year for ejections, overall. All told, the 1982 ejection survival rate showed a dramatic improvement over that of the past six years. The average success rate for the period 1976 to 1981 was 75 percent. Since in 1982, 63 of the 71 crewmembers who ejected survived, the result was an 89 percent survival rate. This compares to a 79 percent rate the previous year.

We saw eight ejection fatalities in 1982, as compared to 15 fatalities resulting from 72 ejections in 1981. Of the eight ejection fatalities, four were due to out-of-the-envelope initiations and four were attributed to procedural error, burned parachute, parachute/man interference and one system malfunction.

"The key to survival, once the pilot gets into an irreparable situation, is making the ejection decision," says Rudy Delgado, Egress Systems Manager, Air Force Inspection and Safety Center. "How many times have you heard that? Still, delayed ejection has been a major contributor to ejection fatalities."

Mr. Delgado commented, "Confidence in the ejection systems is a primary consideration. If you look at the statistics for 1982, you'll see the causes of the failures; the human errors outnumber the system malfunctions by a wide margin," he added. "That's really an understatement."

Although we're constantly working toward eliminating those malfunctions, the facts presented here should increase aircrew confidence in the ejection seat, concomitantly reducing ejection fatalities caused by delayed decision making. ■

EJECTION EXPERIENCE
1976-1982

Year	Eject.	Survived No.	Survived Rate	O/E No.	O/E Rate
1976	64	50	78%	8	57%
1977	70	54	77%	12	75%
1978	79	63	80%	11	69%
1979	79	54	68%	19	76%
1980	71	49	69%	17	77%
1981	72	57	72%	10	67%
1982	71	63	89%	4	50%

There's A First Time For Everything

CECILIA PREBLE
Assistant Editor

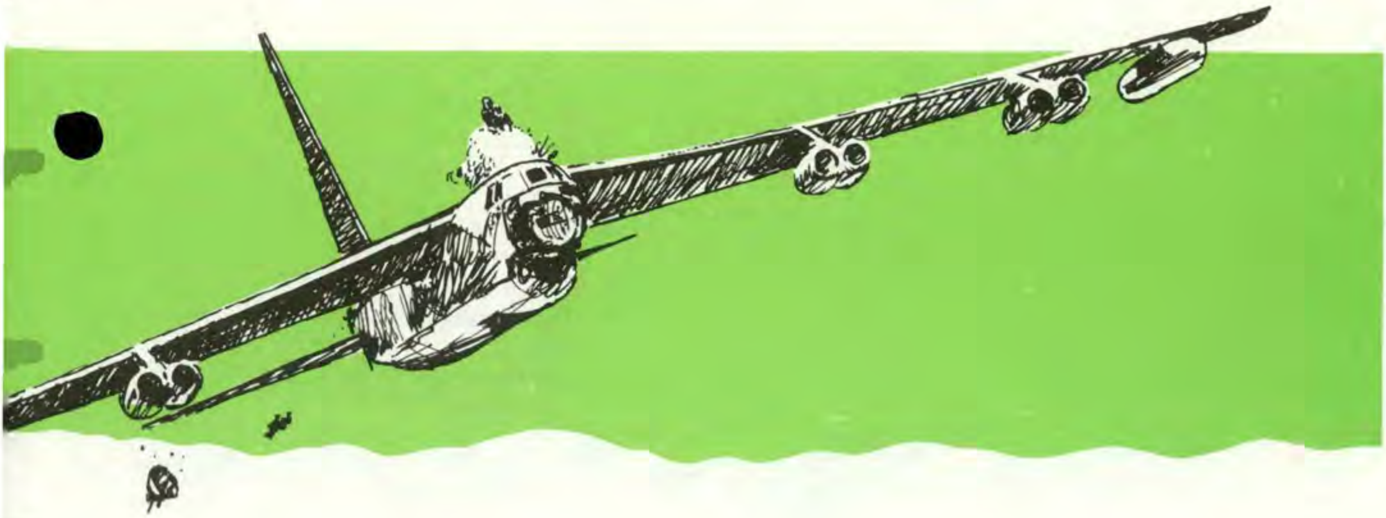
On a summer day, over 20 years ago, eight men faced a chilling prospect — ejection/bailout from a B-52C. After trying everything to regain control, the AC gave the order to abandon the aircraft. Although there have been numerous replays of this scene, it's worth recounting for two reasons: It's the first time an entire crew — with extra crewmembers — ejected from a B-52C without significant injuries; a first-hand account by a crew member might help you if some day you're faced with a similar problem.

■ Joe Hunt leaned back in his chair, shifted his gaze to the ceiling and began his account. . . . Take off was at 0815, normal departure, climb was normal. Approximately 20 minutes after take off, we heard a thump in the aircraft. As we continued our climb, the aircraft commander asked, "What was that?" We didn't have any answers at the time. Later we decided it was the antenna of the radome. We leveled off and continued our mission until we heard more thumps.

The radar was put on standby, rendering it inoperative. We advised the command post that we had no radar and suggested they find another aircraft to finish our mission. We were told to fly a high-altitude pilot proficiency since we couldn't get out of the local area without radar. So we started to fly the pilot proficiency. The airplane was acting normal. The aircraft commander got out of the seat and let the extra crew member jump in the left seat to give him a little flying time. I was in the right seat.

We had been in a turn about 30 seconds when the radome separated from the aircraft, causing a mild vibration. At the time, the noise was the most severe thing. The extra crew member relinquished control of the aircraft to me. I immediately returned it to straight and level flight. We had lost all airspeed indications so I set about 2,200 pounds fuel flow, which I figured would get us close to 400 kts TAS. The aircraft commander and extr crew member changed seats and I began flying back towards home plate. The aircraft flew normally with only the mild vibration from the loss of the radome.

We arrived over the base and flew about two holding patterns. Turns were fine and no altitude was lost or gained. The airplane was flying just fine. Meanwhile, the aircraft commander was talking to the command post, and they were advising us of what to do. The possibility of a chase plane was discussed. The airplane was flying normally, with the exception of noise and mild vibration and we didn't think we needed a chase plane at that time. The weather prohibited us from making an airspeed-out approach to the field. So, we were instructed to go to a base farther north. We changed our heading and about 5 minutes later, the vibrations started becoming slightly more intense. The buffetin was more violent than it had been for the past 30 to 40 minutes and it



became progressively worse.

At 14,000 feet, the aircraft commander gave the signal to abandon the aircraft. I began to prepare myself for the ejection. I heard a noise and felt the cabin depressurize. Then I took my sunglasses off, pulled down my sun visor, checked my O_2 mask, rotated the left arm rest, and the right arm rest, stowing the controls, bottoming my seat and locking my shoulder straps.

The next thing I remember doing was squeezing the trigger with my right hand. I blacked out for a few seconds, felt a forward tumbling sensation, then a snap and I was in the chute which had just opened. I estimate the elapsed time from the squeeze of the trigger to the popping of the chute to be no more than 3 seconds. Shortly thereafter, I drifted into a solid undercast. My next concern was the chute oscillations. They were fairly severe but I learned to live with them until I hit the ground."

That day all eight ejections/bailouts were performed with no hesitation and, most importantly, the ejection equipment performed as designed. The tail turret jettisoned without difficulty and the tail gunner egressed the aircraft easily.

Only the tail gunner and extra crew members were not equipped with automatic parachute releases. The tail gunner planned to free fall until he saw the ground, at which point he intended to open his parachute. Considering the low cloud cover and the fact that he had no idea what the altitude was when he ejected, it was fortunate that he pulled his ripcord after an estimated 10,000-foot free fall.

The extra crew member, concerned that he might hit the sides of the hatchway, activated his automatic release before bailout. At that point the aircraft was at about 14,000', which is the setting of the automatic release, and the 5-second time delay of his parachute release made it possible for him to bail out successfully. He was lucky — without the 5-second delay his parachute could have released in the aircraft.

Once the tail turret was jettisoned and the other crew members egressed, the pilot regained temporary control of the aircraft. After a few minutes of level flight, he tried to regain some of the altitude lost. But after a slight climb, the violent buffeting began again, the right wing dropped and the pilot was unable to regain control. He, too, ejected without difficulty.

Sitting in front of Joe Hunt's desk, listening to the retired Air Force colonel recount the sequence of events he observed as a relatively new copilot that day, it's difficult to imagine the mixture of emotions the crew must have experienced.

Now, as a veterans service officer for Okaloosa County, Florida, Hunt's routine is still interrupted occasionally, but only by his fellow veterans.

"After about 5,000 hours in the B-52 and another 1,000 in the B-47, I can look back on what happened that day and list a few things we should have done differently," Hunt said. "I mean, we handled the emergency very well, considering, but there were still the mistakes you would anticipate in that sort of situation. Overall, I think you can say it was a mixture of good luck and professionalism that got us through."

His summarization of the event is matter of fact. "We had complete faith in our ejection/bailout equipment. We did everything we could to keep that airplane flying, but once the order came to abandon it, we knew we could rely on our equipment. That was over 20 years ago," he said. "I'm sure it's even safer today." ■

In this issue AFISC project officers continue our series of analyses with the F-16, C-141, and C-9 aircraft discussing the statistics for 1982 and the prospects for 1983.

F-16

LT COL PAUL ROST

■ The F-16 Fighting Falcon force continued to grow through 1982 as the Air Force accepted aircraft numbers 352 through 520 and total USAF flight hours more than doubled from 81,000 to 198,000. Unfortunately, our total number of Class As also more than doubled — adding 17 to the previous total of 14. Worse yet, the trend continued in the first two months of 1983 with five more Class As. We ended 1982 with a lifetime Class A rate of 15.6 but the 1982 rate was higher at 16.1, which means the trend is going the wrong way!

This year we will almost double our flying time again, so even though we forecast the overall rate to drop, we are still forecasting a loss of *21 aircraft!* That is a cost in lives and dollars that we cannot afford, so let's take a look at 1982 with an eye for lessons learned that we can apply toward beating this year's predicted rate.

1982 In Retrospect

The 17 mishaps in 1982 and our lifetime operational experience are shown in Figure 1.

Note: Two logistics mishaps occurred in the test/development program (75-78) that are included in the lifetime data but not shown here.

Figure 2 is a comparison of the ops vs logistics rates by year from 1979 to March 1983.

Here is my interpretation of the numbers. Through mid 1982, F-16 mishaps were primarily caused by logistics factors, as you would expect in a new weapon system which is advancing the state of the art. Interspersed with this were the operations mishaps, usually caused by a lack of depth of experience in the airplane — since no one had that much experience, it was hard to identify all the quirks that might se[t] a guy up for a mishap.

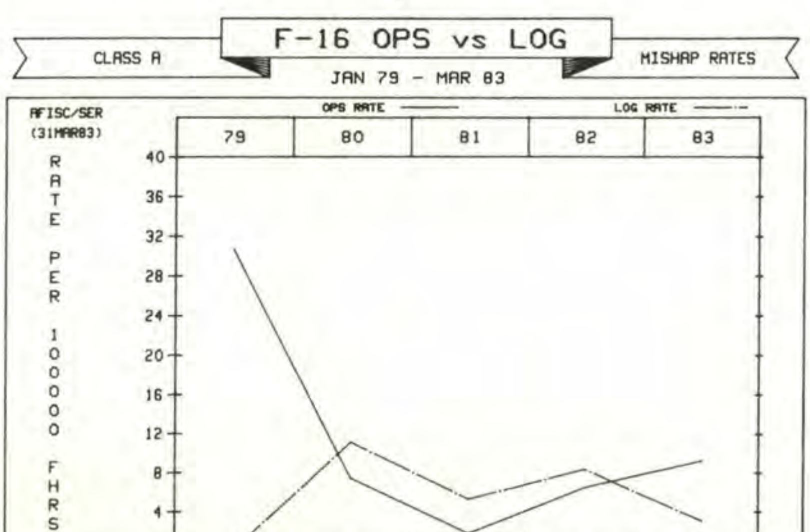
1982 was a turning point. The logistics problems have been worked, hard-fixes have been identified, many have been implemented and the rest are on the

Figure 1

CATEGORY	1982	1979-1982 TOTAL
Logistics		
Flight control	2	2
Flight Control/Electrical	0	2
Landing Gear	1	1
Engine	5	9
Electrical	1	1
Logistics Total	9	15
Other		
Undetermined	0	1
Birdstrike	1	1
Other Total	1	2
Operations		
Pilot Induced Control Loss	3	5
Collision w/Ground	1	1
Range	1	1
Midair	1	1
Landing T/O	1	2
Pilot Induced Flameout	0	2
Operations total	7	12
Overall Total	**17**	**29**

way. On the operations side, however, the problems are expanding. As the program continues to grow, more and more inexperienced pilots are introduced to the aircraft and their risk remains high. However, as units get farther away from their first year of operation, they tend to fall into the business-as-usual rat race (vs the ultra conservative approach) driven by UTE rates, weather, deployment schedules, etc. As individual UE times build, so too does the opportunity for all the classic single-seat operator factors — complacency, over-confidence, etc. For example, in 1982 we had an RTU student mishap, a post MQT mishap and a young flight lead mishap, all showing classic signs of inexperience, over-confidence or complacency. Additionally, experienced fighter pilots accounted for some of 1982's mishaps and in all cases the mishap sequence was triggered by an unplanned event which the pilot should have been able to handle. There is some evidence that chronic fatigue is sapping the reserves these pilots have used in the past to cope with such contingencies. The majority of our mishaps since July '82 involved operator factors in the causes. The lead time to influence these factors is much shorter than for logistics mishaps, so we can turn this trend around in 1983.

Figure 2



OPS MISHAPS	2	2	1	7	3
OPS RATE	30.6	7.5	1.8	6.5	9.3
LOG MISHAPS	0	3	3	9	1
LOG RATE	0	11.2	5.3	8.4	3.1

Logistics Lessons Learned

Five of the nine logistics mishaps were caused by engine failures, with the main fuel pump and tower shaft failures accounting for three. Long-range fixes include retrofit of our engines with shot peened tower shaft bevel gears and development of a gear-driven fuel pump. Nevertheless, the tower shaft problem will be with us until retrofit is complete and forecasts indicate the loss of one aircraft this year because of this.

The gear-driven main fuel pump is several years down the road. In the meantime, the SPO is constantly inspecting pumps to keep a good handle on the max operating hours limit. Leading edge flap failures cost us one aircraft and almost two others. As we inspect and work in this area more often now, the potential for maintenance error increases. The pilots will not always be able to save these so proper maintenance practices are a must. Lack of uninterruptible electrical power to the flight controls also hurt us in 1982. The long-term fix of a quad permanent magnet generator dedicated to the flight controls will be installed as part of Falcon Rally II starting later this year. In the meantime, tying the main aircraft battery to the flight control batteries should give us enough time to get the bird on the ground when the main and emergency generators fail. Main generator reliability is being enhanced now through installation of anti-torque plates on the oil return line, CSD accumulator, flexible oil lines and a new oil fill port.

continued

F-16

continued

Operations Lessons Learned

A lot of our pilots learned lessons the hard way in 1982. If I were to boil it down to two words it would be basic airmanship. Apparently, lack of good basic instrument cross-checks (which we need at night and/or IMC) accounted for 4 of 7 ops mishaps. Add one more probable in 1983. Loss of situational awareness while entering the low level during a head-on DACT intercept pass and during 1 on 1 BFM cost us the other 3 ops accidents.

In some of our logistics mishaps, the pilot missed out on the opportunity to save the aircraft. In one case, the pilot gave away the chance to complete a flameout landing. He didn't turn toward the closest suitable field because his flight planning was incomplete. (I'm not saying he would have saved the bird by going to the closer field, only that he would have had the opportunity to decide whether he was in the ideal position to complete a flameout landing. If yes, we get a bird back to fly again. If not, at least the opportunity was there).

In the other case, the pilot's inaction in not trying AB, turning off the EEC or going to BUC gave away the possibility of regaining thrust needed to get him home.

When you look at these mishaps from this perspective, it becomes apparent that practicing an emergency with the appropriate whistles and bells in a simulator can go a long way toward helping us handle an emergency. Doing it the first time for real is a high-task job for even the experienced F-16 pilot.

We had our first F-16 midair in 1982, but it is significant to note that worldwide it was the sixth F-16 lost to midairs. The high pitch and roll rates, small size, and deceptive paint scheme all contribute toward making the F-16 highly vulnerable to midairs. While its maneuverability allows it to vacate the space quickly, the pilot has to perceive the collision course first and *that* is the problem. Remember also, in DACT you can turn in to a less maneuverable fighter and easily force an overshoot — just make sure it isn't through you. Stay out of his plane (both kinds).

1983 Game Plan

The data crunchers locked in with the AFISC computer banks have come up with the 1983 loss predictions shown in Figure 3. My goal is to cut that number to 13 or less. How? Here are some thoughts on areas where emphasis is needed.

Figure 3
1983 USAF F-16 CLASS A FORECAST

Operations	
Control loss	3
Collision with ground	1
Midair	1
Landing (pilot)	1
Ops other	1
	7
Logistics	
Flight control	2
Engine	8
Electrical system	3
Undetermined/Misc.	1
	14
Forecast Total F-16 Loss:	**21**

Logistics

- Engine: Be critical of your engine, including accurate logging of JFS starts — it's the only one you have.
- LEF: Better quality control of maintenance is essential.
- FOD: Awareness programs protect pilots' and ground crews' lives and save engines.
- CSD: Pay close attention to servicing.
- AOA probe heat: It must work. Until something better is developed, do the after-landing checks faithfully. Maintainers need to know the real status of the circuit breakers.
- Malfunctions: If it isn't right,

bring it home *now*. So far F-16 wings have not had mishaps during their first year, why? Because when everyone is new to the system, you really do take the conservative approach and you're not so wrapped up in realistic training.

Operations

- Self-discipline and basic airmanship are the keys to flying a single-seat, single-engine fighter. It starts with mission planning. Don't go out the door until you know exactly what you expect to be doing for the next few hours. And don't take off until everything in the cockpit is set up. There are no short cuts. Do things exactly the same way, both when you're rushed (e.g., preflight and after start) and when you're not. Also, foot on the ladder to takeoff time is the same for the spare aircraft as for the primary.
- Emergencies: The best way to handle emergencies is to think about them before you take off (mission planning again). Mutual support from your wingman (checklist, vectors, visual info, etc.) is critical. Task saturation comes fast in a single-seat fighter. So, instead of waiting for it to happen, pre-empt it. Keep it simple.
- Fatigue: It's a killer, especially for supervisors. The most realistic simulation of war in day-to-day training and especially an ORI is fatigue — how you manage it in yourself and in your troops determines how well you survive.
- Instrument crosscheck: A self-disciplined crosscheck that does not fixate on any one instrument is the key to survival in IMC and night.

The difference in recognition between the HUD flight path marker and the ADI is the time it takes to decelerate from 3 degrees to 10-15 degrees AOA. The flight path marker won't tell you anything until you start going down. Unusual attitudes are often easier to recover from on the ADI than the HUD. There are two absolutes about instruments in the F-16: There has never been an F-16 HUD flyer spatially disoriented while practicing instruments in VMC; There has never been an F-16 pilot who has not had a spatial disorientation experience while flying instruments in IMC. Our practice does not prepare us for the real thing. Night flying techniques are the same as for instruments. It's either instrument crosscheck or "light on the star." Turn the interior lights up bright enough so you can accurately read the gauges in an instant. Low interior light may help preserve your night vision but it will kill you when you try to do an unusual attitude recovery.

The only purpose of the autopilot is to allow you to take your right hand off the stick. The crosscheck remains the same. Forgetting to crosscheck with the autopilot on is just as dangerous as an "unloaded" gun pointed at you.

- G tolerance: 1983 has already taught us some painful lessons here. If you G yourself into unconsciousness, you will be completely incapacitated for about 15 seconds. *The F-16 is the first fighter that is stronger than the pilot.* If you don't have a G tolerance conditioning program, you are risking your life. Even with a functioning and properly fitted G suit (is yours?) you can take yourself out of the fight through fatigue, lack of recent conditioning, improperly performd M-1/L-1 maneuvers, etc. Hardware improvements are coming, but the smart pilot avoids snatching full aft stick. It only takes a split second longer to give yourself some time for feedback.

Last year was a difficult year for the F-16 with definite signs of growing pains. This year we enter the mature stage in its flying hour history and we can significantly reduce the loss rate. Since there are no simple answers, a broad spectrum of attack is needed to bring down the rate. Our work is cut out for us — but is there a job you'd rather have than to fly and fight in the Fighting Falcon? ■

C-141

MAJOR KURT P. SMITH

■ 1982 marked the C-141 Starlifter's 19th year of active service as the USAF's strategic airlift workhorse. It saw the completion of the "stretch modification" and the arrival of the European green paint job. The aircraft also continued to receive a number of mid-life improvements that will allow it to safely achieve 45,000 flying hours and for the fleet to serve well into the 21st century.

However, 1982 was not what you would consider a banner year for the aircraft. The tragic loss of a crew and aircraft seemed to overshadow an otherwise good year. The aircraft was on a VFR low level training mission (SOLL I) in "marginal weather" when it impacted just short of the top of a 4,800-foot mountain. All nine crewmembers were fatally injured in the crash.

This one major accident (Class A flight mishap) resulted in a rate of 0.40 mishaps per 100,000 flying hours for 1982 and brought the lifetime rate to 0.41. The mishap also brought the lifetime total to 27 Class A mishaps. Unfortunately, it was the 9th fatal flying accident in the C-141's 19-year history. The mishap also claimed the tenth aircraft loss (two aircraft have been destroyed on the ground) bringing the lifetime total of destroyed aircraft to 12.

The remaining safety statistics were good. There were no minor accidents (Class B mishaps) in 1982, keeping the lifetime total for these mishaps at 18. The number of Class C and High Accident Potential (HAP) mishaps remained stable at 66 and 74 respectively. This brought the total number of mishaps (all classes) to 141 in 1982.

Figure 1 C-141 Flight Mishaps (1979-1982)	A	B	C	HAPS	Total
1979	3	4	90	103	200
1980	1	0	109	123	233
1981	1	1	73	66	141
1982	1	0	66	74	141

A breakout of the 141 flight mishaps revealed 13 were operations/crew related; 60 were logistics/maintenance related; and 68 were "other." The "other category includes cargo leaks, birdstrikes, physiological, lightning, engine FOD, etc.

Figure 2 1981 vs 1982 Mishap Comparison	1981	1982
Logistics	**76**	**60**
Flight Controls	37	18
Landing Gear	24	10
Engine	3	6
Thrust Reversers	1	4
Misc (no trend)	11	22
Operations	**15**	**13**
Taxi Mishaps	5	0
Air Refueling	4	2
Belly Scrape	3	2
Misc (no trend)	3	9
Other	**50**	**68**
Cargo Spills	19	29
Birdstrikes	15	20
Engine FOD	7	8
Physiological	7	6
Misc (no trend)	2	5

Logistics Mishaps

The term logistics refers to any mishap that has to do with the design, procurement, maintenance, handling, or modification of the aircraft. The C-141 experienced 60 of these mishaps in 1982, 16 less than 1981. The problems were basically the same as in 1981, but the number of reported mishaps in the leading two categories, flight controls and landing gear, was reduced by over half. The number of engine (not counting FOD), thrust reverser, and miscellaneous mishaps increased only slightly.

Flight Control Problems The number of reported flight control mishaps decreased by half from 37 in 1981 to 18 in 1982. Three areas were responsible for most flight control mishaps; they include the rudder power control unit (PCU); the aileron PCU; and a weak aileron structure. The installation of a new and improved rudder PCU is approximately 50 percent complete and should be completed by mid-1983. The modification to strengthen the aileron structure is approximately 50 percent complete and should be completed by early 1984. These two mods have helped reduce the number of flight control mishaps. A further reduction should be achieved with the start of the aileron PCU mod. Finally, after 10 years of living with the flight control problems, progress is being made. This favorable trend should continue in 1983.

Landing Gear Problems The number of landing gear related mishaps decreased from 24 in 1981 to 10 in 1982. The reduction is mainly attributed to the lack of any tire failures and to decreases in the number of wheel failures. Of the 10 mishaps in 1982, 4 were MLG related, 2 NLG related, 3 wheel related, and 1 antiskid problem.

No new problems were reported with the MLG system. The aircraft experienced two actuator failures, one support structure problem, and one MLG door problem.

The two NLG problems involved a cocked NLG gear and an NLG actuator fitting failure. The cocked gear resulted in the aircraft departing the runway during landing. The investigation determined the problem was caused by improperly designed nose wheel steering disconnect paddles. The NLG actuator fitting failure created some difficulty in emergency extending of the NLG; however, the crew eventually was able to get the gear down. The problem was caused by stress corrosion cracking. Overhaul procedures at depot have been improved to eliminate this problem. Lessons learned from this experience have

continued

also been submitted for a Dash One change.

The three wheel problems in 1982 were a marked improvement over the seven problems reported in 1981. One was caused by a material failure of the wheel; the other two were improperly installed wheels. The number of wheel failures decreased from five to one, validating the corrective action to replace heat damaged wheels. The number of mishaps caused by improperly installed wheels remained stable at two. The remaining gear problem was caused by a failure of a capacitor in the antiskid system. The capacitor is being replaced during depot overhaul.

In summary, the C-141 main landing gear system is in good shape. Major problems identified in mishaps with actuators, wheels, tires, and support structure have been or are being addressed. The two NLG problems identified have not been fully resolved and will require further study before an all clear can be given.

Engine Problems The number of engine related problems increased from three in 1981 to six in 1982. Three of the six problems in 1982 involved two engines. The number of engine FOD problems remained relatively stable with eight mishaps in 1982. No new trends were reported or observed in 1982. Basically, the TF-33 is in good shape — a tribute to the people who designed and built it and to the people who maintain it.

Other Logistics Problems

Another logistics related area that warrants concern is the increase in the number of mishaps caused by problems with the thrust reversers. The number of mishaps increased from one in 1981 to four in 1982. So far, the investigation of these mishaps has failed to identify any trend. The depot has been asked to evaluate the problem.

Finally, the C-141 experienced five other logistics related mishaps that warrant your attention. They included two dual CADC failures, one dual INS failure, one electrical failure, and one "potential" wing fire. Unfortunately, the investigations failed to determine the cause of one dual CADC failure and the electrical failure. Failure to install pitot covers caused the other dual CADC failure. The INS failure was caused by a small nut shorting out the relay to both INS units. The "potential" wing fire was caused by improper clamping of wing anti-ice ducting.

Operations Related Mishaps

The number of operations/crew related mishaps decreased from 15 in 1981 to 13 in 1982. Several are considered noteworthy. They include two runway departures, two belly scrapes, two air refueling mishaps, two blown tires mishaps, one cockpit fire, and one engine icing problem.

The most significant of these was a cockpit fire that came close to ending in disaster. The mishap involved cigar smoking, use of oxygen, and less than professional behavior. Somehow, a cigar ash was introduced into an oxygen regulator hose. The resulting oxygen-fed fire ignited floor coverings which filled the cockpit with dense black smoke. The emergency was further complicated by communication problems due to

a non-standard headset and not having an oxygen mask connected to the interphone. Accidental isolation of the left wing also cut air flow to the cockpit.

To make matters worse, a materiel problem with the number 2 hatch prevented its deployment. The situation was finally brought under control with the selection of manual ram air door. Although this mishap was the result of poor crew discipline, you might reflect on it the next time you light up or put on your oxygen mask.

The two runway departures served to reemphasize the importance of applying prompt and correct reject procedures. In both mishaps, the spoilers were not deployed. The first mishap occurred when the flight engineer called "reject" shortly after "go." The second mishap occurred during a touch and go when an unknown crewmember called "reject." In both cases, the results were the same — the aircraft departed the runway. Luckily, the areas adjacent to the runways were relatively clear, or the results could have been worse. Reject procedures may not seem complicated, but we also don't use them much. You might make it a habit to give them a quick mental run-through before each take off.

The C-141 experienced its sixth belly scrape mishap in 1982. There is still no satisfactory explanation other than the B model is less forgiving when deploying the spoiler on landing. In a lot of mishaps, the crews were unaware they had even scraped the ground.

Both blown tire mishaps involved landing without antiskid protection; one due to hydraulic system loss and the other due to malfunctions in the antiskid system.

The engine icing mishap resulted in compressor damage to all four engines. While at cruise, the crew failed to heed the warning of the icing light. When the engines began to compressor stall due to ice buildup, the engine anti-ice was turned on. This resulted in the ice ingestion and damage.

The number of air refueling mishaps decreased from four in 1981 to two in 1982. Both air refueling mishaps involved the receiver rapidly exceeding the envelope limits. One mishap also involved an inexperienced boom operator.

On the positive side, the C-141 did not experience any taxi mishaps in 1982, compared to five in 1981. Good show!

Other Mishaps

The number of mishaps not attributed to logistics or operations increased from 50 in 1981 to 68 in 1982. The rise was primarily due to increases in cargo spills and birdstrikes. The number of cargo spills increased from 19 in 1981 to 29 in 1982. Birdstrikes increased from 15 in 1981 to 20 in 1982. (Four occurred at Altus, three at Travis, one at Charleston, one at McGuire, two during low level, and nine at enroute stations.) The number of engine FOD and physiological mishaps remained relatively stable at eight and six respectively.

C-141 Safety Record

Overall, the C-141's safety record is a good one. The 0.41 lifetime Class A rate is the best rate among large/transport aircraft.

continued

Figure 3
Class A Mishap Comparison

Aircraft	Years	Mishaps	Flying Hours	Rate
C-124	50-74	132	6,627,613	1.99
C-130	55-82	121	9,467,221	1.28
C-135	57-82	65	7,648,271	0.85
C-141	64-82	27	6,549,870	0.41
C-5	68-82	10	583,293	1.69

During its 19 years of service, the aircraft has accumulated over 6,549,870 flying hours. Of the 27 mishaps, only 9 have involved fatalities and of the original 284 aircraft produced, 272 remain in the inventory. A breakout of the 27 mishaps reveals 15 were logistics/maintenance related, 10 were operations/crew related, and two were "other" causes.

What To Expect In 1983?

The official AFISC forecast calls for one Class A mishap and no Class B mishaps in 1983. The Class A predicted involves a collision with the ground in which the aircraft is destroyed. So far in 1983, the C-141 has experienced one Class B mishap which involved a gear-up landing.

Unfortunately, an unfavorable trend in crew related mishaps is increasing. If you divide the 6 million plus flying hours in half and count the number of crew related mishaps in each half, the trend is not good. The aircraft experienced only one of these mishaps in the first half of its life, compared to nine in the second half.

In addition to the crew related Class A mishap trend, crew related Class C mishaps in 1982 reflect the same general theme. Three of these mishaps could very easily have been Class A mishaps involving fatalities and/or destroyed aircraft. The cockpit fire and both runway departures were close calls. The blown tire mishaps to a lesser extent, could have also had serious consequences. The challenge is clear; we cannot afford to become complacent and stand on past accomplishments.

The Starlifter is in good health, and its safety record is an impressive one. The challenge as operators and maintainers is to keep it that way. Make every sortie a safe one in 1983. ■

Figure 4
C-141 Lifetime Class A Flight Safety Record

	Class A Total	Log	Ops	Other	Fatal Mishap	Fatal-ities	Dest A/C
1964	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0
1966	1	1	0	0	0	0	0 (1)
1967	4	2	1	1	2	12	2
1968	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0
1970	1	1	0	0	0	0	0
1971	1	1	0	0	0	0	0
1972	0	0	0	0	0	0	0
1973	2	1	1	0	1	24	1
1974	2	1	1	0	1	7	1
1975	4	3	1	0	1	16	1
1976	3	1	1	1	2	41	2
1977	2	2	0	0	0	0	0
1978	1	0	0	0	0	0	0
1979	3	1	2	0	0	0	1
1980	1	0	1	0	1	13	1
1981	1	1	0	0	0	0	0
1982	1	0	1	0	1	9	1 (1)
TOTAL	27	15	10	2	9	122	10 (2)

( ) Nonflight destroyed aircraft

C-9

MAJOR JOHN J. COLSCH

■ The USAF C-9 fleet is small, but safety is as important for these aircraft as for our larger fleets. From acquisition of the first C-9A's in 1968, to date, they have had two Class A flight mishaps and one Class B flight mishap and have flown more than 366,000 flight hours.

The first C-9 Class A occurred when a C-9A crashed shortly after a go-around. The aircraft was destroyed, and all three aircrew members aboard were fatally injured. The other Class A occurred when a C-9A touched down short during bad weather. No injuries resulted, but the aircraft sustained major damage. In 1980, a C-9A sustained Class B damage when a landing gear door caught an arresting barrier cable during an emergency landing.

The overall C-9 Class A flight mishap rate at the end of 1982 was 0.54 per 100,000 flight hours; the C-9 Class B flight mishap rate was 0.27.

Seven C-9 Class C mishaps and High Accident Potential (HAP) mishaps were reported in 1982. These included three engine malfunctions, one engine FOD, a birdstrike, a blown tires mishap, and a failed flap buss cable mishap.

The 20 aeromedical evacuation C-9A Nightingales and three VC-9C Special Air Mission (SAM) aircraft have vital missions that demand the highest degree of reliability and safety. The small fleet size and the urgency of the C-9 missions require continual vigilance to assure mission urgency does not compromise safety.

The C-9 flight environment routinely includes high-density air traffic areas and adverse weather conditions. This is reflected by the 11 Hazardous Air Traffic Reports (HATRs) involving C-9 aircraft submitted in 1982. Four of the 1982 HATRs were confirmed near midair collisions of C-9 aircraft with other aircraft. A modification proposal has been submitted by HQ MAC to acquire strobe lights for the C-9A aircraft. The VC-9A aircraft were delivered with strobe lights installed.

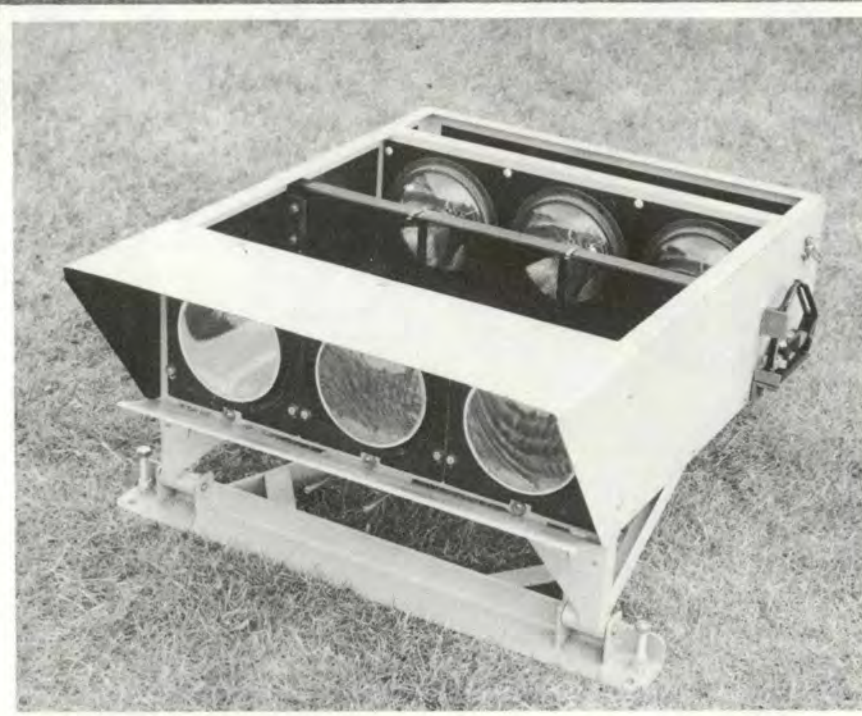
Besides the strobe lights, kits have been delivered for installing upper torso restraint straps for forward and aft attendant seats. Additionally, time compliance technical orders have been distributed for modification of the spoiler actuator assembly and a main landing gear attachment fitting.

Because of similarities between USAF C-9's and commercial DC-9's and because a large portion of the commercial DC-9's have accumulated more flight hours than USAF C-9's, failure data from the commercial DC-9's can be used to prevent similar failures in the USAF C-9's. However, continuous attention must be exercised to prevent those failures that are the result of age and environment rather than flight hours.

The C-9 fleet has an enviable safety record. However, an excellent safety record does not preclude future mishaps. Only by continued vigilance and safety awareness by all involved can the C-9 safety record be improved. Past and present C-9 personnel have much to be proud of. Keep up the good work. Make the 1983 C-9 mishap forecast true — zero Class A's and Class B's. ■

PAPI, PLASI, etc . . .

A new generation of avaition lighting systems



LT COL HAROLD OLSON
HQ USAF/LEEV
Washington, D.C.

■ A new generation of aviation approach lighting aids is rapidly coming of age. New systems of lighting aids that employ advanced technology are currently being developed and promise advantages of improved visual characteristics, reliability, and reduced cost. Some of these systems are already operational, others are undergoing testing, and still others are being refined in the laboratory. In the next few years you will probably be getting a "first-hand" acquaintance with these aids as they come on line.

PAPI

For the past 25 years the VASI has been the world's primary visual approach slope indicator. The VASI system has served well as an approach guidance aid for the pilot. Now, second-generation systems are being manufactured. Developed in England, the precision approach path indicator (PAPI) is designed to provide sharper and more specific indicators of glide slope position than VASI. It can be visualized as a VASI with the near and far units arranged horizontally on each side of the runway. The PAPI display provides five different combinations of light to the pilot, each representing a specific indication of approach position. The accompanying pictorial depiction (Figure 1) relates the various combinations of light to position.

Ideally, the crisper definition of PAPI positional information should allow smaller pitch and power adjustments by the pilot. NASA is employing PAPI units during recovery of the space shuttle and several airfields in the United Kingdom have the units in place. The system was recently certified by the International Civil Aviation Organization (ICAO) and has been approved by NATO. Currently the FAA is completing an evaluation, and US Air Force testing will be accomplished at Williams AFB this year. While the VASI system will be around for a long time to come, you can expect to see more and more PAPI's installed worldwide.

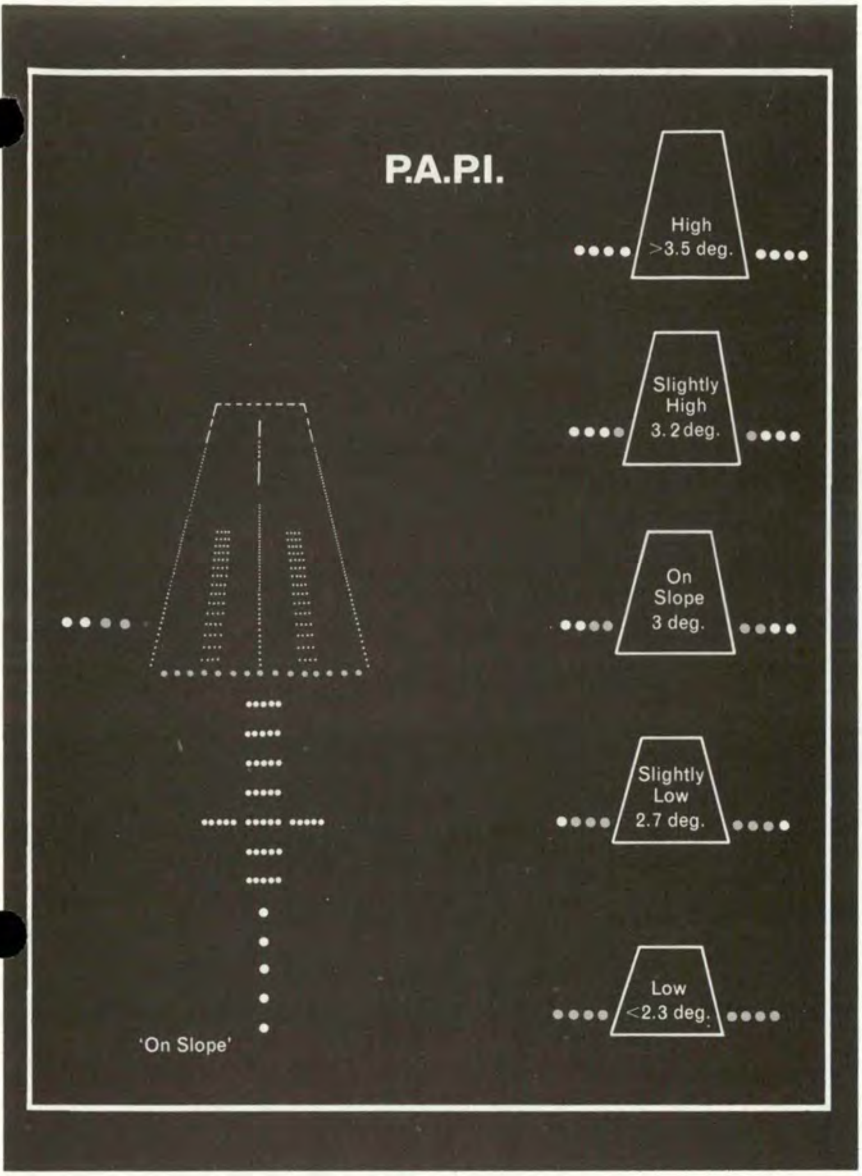


Figure 1

PLASI

Another second generation approach aid is the pulse light approach slope indicator (PLASI). The PLASI is a single-source unit that uses a pulsing light to provide glide path information. Deviation below glide path results in the pilot seeing a pulsing red light — above glide path, a pulsing white light. When the correct approach path is flown, the pilot views a steady white light. PLASI is a relatively inexpensive system that has been certified by the FAA. Testing by the USAF will be accomplished in conjunction with testing of the PAPI system at Williams AFB. See Figure 2 for a depiction of the way PLASI works.

Advanced Technology Lighting

Technology advances achieved within the past several years offer significant potential for future airfield lighting systems. Two new technologies have been undergoing research and development and offer promise in augmenting incandescent sources that have been the mainstay of aviation lighting.

Electroluminescent Lighting

Electroluminescent lights employ microincapsulated phosphors sandwiched between two flat electrodes, one of which is translucent to allow for light

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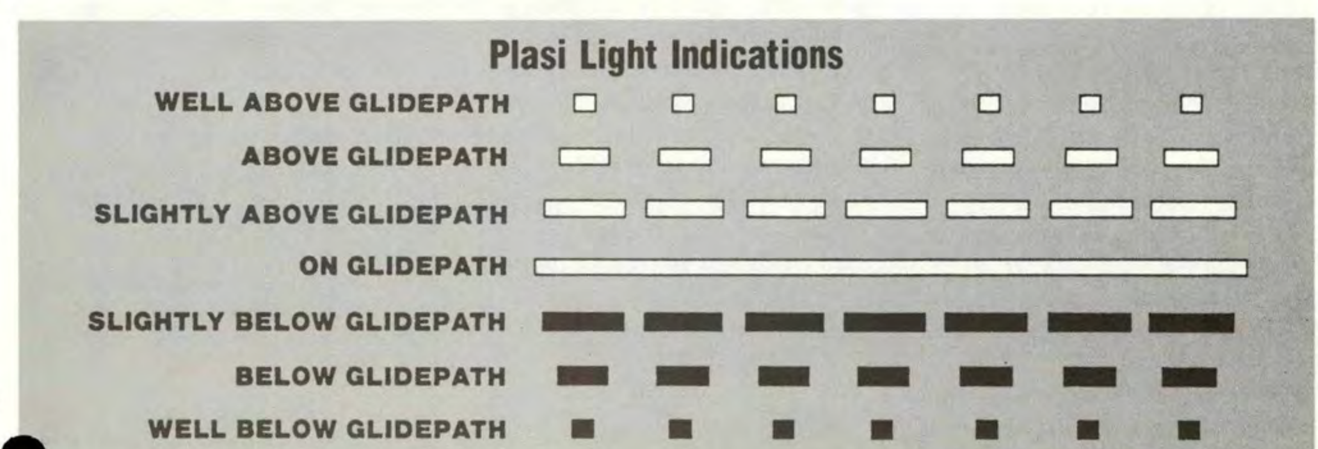


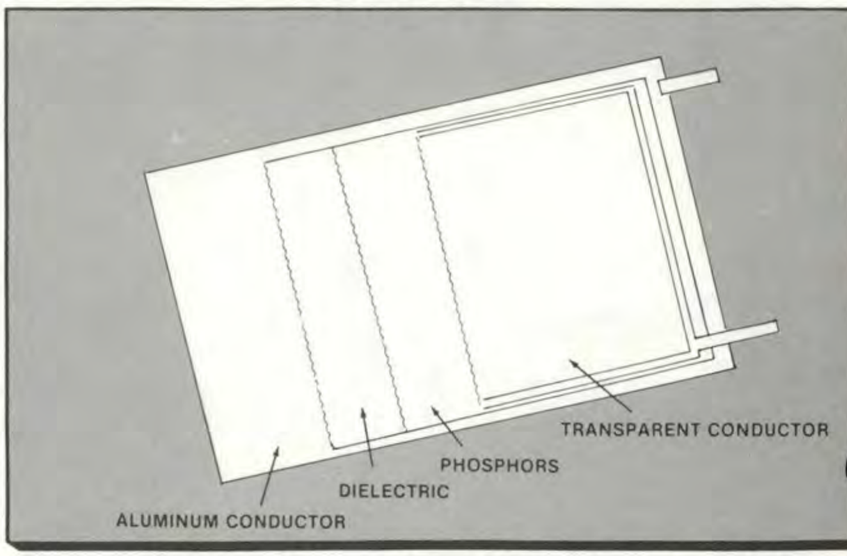
Figure 2

Radioluminescent Light Unit

PAPI, PLASI, etc.

continued

El Lamp Construction



transmission. The thin wafers are laminated with clear plastic to seal the light emitting surface. The Air Force leader in developing this technology is the Productivity, Reliability, Availability, Maintainability Group at Wright-Patterson AFB. In addition to its low weight, electroluminescent lighting offers the advantages of long life, lower electrical consumption, excellent contrast characteristics, elimination of heat, and ability to be shaped. The particular characteristics of low weight, low power consumption, and reliability are ideal for portable lighting applications. New equipment employing this technology is being developed to replace traditional portable lighting systems. Prototype units have been manufactured and field tested with refined versions soon to be procured.

Radioluminescent Lighting

The second of the new lighting technologies is radioluminescent lighting. Because existing airfield lighting systems are energy-intensive, it takes a great deal of energy to operate an airfield in addition to the expense of associated construction and maintenance costs. Radioluminescent lighting is totally self-sufficient, requiring no externally provided power source. Light is produced by phosphors activated by radioisotopes. The Air Force Engineering and Services Center at Tyndall AFB, Florida, has been conducting tests in conjunction with the US Department of Energy for several years in order to refine this technology. Radioluminescent lights offer particular promise in portable lighting and cold weather applications where normal battery and generator electrical sources are unavailable or sensitive to extreme climate conditions. Prototype units have been manufactured and field tested, including recent cold weather testing in Alaska during Brim Frost. Equipment improvements are occurring steadily and technology development will continue in the future.

The next generation of aircrews will have a new generation of airfield lighting aids to help accomplish their mission. While the specific configuration of approach/landing lighting systems has not been finalized, development and testing is well underway. As you can see, it is an exciting time in the aviation lighting field and Air Force aircrews will benefit from improved systems.

The Air Force Engineering and Services community is working to achieve better, more reliable aviation lighting equipment to help get the job done. ■

About The Author

Except for a one-year tour in Thailand flying C-47s, Major Olson spent the first 10 years of his career in Air Training Command. In 1978 he was assigned to MAC at Dover AFB, Delaware and served as a C-5 aircraft commander, command post controller and executive officer. In 1982, he joined the Engineering and Services Directorate of the Air Staff as manager of airfield lighting, marking, and noise abatement programs.

LIGHTNING . . . OUT OF THE BLUE

Photograph taken by Michael W. Maier, Lightning Location and Protection, Inc., Tucson, Arizona, demonstrating a lightning flash that angled outward from the leading edge of the thundercloud on an angle of approximately 125°, striking the earth some 5.6 miles from the vertical overhead origin of the flash.

LT COL JOSEPH A. ZAK
Chief, Aerospace Sciences Division
Tactical Air Command
Langley AFB, VA

■ Can lightning strike an aircraft or a ground object from the clear blue sky, or as they say, "out of the blue?" The answer at this time is maybe; but let's put that answer in perspective. In all documented cases this lightning out of the blue has always been associated with an active thunderstorm nearby.

In about 90 percent of cloud-to ground flashes, negative charge is exchanged from a cloud base to the ground. The other 10 percent are called positive stroke lightnings. These usually travel from near the cirrus anvil at the top of thunderstorms or from "clear" air near the mid or upper part of the storm cloud to the ground. Although less frequent, these strikes are most intense and often occur unexpectedly.

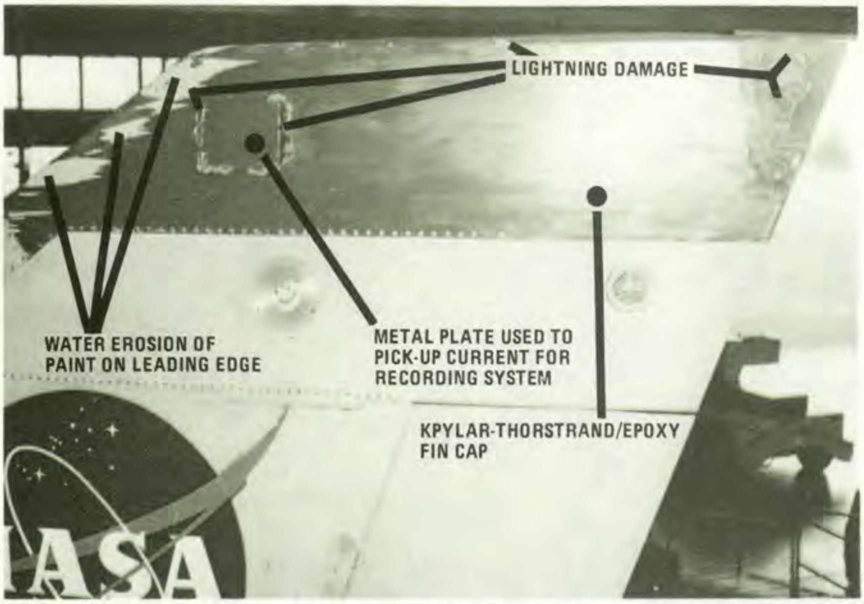
Aircraft Lightning

We don't know as much about the lightning that strikes your aircraft. It appears to behave like lightning that emanates from a tall building. Tall buildings seem to collect charge and to initiate the stepped leader process. Of course, you could just happen to be in the path of a naturally occurring flash, but there is increasing evidence to indicate that sometimes your aircraft may initiate or trigger the lightning flash process. This is especially possible if your aircraft has become charged by flying in clouds, in precipitation, and near the freezing level. Throw in some convective activity (imbedded CBs) and you've increased your strike probability significantly.

Research

Although we don't know all the ways lightning affects your aircraft, we are learning more each year, thanks to several research projects. The NASA-Langley Research Center in Hampton, Virginia, has been researching lightning since 1978. As part of NASA studies, a fully instrumented (for lightning

continued



Lightning damage and water erosion damage to the Kevlar-Thorstand/epoxy fin cap on the NASA F-106B storm hazards airplane following a flight in which nine direct lightning strikes were experienced at an altitude of 25,000 feet over Appomattox, VA (July 11, 1982).

measurement) F-106B was flown into some 150 thunderstorms in the past 3 years. This aircraft has been struck by lightning 176 times. In 1982 they increased their "success" (success means getting hit by lightning) by penetrating at higher altitudes using a ground-based lightning detection system.

Storm Hazards Program

The F-106B aircraft participated in 15 experiments in 1982 to improve our knowledge of the effects of thunderstorm hazards on the design and operation of aircraft. Much of this effort was devoted to lightning because of the possible problems associated with lightning strikes to advanced aircraft which use composite materials and solid state micro-electronics. Composite materials are poor conductors and must withstand the heat generated by current flow through high resistance. Also, micro-electronics have a lower tolerance to voltage fluctuation and are consequently more vulnerable to lightning.

Lightning Hardening

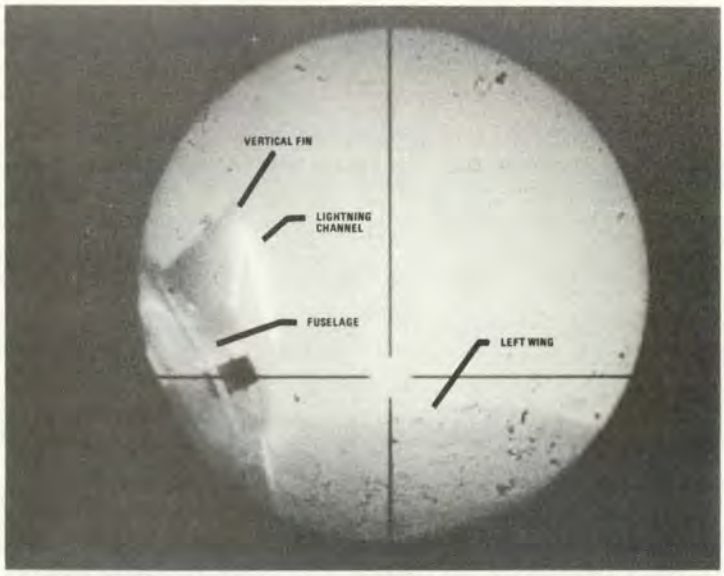
NASA did extensive research before conducting this experiment. They worked closely with the NOAA National Severe Storms Laboratory in Norman, Oklahoma, and with the Air Force Rough Rider program in the past. More than 10 special instruments were installed on their aircraft to measure nearly every characteristic of lightning and to help guide the aircraft into regions of high lightning potential. In addition, several modifications for lightning hardening were accomplished.

- Insured positive electrical bonding between external mounted electrical component hardware and the aircraft structure.
- Installed transient suppressor lines to ground on each of the aircraft's 15 volt, alternating current (VAC) power distribution buses.
- Used transient suppressors at all probable points of entry of lightning surges into the aircraft electrical and avionics systems.
- Provided electromagnetic shielding of critical electrical circuits.
- Improved electrical bonding of internal fuel system hardware.
- Paid careful attention to proper routing and restraining of the lightning current-carrying conductors from the nose boom mounted sensors.
- Used JP-5 or Jet A fuel instead of much more volatile JP-4.
- Eliminated external fuel tanks to get rid of unwanted lightning strike attachment points.
- Removed all paint on the wings to reduce dwell time of lightning attachments and burn-through possibilities.

Results

Although the experiment is still in progress, some preliminary results are available. First, each thunderstorm penetrated displayed somewhat different characteristics. Some had a lot of turbulence and rain but very little lightning; others had little turbulence or rain but heavy lightning. Lightning, precipitation, and turbulence did not correspond in location and time for the thunderstorms studied. This conclusion is backed up by other recent research. It is very likely that the stage of thunderstorm development plays a key role in the lightning encounter. Very little lightning, though still heavy precipitation, can occur in dissipating cell stages and frequent lightning can occur in new developing cells. Since a thunderstorm complex can be composed of several cells at different stages of development, all conditions are possible in nearly all storm systems.

Secondly, new and unique information has been obtained about strike patterns with respect to lightning attachment mechanisms and the resulting lightning strike zones on the exterior of the aircraft. On several occasions each year the flash has swept aft across the top or bottom of the midspan area of the wings, a region thought to be relatively immune on swept wing aircraft. This indicates a need for increased emphasis on design and protection for the surfaces of integral wing fuel tanks in swept wing aircraft. Crews have not experienced electrical transients or electrical shocks as a result of strikes. The peak strike rate for the 3-year period occurred at ambient temps between -40°C to -45°C; while published lightning statistics for military and commercial aircraft indicate that most strikes occur at or near the freezing level (O°C). It is possible that because most thunderstorm penetrations occur in the terminal area (on descent or climbout) the historical data on strikes are biased when they show 0°C as the most common temperature for strikes.



Photograph of a lightning strike to the vertical fin cap of the NASA-Langley F-106B storm hazards airplane. The strike occurred May 28, 1982 at an altitude of 24,800 feet (7.6 km) during a research flight through a thunderstorm at Annapolis, Maryland. The outside air temperature was -21C. (Photograph courtesy of F.L. Pitts and B.D. Fisher of NASA-Langley.)

Although these findings may change as more data are gathered, results to date give us added confidence that careful aircraft designs can minimize lightning damage even if strikes cannot be avoided. It behooves all crews to learn more about the "ingredients" for lightning during their flight weather briefings.

What To Do

Stay clear of thunderstorms. Don't expect to be immune from lightning when you are flying even 25 miles from the radar precipitation echo if there are other cells nearby and cirrus above you. Your radar may not show an actively building cell which is just about ready to produce lightning. A little help from your charged aircraft may do the trick. During your weather briefing, find out if any part of your trip will be in the clouds, near CBs, or in precipitation. Try to arrange it so as few of those "ingredients" as possible are present, even if it means a delay or a reroute. Your awareness of weather should definitely not end with the weather briefing. Check again just before you leave to see if there are any last-minute changes. Also, check frequently en route and listen to weather broadcasts. Be continuously aware of the location of potential threat areas with respect to your flight plan. Yes, it is a great deal of trouble to reroute or delay, but the payoff is worth it. We might just save the Air Force's most valuable resource, *you*.

About The Author

Prior to his present assignment, Col Zak has been an AWS Staff Meterologist for Space Division, AFSC, Buckley ANG, CO, part time meterology faculty member at Metropolitan State College, Denver, CO, and a Department of Defense Representative to the Prototype Regional Observing and Forecasting Service at Boulder, CO. He has 19 years of military service and holds a BS and MS in meterology from the Pennsylvania State University and a PhD in Meterology from Texas A&M. ■

DO YOU REALLY KNOW WHERE YOU ARE?

MAJOR MICHAEL T. FAGAN
Directorate of Aerospace Safety

■ This is not a story about getting lost. It describes three events, each occurring in legally approved areas under responsible supervision. Unfortunately, the location of these events is coincident.

Just west of Lake Arrowhead, California, is an area known as "The Pinnacles." It is a beautiful spot where the forest ecology of the south slope of Miller Canyon transitions into the desert ecology of the Mojave. At the east end of Miller Canyon, there is a public rifle range.

The sectional chart shows a military training route (MTR) three miles north of the rifle range, north of a scenic rocky peak. It does not show the rifle range which is at an altitude of 5,100 feet MSL.

South of the rifle range is the ridgecrest of the San Bernardino mountains, rising as high as 7,000 feet. Farther south is the heavily trafficked airspace leading into Norton AFB, March AFB, Ontario International Airport, and LAX. This area is not so scenic, and a place where casual airborne sightseers often fear to tread.

Those of you who have had the opportunity to fire military rifles with tracer ammunition at night will know that, on the best rifle ranges, with soft earth backstops, ricochets are frequent. Perhaps one out of five rounds will take off in a nearly vertical path after striking the berm. While its initial velocity is reduced, it still has several hundred feet of climb in it.

To put these three seemingly unrelated sets of circumstances together, imagine yourself with me on a Sunday afternoon sighting in the old deer rifle. Also shooting are some 12 others, firing everything from plinkers to safari-weight heavy rifles. It is a well-supervised range, so everyone opened the actions and laid down their weapons when the range master called, "cease fire!"

As I pulled off my ear protection, a little irritated at an unscheduled delay, the reason for the cease fire became obvious. An older model Cessna 150 was droning across the field of fire, about 300 feet AGL. While the chance of an odd ricochet hitting the plane was slight, we took no risks.

The two occupants of the bugsmasher were sightseeing — perhaps it was a training flight. They were near enough that we could see the colors of their shirts. They made

a gentle bank to the left, looked down at the rifle range from above the backstop, and continued west toward Miller Canyon. They appeared unaware of our presence, and much less the danger of flying over an active shooting range.

At this moment, another common visitor appeared. A flight of two Navy fighters came out of the canyon, west to east, at half the speed of heat. They must have seen the Cessna. They split, passing on either side of it with room to spare. It's possible the light aircraft did not see the fighters as it did not alter course.

Number two in the military flight probably didn't notice that he, like the light aircraft, flew directly over the backstop of an active firing range at a little more than 300 feet AGL.

The military guys were legal and "heads up" for the light civilian traffic. The military training route is 10 miles wide. At the speed they travel, there might not be time for a "cease fire" between noticing them and their overflight of the range.

The Cessna pilot was legal, away from populated areas, and the people were enjoying the beautiful scenery which is one of the reasons they put windows in the side of those things. His sectional, if he was using one, showed him three miles south of the MTR, with a mountain in between. The map didn't show the rifle range nor did it give a clue that the training route extends five miles either side of centerline to well south of the range.

The shooters were legal, safety conscious, and well supervised. While they stopped firing for the light aircraft, there would not have been time to call a cease fire between noticing the high-speed jets and their overflight, had they come first.

Everyone was legal, but the risk of a disaster was present, either from a midair or being struck by up to 220 grains of spent bullet. For a moment, uncongested airspace became congested. A near midair collision would have been attributed to "failure to see and avoid" under conditions which make seeing and avoiding difficult (head on, at a high speed against a cluttered background of mountains).

So you're legal, safety conscious, and the weather is unrestricted VFR. Are you aware of what you may encounter out there? Do you *really* know where you are? ■

OPS TOPICS

It's Insidious!

■ Sometime during climbout from low level, both F-111 crewmembers disconnected the right sides of their oxygen masks. On this flight and on the previous flight by the same crew in this aircraft the cabin pressure had been fluctuating between 8,000 and 11,000 feet and the cabin pressure warning light had been flashing each time the cabin altitude exceeded 10,000 feet.

After about 30 minutes at altitude, the pilot noticed that the cabin altitude was 20,000 feet. He advised the WSO and both crewmembers reconnected their oxygen masks. Both crewmembers immediately recognized resolution of hypoxia symptoms which to that time had gone unnoticed!

But It Didn't Seem Too Bad

Two F-4s took off on a scheduled surface attack mission. Just as the flight lifted off, Number 2 saw and heard a bird strike the aircraft. The crew saw no indications of engine problems. Lead looked the aircraft over but saw no damage. Therefore, they elected to continue the mission. After landing, the crew reported the birdstrike, and maintenance investigators found bird remains in the Number 1 intake and damage to the compressor.

TAF reg 55-4 has very specific guidance on air aborts. "If foreign object damage (including birdstrike) occurs or is suspected, the mission will be aborted regardless of apparent damage."

In this case, the lesson should have been learned long before the mishap. This crew was very fortunate that the damaged engine didn't cause problems at a critical point in the mission. The rules are for everyone, and an overwhelming desire to complete the mission is no excuse to violate them.

Tail Scrape

Shortly after touchdown, an F-15 pilot used external references to rotate the nose of his Eagle to a 12-13 degree attitude for aerobraking. Then the pilot mistakenly used the HUD velocity vector instead of the fuselage reference symbol to refine and finalize the aerobrake attitude. When no velocity vector movement was observed, the pilot rapidly increased the pitch rate and in so doing exceeded the aerobrake limits and scraped both tail cones.

This was the pilot's first ride in the F-15, and unfamiliarity with the HUD caused him to react as he did. The IP in the rear cockpit was not able to react quickly enough to overcome the front seater's input before the tail cones struck the runway.

FLIP User Comment Card

■ In the 14 April 1983 issue of the DOD FLIP Enroute Supplement a user comment card was inserted to provide a convenient method to submit errors, corrections, omissions or changes to improve content or presentation of DOD FLIP only. The preaddressed and postpaid card is being tested for 6 months to evaluate its utility. The card does not replace procedures for reporting safety and operation hazards nor is it to be used for commenting on military department operational policies. — Major Harber, DMAAC/PRRF, AUTOVON 693-4961. ■

Spring — Birds

A C-5 was flying an ILS approach to an east coast base. When the aircraft broke out of a 500 foot overcast, the crew did not see any birds. As the aircraft approached minimums, the copilot saw a very large flock of blackbirds take flight and begin climbing toward the aircraft's flight path. The crew initiated a go-around but could not avoid the birds. The aircraft sustained around 250 birdstrikes causing Class B damage to all four engines, the leading edge slats, and both wings.

This base is in the Atlantic flyway and so is directly in the migratory path of millions of birds each year. The only effective birdstrike prevention action in such an area is avoidance. Although this crew took all the action they could to avoid the birds, they were unsuccessful. If you are flying in an area of known bird activity, be aware of the hazards and be prepared to take necessary avoidance action.

Late to Rotate

During take off at about 126 knots, an F-16 pilot began back stick pressure to rotate. Noting no pitch response and suspecting a premature rotation attempt, the pilot relaxed back pressure and then reapplied it at about 130 knots. Again, there was no pitch response, so the pilot aborted.

The flight controls were working properly and the pilot had properly computed the rotation speed as 127 knots. However, he was not aware that the nose strut was underserviced. This underservicing caused an 8 knot increase in rotation speed. Thus, the aircraft did not rotate because it never reached 135 knots.

Visual verification of strut servicing is very difficult, so it is not surprising that the pilot was not aware of the low strut. Consequently, he reacted as he should have to the failure to rotate, given the information he had.

Engine Failure?

An F-4 was on a surface attack tactics mission. After a simulated attack, the pilot initiated a 60-degree climbing turn at 450 knots and 6,000 feet MSL.

A few seconds after the pilot had reduced power from mil to 85 percent, the WSO advised that he thought the right engine had failed.

Both the pilot and WSO noted the right rpm at zero but failed to note normal readings for EGT, fuel flow, nozzles, oil pressure, and hydraulic pressure as well as a functioning right generator. The pilot attempted an immediate airstart, then stopcocked the throttle and had the WSO refer to the checklist.

The engine restarted normally, but the pilot shut it down again when there was no rpm indication. He then declared an emergency for a failed/frozen right engine and made an uneventful single engine landing. Maintenance replaced the worn tach generator spline shaft for the right engine, and the aircraft flew without further problem. ■

Lightning Can Be A Problem!

■ An F-15 was crusing IMC at FL 330 on ATC vectors to avoid thunderstorms when there was a flash of light and a severe jolt throughout the aircraft structure.

Almost immediately, the pilot saw the left boost pump warning light illuminate followed by the PC-1A hydraulic system light. The pilot continued toward a recovery base and, several minutes after the initial jolt, the AMAD fire light came on. The light went out when the throttles were retarded, but the pilot found that the right engine was stuck at 82 percent.

At this point, the pilot began an enroute descent to his recovery base. There were no further problems until about 25 NMs from the field when the AMAD fire light began to flash and then came on steady indicating first, overheat, and then, fire. Shortly thereafter, the primary attitude indicator failed in INS mode followed by rapid wind down of the fuel quantity gauge. Fortunately, by this time the pilot was VMC and ready to turn final for a straight-in approach.

After he completed the turn, he shut down the right engine with the master switch, configured and completed a successful landing. During the rollout the tower advised that the aircraft was on fire. The pilot stopped on the runway and safely egressed while the fire department put out the fire.

Investigators, following reports from witnesses, conducted extensive searches of the area of the flight looking for parts of the centerline tank which had been lost in flight. The tank had exploded with such violence that pieces of shrapnel from the tank penetrated the aircraft skin and caused considerable damage. It was this damage which gave the pilot the problems he encountered.

For example, a piece of the tank nose cone was found imbedded in the forward avionics bay just aft of the radome. This piece had penetrated two bulkheads before coming to rest. Another piece entered the right engine bay severing the throttle linkage to the unified fuel control. This was the cause of the pilot's loss of throttle control of the right engine. Pieces of shrapnel also damaged the PC-1A circuit breaker and the fuel pressure switch in tank 3A. The latter damage caused a pressurized fuel leak, resulting in a fire.

Investigators were not having much luck determining the source of the explosion and fire until they recovered two large sections of the centerline tank nose cone and tail cone. These pieces had positive evidence of five separate lightning attach points. There were no lightning burn-throughs, but subsequent tests on another tank showed that lightning could cause internal arcing at the drain plug. This arcing could cause ignition of the fuel air mixture in the tank and the explosion. ■

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UNITED STATES AIR FORCE

Well Done Award

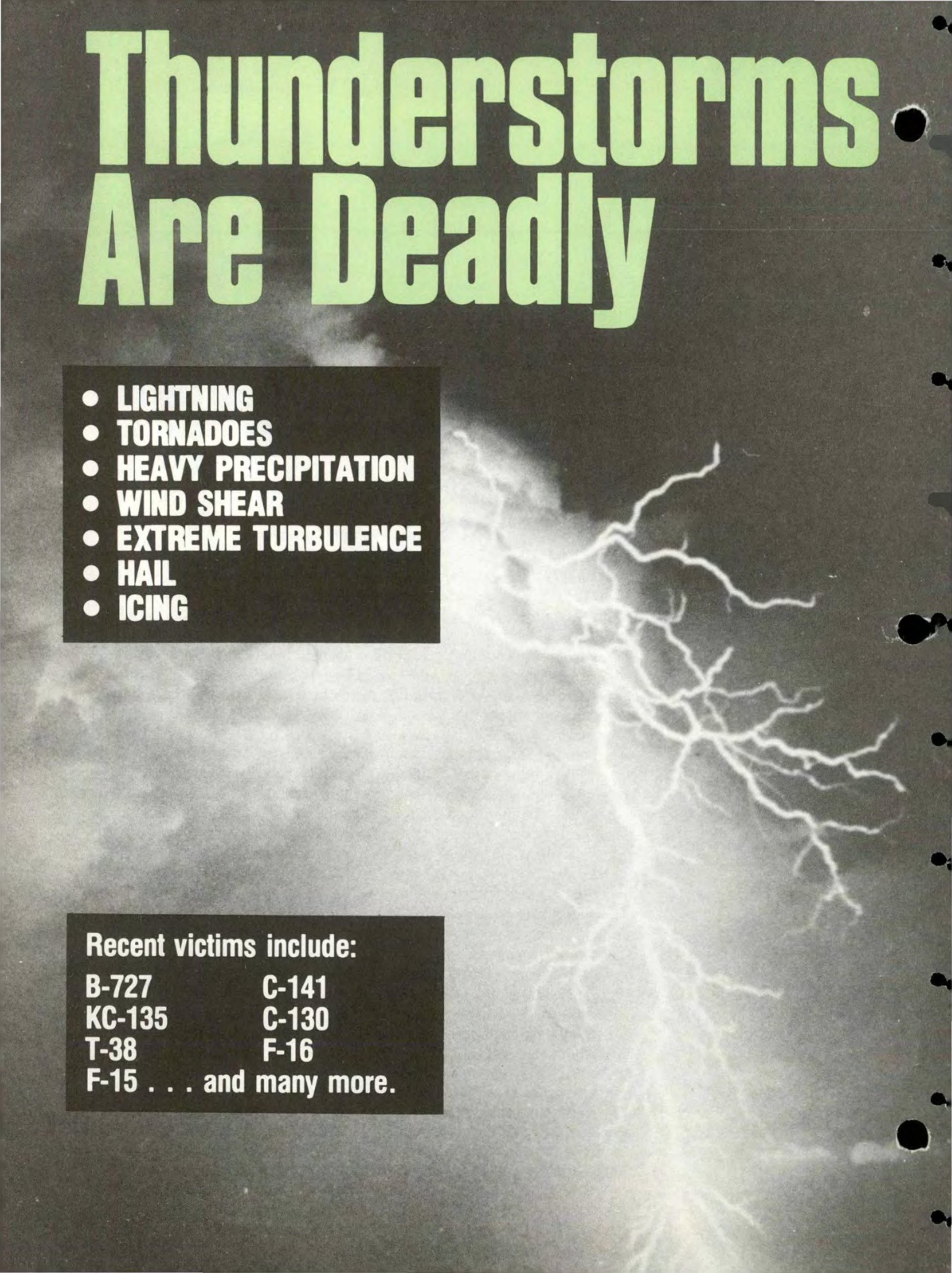
outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.

CAPTAIN
Braxton P. Smallwood

FIRST LIEUTENANT
Craig E. Tubb

77th Tactical Fighter Squadron

On 3 May 1982, Captain Smallwood and Lieutenant Tubb were flying an F-111E aircraft on a single-ship training mission at 500' AGL. Approximately 10 minutes after the low level entry, Captain Smallwood felt spurious stick movements in the roll axis. The roll channel caution lamp illuminated, and Captain Smallwood immediately initiated a climb to altitude, swept the wings forward to 26 degrees, and headed the aircraft towards home base. After initiating the climb, Captain Smallwood felt the stick continue aft and the aircraft continued to pitch up. He selected full afterburner to maintain airspeed and used both hands to apply forward stick pressure to arrest the pitchup. During this maneuver all eight flight control lights illuminated. The spurious roll inputs subsided, but the aft pressure continued. Both crewmembers depressed their autopilot release lever to alleviate the aft stick forces, but to no avail. Seconds afterward, the wheel well hot caution lamp illuminated indicating a possible bleed air line rupture in the main wheel well. The crew accomplished the bold print emergency actions to vent the wheel well. Captain Smallwood turned off all three flight control damper switches and the wheel well hot lamp extinguished and the spurious flight control inputs disappeared. After leveling off at FL 200, and as the airspeed decreased, the aircraft became nose heavy. All trim modes were inoperative. Since the weather was bad, a long, straight-in was planned. A controllability check was made at FL 150, and gear, flaps, and slats extended normally. However, with full flaps, nose down stick force was so heavy that Lieutenant Tubb had to use both hands on the right seat stick to help Captain Smallwood maintain level flight. Throughout the approach the crew worked on coordinating the aft stick inputs. Following an uneventful landing, investigators found that a bleed air duct carrying 1,000°F air had ruptured and burned through 45 of the 54 wires in the bundle which carries all the flight control wiring from the rate gyros to the flight control computers. The calm, timely actions of Captain Smallwood and Lieutenant Tubb resulted in the safe recovery of a valuable aircraft. WELL DONE! ■


Thunderstorms Are Deadly
• LIGHTNING
• TORNADOES
• HEAVY PRECIPITATION
• WIND SHEAR
• EXTREME TURBULENCE
• HAIL
• ICING
Recent victims include:
B-727 C-141
KC-135 C-130
T-38 F-16
F-15 . . . and many more.