flying

SAFETY

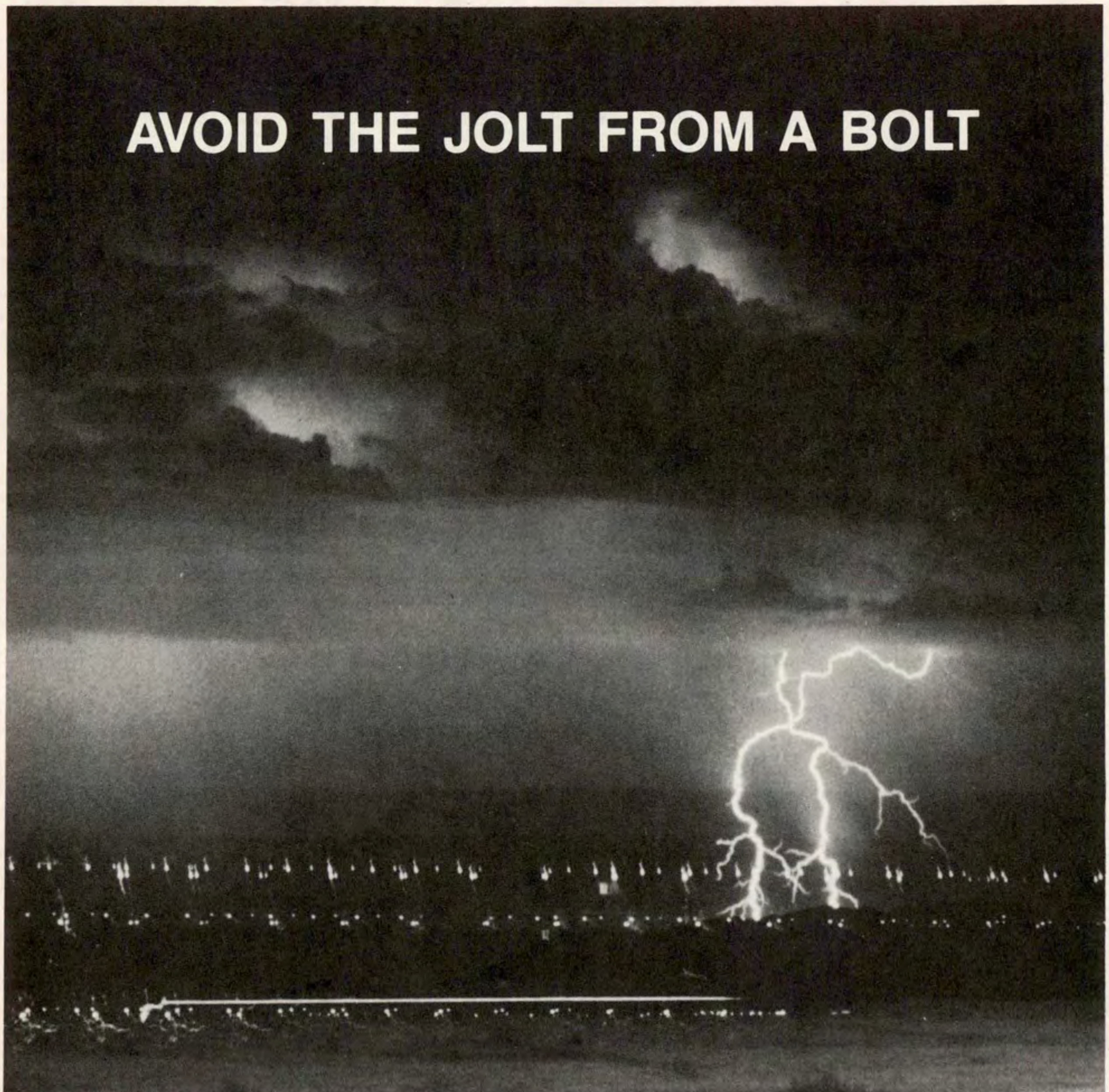
FEBRUARY 1987

Crew Actions In An Emergency

Rivet Workforce

Spring Forward or Fall Back?

The Early Days



THERE I WAS

■ . . . fangs out, hair on fire, making my best ZSU break off some vehicles I'd just "shacked" with simulated Rockeye. Fat, dumb, and proverbially happy, I started to roll out and head back to the IP when something big and dark flashed by just under the canopy rail. My God, I almost hit my wingman! "Reno, knock it off . . ."

How could this have happened? My mind was already reviewing the previous attack. Obviously, Four had turned into me, not away. "Reno, set up for another attack," said lead. "Ah, Reno One, Reno Three and Four just scared ourselves pretty bad," I said. "Roger, can you RTB OK?" "Yeah." "See you later."

In the debrief, Four and I discussed how we almost reached out and touched one another. We had briefed our attack options against this target, an airfield in northeastern England. The four ship was to attack in coordinated two ships from separate IPs sequenced to the sectored target.

I would carry simulated Mk 20, and I told my wingie to plan on suppressing the target defenses at long range with 30mm while I pressed in with the Rockeye. I made it clear. Four should avoid getting too close to the target in his suppressor role. We discussed ordnance and flightpath deconfliction thoroughly, or so I'd thought.

The first attack went well, despite the rain showers in the generally good VMC area. Both Four and I got a tally on the target, some vehicles, on the first pass. Then One directed Rockeye attacks for the element leads, so I air briefed a line ingress to a split with Four suppressor and myself, the bomber. One and Two would be attacking 30 seconds before us from the north. Four was on the left as we ingressed heading east.

As I came off the target, I heard Four call "off right." I looked up to see him about 2,500 feet away. Yes, he was turning right, tail on. No conflict, I thought, and called "visual" as I racked over into a hard left bank to separate toward the IP. In fact, our flightpaths almost converged — we later estimated we passed within 50 feet of each other.

What happened to make our attack a near Fox-Four? After I finished hammering Four for overflying the target (your job was to suppress, not go for the min range shot), I pointed out my own big error — calling visual and then failing to continue clearing my flightpath. Anyone who's ever seen the A-10 in the air knows how easy it is to mistake aspect and angle off. The jet appears as a dark silhouette, and its odd angles can fool even an experienced hog driver. Coming off the target, I "saw" my wingman turning north.

If I'd thought about it for a moment, I would have realized Four had pressed in too close and was turning *toward* me. Four said he had been worried about the location of the other element and had turned south to avoid them. An error, since we were well separated by time, but it made me think — should I have put the wingman on the other side on ingress? Also, Four made the same mistake I did — he "saw" me turn away from him and relaxed his vigilance. In retrospect, we both should have realized immediately we were headed toward each other — it was obvious from the geometry of the attack.

Lessons learned? For the wingie: Do as you're told, and if you can't, tell somebody about it (a KIO would have been appropriate here). For the leader: Yeah, it's tough navigating, setting up your weapons and countermeasures, and performing all the tasks to run your attack — but don't let an experienced wingman suck you into relaxing. Monitor your wingman and *anticipate* his actions. Finally, for both: It's absolutely vital for tactical partners to get and maintain sight of each other when they're that close. Don't assume anything. Complacency almost killed us. ■

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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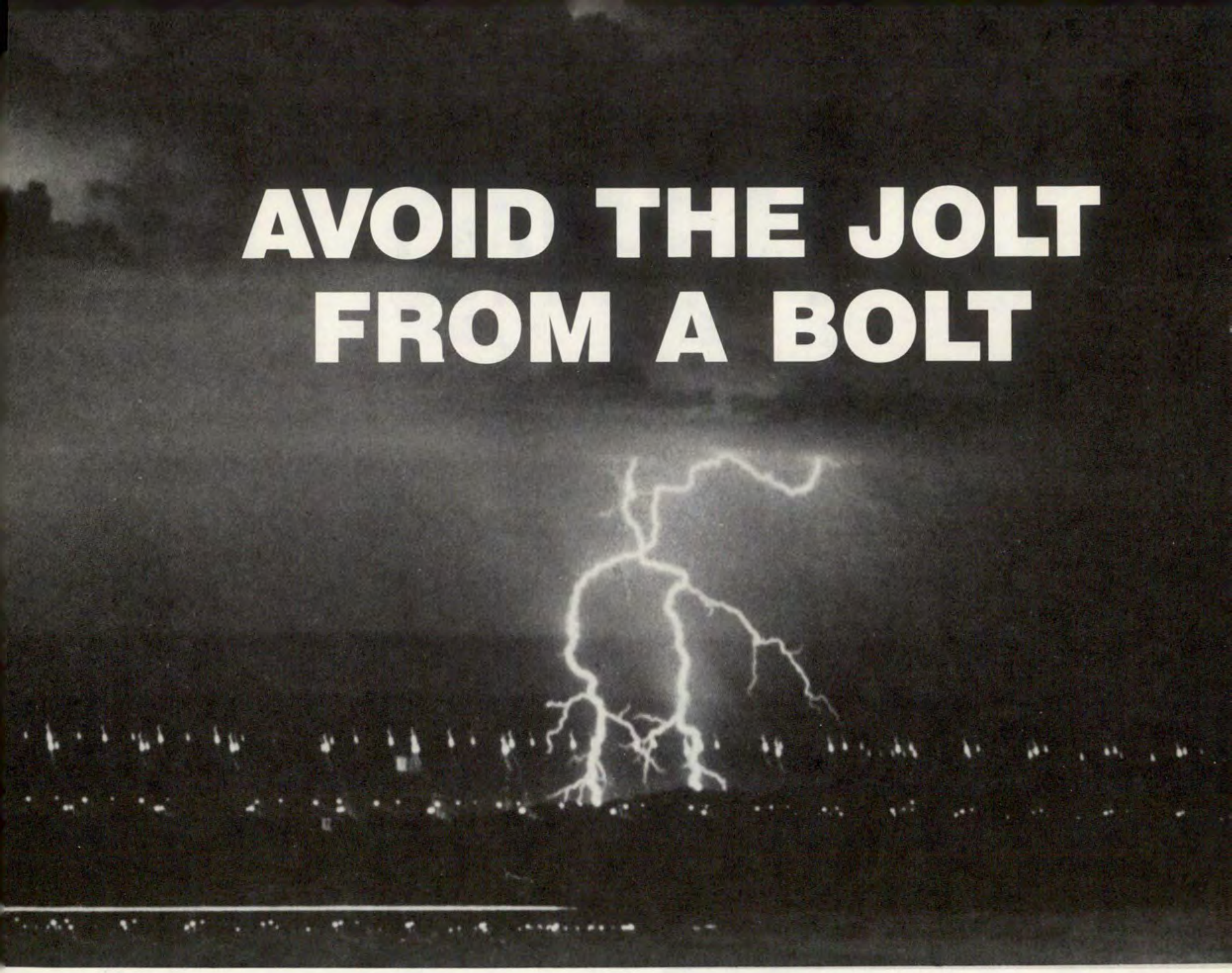

AVOID THE JOLT FROM A BOLT

LT COL KARL F. ZELLER, USAFR
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■ Is lightning really a threat to you and your aircraft? You bet! Just as we take precautions ourselves and teach our children to avoid lightning on the ground, so must we take precautions to avoid lightning and to protect ourselves, our passengers, and our aircraft in the air! "The h--- you say?"

Well, here's the flash news: Lightning can delete you and your aircraft in the air, but lucky for you there are some easy-to-remember rules based on actual pilot experience to help keep your aircraft flying, your destination met, and your retirement years attainable. Unlike the lesson learned from Mr. Franklin — not to fly kites during a thunderstorm (TSTM) — you can continue to fly if you know the rules.

Recent lightning research involved the deliberate penetration of TSTMs by high-performance aircraft at all altitudes and temperatures. The accumulated data from these flights show average strike altitudes around 28,000 feet, average strike temperature at −32° C, and the peak number of strikes at −42° C. They also showed most of the strikes were actually triggered by the aircraft itself.

Prior to this research, it was thought an aircraft had to fly into the path of naturally occurring lightning to get struck, and the altitudes near the freezing level (0° C) were considered the most probable location for this to happen. The research data seem to conflict with previous statistics.

Does this mean all the old rules don't apply anymore? Not at all. It just means we are learning more about the behavior of lightning and its effects on aircraft. Many of the old rules are still valid for USAF aircraft operations, and several new rules are being developed for the future. To set the record straight, this article will present some of the new information and will also review the old rules. It should provide you valuable information about how to avoid most lightning strikes and what to expect if you do get struck.

Lightning and TSTMs in the Scheme of Things

Actually TSTMs and lightning are part of a global electric circuit. According to God's plan to maintain an electric potential between the Earth's surface and the ionosphere (called the "fair weather" electric potential), TSTMs are necessary. Figure 1 is a simplified diagram of the electric field between the ionosphere and the Earth's surface. It shows the TSTM plays a key role in maintaining the Earth's fair weather electric potential. In fact, the total number of all TSTMs occurring at any given time around the globe is approximately 2,000. These TSTMs average about 100 strikes per second. They act as an electric generator, maintaining the electric field. From this perspective, lightning within a TSTM cloud helps maintain the Earth's electric potential.

Figure 2 shows the worldwide average number of TSTM days per year. Statistics show commercial pilots experience an average of one lightning strike for every 3,000 flight hours, and the commercial airlines average one hit per aircraft per year. Air Force statistics show a lesser rate than the civilians. This can be explained by the differences in mission profiles and more conscientious avoidance by USAF pilots which result in a lower rate of exposure of Air Force aircraft to hazardous

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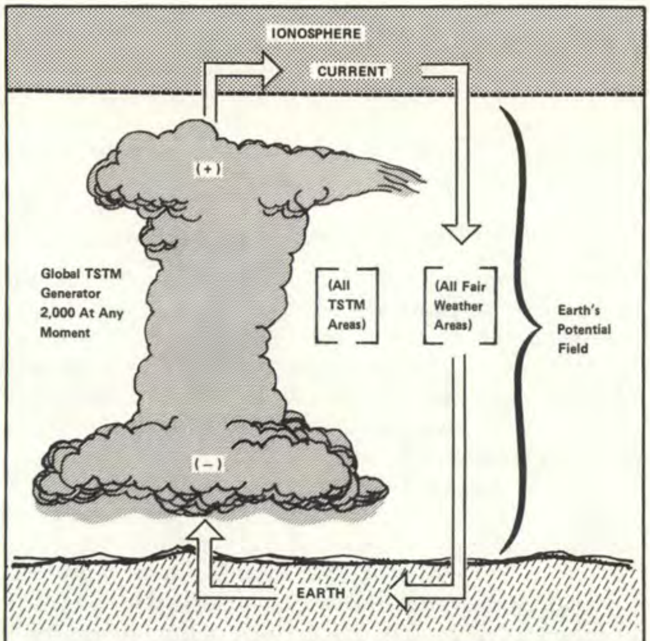


Figure 1. Diagram of the relation of all TSTMs at any moment to the Earth's electric potential. (Remember: Current flows from plus to minus while electrons flow from minus to plus.)

Although the highest averages are in Central America, South America, and Africa, that doesn't lessen the danger elsewhere. They grow them big in Texas, and the US TSTM season will soon be upon us.

conditions. Nonetheless, the USAF has averaged 51 lightning mishaps per year since 1981.

Aircraft Damage Caused by Lightning

You may be surprised to find lightning strikes are responsible for more than half of the weather-related mishaps in the Air Force. From 1975 through 1985, these mishaps resulted in nearly $80 million of damage and included the loss of 10 aircraft and 8 lives. Fifty-seven percent of the mishaps occurred during the months from March through July.

Aircraft damage from lightning can be caused as a direct or indirect effect. Direct effects result when the lightning current attaches to and flows through the aircraft skin. Locations on the aircraft where lightning strikes occur experience extreme heating which causes burning and melting damage. Current flowing through the aircraft structure can result in isolated arcing or sparking and heating. If this occurs in a fuel tank, explosion and fire can result.

Indirect effects are caused by transient electrical pulses produced by the changing electric and magnetic fields due to the lightning current. Unless avionics and other systems are properly shielded, they are easily damaged by indirect lightning effects. Figure 3 shows the systems on military aircraft that are most susceptible to lightning hazards.

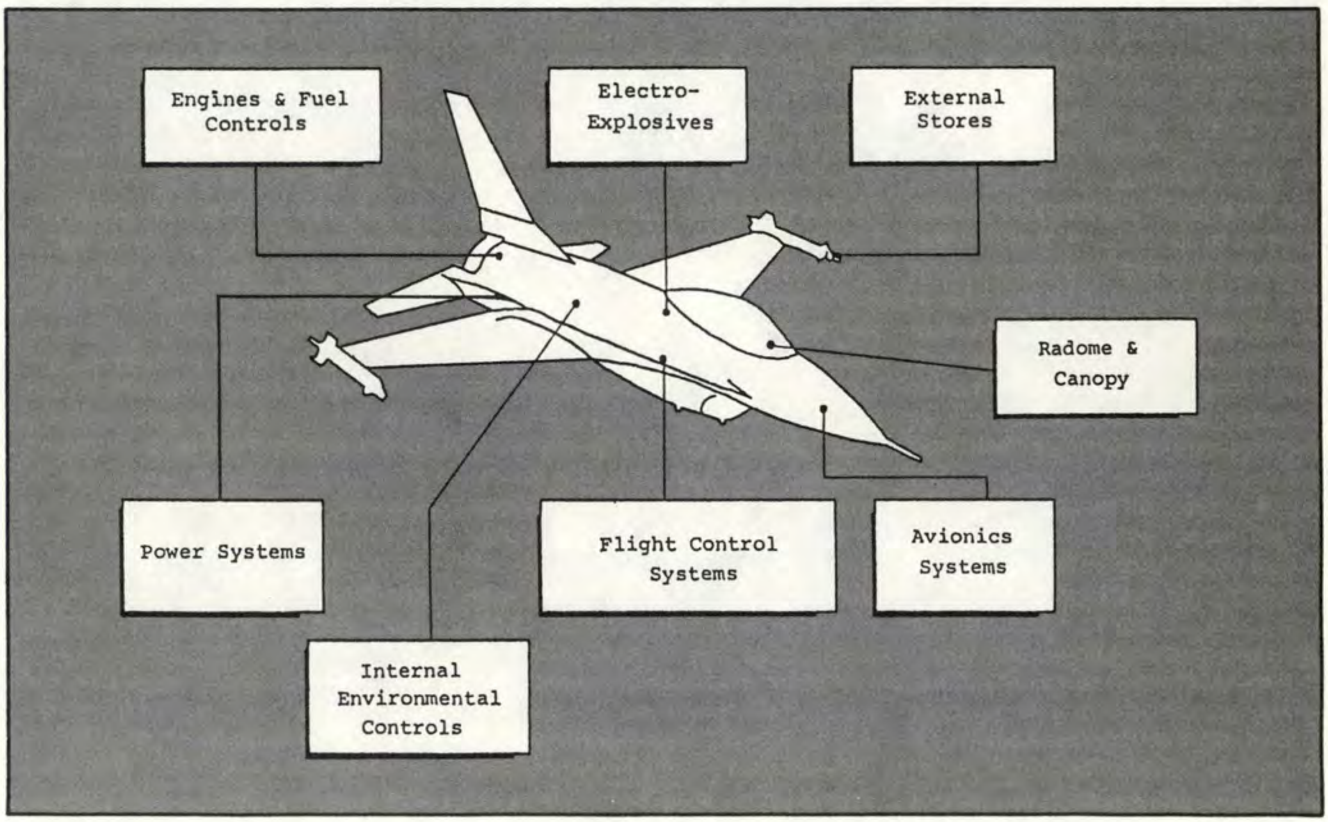
The following is a general list of lightning-caused damages from 773 lightning strike mishaps documented by the US Air Force:

Lightning-Caused Damages

- Pilot disorientation/blinding
- Instrument failure
- Flight control failure
- Fuel tank burnout and explosions
- Engine flameout with electrical failure
- Failure of non-metallic helicopter rotor blades
- Deformation and burnout of aircraft structures
- Acoustic shock/magnetic forces
- Damage to non-metallic aircraft surface components

External areas most frequently damaged are radomes, pitot booms, canopies, antennas, and wing tips. Internal systems affected vary, depending upon protection and shielding. Dr. Philip Corn, Air Force Flight Dynamics Laboratory (AFFDL), has classified eight known lightning related hazards, their cause, and severity. (See table.)

Figure 3. Systems susceptible to atmospheric electricity hazards.



Atmospheric Electricity Threats To Aircraft

HAZARD	CAUSE	SEVERITY
Malfunction/failure of electronic control systems	Low tolerance to electrical transients caused by direct/induced lightning or static electrification effects. May simultaneously affect parallel "redundant" systems.	Minor to catastrophic
Fuel tank explosion/fire	Fuel vapor ignition caused by static electricity or lightning effects.	Serious to catastrophic
Loss of engine	Possible lightning acoustic shock at engine inlet, or electrical transient effects on engine controls.	Serious
Prerelease/ignition of external stores	Premature activation caused by lightning or static electrification effects.	Serious to catastrophic
Radome, canopy, and windshield damage	Direct lightning strikes; arc discharge caused by static electricity buildup.	Minor to serious
Instrumentation problems/communications, navigation, and landing system interference	Transient effects caused by static electricity buildup and direct and nearby lightning strikes.	Minor to catastrophic
Structural damage	Direct lightning attachment to aircraft	Minor to serious
Physiological effects on crew	Flash blindness and distracting or disabling electrical shock caused by direct and nearby lightning strikes.	Minor to catastrophic

Recent Lightning Studies Related to Aircraft Strikes

Recent experimental flights designed to determine probabilities and causes of aircraft lightning strikes have provided some new information related to your chances of receiving a "jolt from a bolt." Although there have been several recent studies, the bulk of the new information comes from two research projects: A USAF/FAA July to September 1984 study which involved the use of a CV-580 specially instrumented aircraft which flew for 42 hours and experienced 21 lightning strikes; and from a NASA Storm Hazards Program, conducted between 1980 and 1984, which involved the use of a specially instrumented F-106B aircraft which made 1,154 TSTM penetrations and received 637 lightning strikes. These studies show:

1. The majority of the strikes (►90%) were triggered by the aircraft itself.

2. The probability of aircraft triggering a lightning discharge in a thunderstorm increased with altitude.

3. The probability of a lightning strike to an aircraft flying in a thunderstorm increased from a minimum at the TSTM base to a maximum at the 36,000 to 40,000 foot level. The temperature at this level was from $-40°$ C to $-45°$ C. The strike rate encountered at these high altitudes was two strikes per minute of penetration time. At 18,000 feet, the frequency was one strike every 20 minutes. An average of only one aircraft strike every 3 hours was encountered when flying below active thunderstorms.

4. Lightning strikes at high altitudes generally resulted in greater total charge transfer than strikes at lower altitude; however, the low altitude strikes sometimes produced greater instantaneous discharge.

5. The entire surface of the aircraft may be susceptible to lightning attachment even though strikes are more probable to particular areas such as the aircraft extremities (nose, wing tips, tail) and composite surfaces.

6. During penetration of thunderstorms at low levels, lightning strikes were found to occur in areas of moderate or greater turbulence at the edge of and within large downdrafts. Conversely, lightning strikes experienced in the upper areas of TSTMs and in the vicinity of decaying TSTMs most frequently occurred under conditions of little turbulence or precipitation.

continued

AVOID THE JOLT FROM A BOLT . . . continued

Facts and Myths

Combining this new research information on lightning with the lessons of the past, let's examine the following myths for validation.

Myth	Fact
At least 50% of USAF weather-related aircraft mishaps are caused by lightning strikes.	TRUE: Annual USAF flight safety statistics consistently show that more than half of all weather-related mishaps are caused by lightning strikes to aircraft.
Some aircraft are less prone to lightning strikes.	TRUE: Size, shape, and speed are all aircraft specific variables which determine an aircraft's susceptibility to a strike. However, *all* aircraft are susceptible to a lightning hit.
Aircraft damage varies with aircraft type.	TRUE: Careful aircraft design can minimize lightning damage. However, all surfaces are susceptible to a hit, and all unprotected systems can be affected.
Some pilots are better at avoiding lightning strikes than others.	TRUE: The wider the berth given to TSTMs, the better the chance of avoiding a strike; however, if you try to pick your way between thunderstorm cells, you are asking for trouble.
If you avoid thunderstorms, you will avoid all lightning strikes.	FALSE: Statistics show that many triggered strikes have occurred during flights that did not penetrate thunderstorms. Aircraft have triggered strikes in cirrus clouds downwind of previous thunderstorm activity, in cumulus clouds around the periphery of thunderstorms, and even in stratiform clouds and light rain showers not associated with thunderstorms.
If you are greater than 20 miles from radar-indicated precipitation, you are "in the clear" with respect to a lightning strike.	FALSE: Aircraft have been struck by the proverbial "bolt out of the blue." In addition, aircraft have been struck at distances out to 50 nautical miles from thunderstorms, particularly when cirrus clouds existed above or at their flight level, or when there were other developing showers nearby that hadn't reached maturity.
Flying through precipitation, volcanic ash, or heavily polluted air can cause an aircraft to experience electrostatic discharge or triggered lightning.	TRUE: Usually these discharges only cause minor aircraft damage; however, there is always the chance for catastrophic damage if the discharge passes through the vaporized fuel-air mixture in the fuel tank.
Lightning strikes to aircraft only occur near the freezing level and are always associated with turbulence and precipitation.	FALSE: Recent thunderstorm penetration studies show lightning strikes can be encountered at all temperatures and altitudes. In fact, they are most likely to occur in the upper levels of mature or decaying storms near temperatures of −40°C. In addition, the studies showed most strikes occurred in regions where turbulence intensities were light to negligible.
You should avoid flight in clouds near the freezing level.	TRUE: Most lightning strikes not associated with thunderstorms occur near the freezing level. Besides, icing can be a problem as well.
Aircraft flying at altitudes above the freezing level are more likely to be involved with in-cloud or inter-cloud lightning flashes.	TRUE.
Aircraft flying at altitudes below the freezing level are more likely to be involved with a cloud-to-ground lightning event.	TRUE.
The more frequently a TSTM is flashing, the lower is your probability of being struck by lightning if you fly into the storm.	TRUE: However, the greater the flash rate, the higher the potential for severe turbulence, heavy rain, and hail. Therefore, don't interpret this new information as a reason to fly in or near any thunderstorm.

Rules of Thumb

Now that you know the facts, here are some rules of thumb that have been proved with time.

1. Stay clear of TSTMs (follow Air Force and MAJCOM guidelines as a minimum). Don't attempt to "pick your way through"; deviate around the area on the upwind (nonanvil) side, if possible.

2. The most probable lightning strike location for USAF aircraft missions that avoid thunderstorms is within ±8° C or ±5,000 feet of the freezing level. For those missions that result in unavoidable thunderstorm penetration, the most probable location for a lightning strike is above 28,000 feet at temperatures colder than −32° C.

3. The higher the aircraft altitude, the farther away from a TSTM you should fly. Lightning strikes have been known to occur in the clear air up to 50 miles downwind from the nearest TSTM.

4. At low levels, avoid flying close to high surface features (ridge tops, towers, etc.), or between such features and an overhead TSTM.

5. Generally, the larger the aircraft, the greater the probability the aircraft can initiate a lightning strike. There are exceptions, however, because there are many other factors involved. For example, the Air Force experiences more C-130 lightning mishaps than C-5 mishaps. This is probably explained by the difference in mission profiles. The C-130 generally spends more time in the clouds at altitudes conducive to "triggered" lightning strikes. The C-5 spends a greater percentage of flight time in visual meteorological conditions (VMC).

6. Probability-of-lightning conditions (POLC) statements that may be provided by your AWS forecaster are *not* a probability of your chances of being struck, but are an assessment of the occurrence of meteorological conditions associated with lightning strikes. One hundred percent POLC means all the conditions are present for a lightning strike to occur. Statistically however, only 2 or 3 percent of flights under these conditions experience lightning strikes.

TSTM Information

If you have to penetrate or fly close to a TSTM system, here is some additional information that may be useful to you:

1. If you fly above the freezing level in or near TSTMs, you can trigger an in-cloud or cloud-to-cloud discharge. If you fly below the freezing level, you could be involved with a cloud-to-ground lightning strike. Overall, you can expect more hits penetrating a TSTM area at altitudes well above the freezing level.

2. Lightning damage is usually worse for large total current transfers. At altitudes above the freezing level, you are more likely to experience longer-lasting lightning attachments made up of numerous small pulses and a large total current transfer. Below the freezing level, you are more likely to experience shorter lightning attachments with a few strong current pulses; however, the total current transfer is usually less than that above the freezing level.

3. Lightning has been known to strike several aircraft in formation, simultaneously. During formation flights, fly single-ship or radar trail in areas where the strike potential is high.

4. Electrical activity generated by a thunderstorm may exist even after the thunderstorm cell has decayed; therefore, avoid penetrating the cirrus decks that were once associated with thunderstorms.

A Word About the Future

Most existing military aircraft have metallic skins and structures that protect crewmembers, passengers, and instrumentation inside the aircraft from the effects of lightning strikes and electric discharges. However, many of the new lightweight, non-metallic structural materials provide less protection for internal contents.

In addition, advanced aircraft have sophisticated electronic and electrical subsystems which are more prone to lightning damage. Most aircraft designers have concluded total avoidance of lightning strikes is not possible. Therefore, the possible effects of lightning are a great concern in the design of advanced aircraft and are the subject of extensive research. (See "Lightning Protection for the Eagle" — *TAC Attack*, March, 1984.)

The final word: Pilot awareness of lightning and where it might occur is, and always has been, an important consideration for any mission. With the new breed of sophisticated, lightweight aircraft, this concern will continue to be a valid one. ■

CREW ACTIONS IN AN EMERGENCY

In an emergency, crew coordination is at its peak of importance and vulnerability.

SQN LDR ALASTAIR G. BRIDGES
RAAF
Directorate of Aerospace Safety

"Mayday, Mayday, Mayday. We have an engine fire and are returning to the airfield."

■ The military transport had departed only 4 minutes earlier with a crew of 6 and 9 passengers on board. It never made it back. After the left wing failed from the engine fire, the aircraft dropped into a river, 1,700 feet short of the runway threshold. The only survivor, a passenger, was thrown clear.

The investigation revealed an internal failure in the engine, resulting in major damage and an uncontrollable oil-fed fire. The crew had probably diagnosed the problem initially as the usual rough-running engine and had reduced power for 90 seconds before shutting it down. The aircraft reached 9 miles from the airfield during its turn back, and the left propeller was feathered at 7 miles inbound. Witnesses reported seeing the left engine on fire at 6 miles, although the left wheel stayed up. On short final, the flames were noticed to be intense, and the engine was drooping. Heat from the fire weakened the wing structure which began to fail at the front spar; the failure progressed to the rear. On impact, all seat belts failed due to excessive G-forces.

The investigation noted that a similar mishap involving a civilian version occurred at altitude. Although the crew feathered the propeller immediately and all actions were performed promptly, the wing failed 6 minutes after the initial emergency call.

The pilots did all that could be reasonably expected of them. They commenced a turn back but without any strong sense of urgency. They completed the Dash One procedures and prepared for landing. With the runway in sight less than 8 miles away, and established on final, probably neither pilot considered an emergency landing or a ditching in the river; how many of us would? And if consideration was given to ditching, no one was wearing life jackets; after all, it was a land-locked airfield they were using.

The flight attendants gave the passengers an emergency briefing and removed the over-wing escape hatches. It is unknown what actions the other crewmembers took, although the flight engineer was probably very busy throughout the sequence. It is at critical times like these when crew coordination and teamwork are paramount, and each member of the crew can and should be doing something positive to help save his/her life and the lives of those on board.

Let us move on from this real-life situation to the hypothetical "general" case and ask ourselves just what could each member of the crew do. With an engine problem like this one, both pilots and the flight engineer are going to be pretty busy. If the emergency includes a bit of smoke in the cockpit or a night or IMC approach, the pilots will definitely appreciate useful and timely inputs from other crewmembers.

The aircraft commander (AC) can only base decisions on the inputs received. In this mishap, it is possible the pilot was too busy on final to look out the side window at the engine. If someone had mentioned the flames were intense and the engine was drooping, the AC may have decided to land immediately without lowering the gear. But don't swamp the pilot with information, either. The AC's mind may become saturated and start selecting pieces of information and ignoring others, some of which may be critical. If you are a flight attendant, a loadmaster, or any other crewmember in back with passengers, take on the responsibility to brief the passengers and prepare the cabin without interrupting the pilots.

The copilot should devote full attention to meeting the AC's requirements. The co should be prepared to assist the AC on the controls, if requested; run the checklists asked for and be prepared to suggest other appropriate checks which the AC might overlook in the heat of the moment; and make the radio calls as requested by the AC, but must place AC directions in first place, even ahead of replies to air traffic control. Bearing in mind that the AC will be very busy, the copilot must closely monitor AC actions and indicate loud and clear when AC actions are wrong.

The flight engineer will always be busy in these situations. If the checklist does not fix the problem, then the flight engineer must fall back on experience and systems knowledge. With this, advise the AC of the most appropriate actions to be taken, including whether or not the situation is desperate enough to require an immediate landing. Once all has been done to secure the emergency, the flight engineer can continue to keep the pilot up to date with developments. For example, in this mishap, the engineer may have had time to visually monitor the fire and advise the AC of the changing conditions.

Although this particular mishap aircraft did not have a navigator on board, a navigator could assist in many helpful ways. The navigator is more detached from the emergency than the pilots and so may be better able to determine alternate solutions and predict the outcome of pilot actions. By following the emergency checklist through, the navigator can be a valuable backup to the pilots and flight engineer. The navigator may have time to assist in other ways, too, such as monitoring fire progress and its effect on aircraft structure, aiding the loadmaster with passenger preparation, and securing loose equipment.

The navigator must also carry out routine duties. All NAVAIDS should

continued

be tuned to the airfield and set up for the most suitable instrument approach. NAVAIDS should be monitored to ensure the emergency condition is not adversely affecting their operation. Have the airfield data ready so the pilots can be verbally given such information as runway direction and length, and airfield elevation. Keep the pilots oriented by telling them the position of aids or the airfield in relation to the aircraft when they obviously need such advice. However, this type of advisory information should be provided only on request or when the aircraft is obviously turning the wrong way. Similarly, airspeed, altitude, and rate of descent can be monitored and relayed to the pilots upon request, or when critical.

The loadmaster may be called upon to help troubleshoot, depending on the problem. This is a very good position to monitor fire progress and its effect and the condition of different systems — gear position, flap position, or whatever else could be seen. Again, the loadmaster must not interrupt the pilots unnecessarily, but must advise if, for example, the engine is drooping or one wheel has not come down. The loadmaster must follow the emergency checklist and prepare the cabin or cargo compartment accordingly. All loose equipment must be stowed. Emergency exits should be removed only with the concurrence of the AC. If, however, it is obvious the AC is too busy, then the loadmaster may have to decide on exit removal using the information available; every emergency situation is different, and a loadmaster who has given some thought to emergency actions some time before will be best able to make the right decision in an actual emergency. The loadmaster must also ensure the passengers are briefed and ready with life jackets on, seat belts tight, and bodies in the brace position.

Each member of the crew must be ready to face a unique emergency.

Each member of the crew must be ready to face a unique emergency. Think about the actions you must take in such an emergency. Discuss these kinds of emergencies and your proposed actions with your other crewmembers. That way, they will know what to expect from you if it happens, and you get feedback which will help you to modify your planned actions and know what your other crewmembers might do. Have a personal plan of action to follow once the aircraft comes to rest. Be able to find and operate all the exits and all the escape aids in the dark.

In an emergency, the crew concept is at its peak of importance and vulnerability. To make it work, the crew must work well together, and each member must impose strict self-discipline. Although even the best crews don't always make it, their chances are greatly improved over crews which have never worked well as a team and which dissolve into separate members at the first sign of an emergency. For your own protection, think up unusual emergency scenarios, research them, and talk to your fellow crewmembers about them in-depth. ■

RIVET WORKFORCE

CMSGT AUGUST W. HARTUNG
Maintenance Technical Editor

■ You might say they're planning for the 21st century. They are the men and women responsible for the changes in the aircraft maintenance career fields under an initiative called Rivet Workforce.

Rivet Workforce is the project aimed at providing alternative solutions to maintenance manpower and job performance problems. How will this affect you and me, the aircraft maintainers? Simply stated, job skills and task training of maintenance specialties will broaden. Let's take a look at why these changes are needed, the Rivet Workforce objectives, organization, and process, and the approved proposals.

The aircraft maintenance career fields currently number about 135,000 people, or 29 percent of the total enlisted force. Change is necessary because we have become overly specialized in structuring maintenance jobs for both on- and off-equipment tasks. There are currently 43 distinct maintenance specialties divided into four broad technical career fields: Avionics (32XX), systems (42XXX), aircraft maintenance (43XXX), and munitions (46XXX).

In addition, there are almost 70 additional suffixes or shredouts which identify specific aircraft or subsystems assigned to a specialty. When these are counted, there are well over 100 distinct job specialties in aircraft maintenance.

The ways people are classified, trained, assigned, and used in the work place often produce inefficiencies that impact our maintenance capability. For example, formal "school house" technical training is by nature generic, and Type IV

Rivet Workforce will broaden the job skills of aircraft maintainers, thus enhancing our maintenance capability.

The real key to Rivet Workforce is the participants. The workshop members include those who have the actual hands-on experience.

training must be used to cover specific weapon system demands on the work site. On-the-job training (OJT) is a growing burden to operating units, which must, even with this large training load, still produce essential sorties.

We've all seen situations where workloads are, at times, out of balance, or the workcenter is authorized a whole slot to cover a part time requirement.

As an example, take a look around your own unit. Do you see folks of one or two Air Force specialties (AFSs) whose workload is always at a peak, while others are seldom busy? On the one hand, those who are "maxed out" may feel their work life won't get any better. On the other hand, the people in jobs with a light workload may be the same people constantly picked for details, causing them to feel they are of less value to the workcenter. In essence, the extensive way we have come to specialize and structure our tasks has contributed to these and other problems in the maintenance work force.

What are the objectives of the Rivet Workforce initiative? Four specific steps have been proposed: The first step is to deepen specific job/task skills and allow broadening of skills across different subsystems and maintenance functions. Second, to maximize utility of training and provide greater growth potential to technicians as they rise in rank, the training mix would alter and be phased over the technician's career. Third, by combining similar maintenance specialties, we may redefine our total manpower requirements. (This is especially critical when we're faced with deployments.) The fourth and final step calls for a review of manpower standards to ensure minimum manpower requirements are still met.

Now that we've looked at the reasons and objectives of Rivet Workforce, how do we get there from here? The Air Staff, led by the Maintenance Policy Division (HQ USAF/LEYM), established an action task force in November 1984, consisting of action groups or "Tiger Teams." Participants come from all of the major commands and include the maintenance, manpower, personnel, training, and research communities. Workshops are then organized to consider each set of AFSs targeted for possible restructuring.

Who are the workshop members? Here's the real key to the successful Rivet Workforce process. Participants include on-the-job maintainers, the folks from the flight lines and back shops, who have the actual hands-on experience, contributing as "subject matter experts" (SMEs). Representatives from personnel and training provide valuable inputs to help define the boundaries of the "big picture." The criteria used to evaluate Air Force specialty code (AFSC) restructure options include AFSC size, promotion equity, training impact, manpower utilization, job enrichment versus enlargement, CONUS and overseas imbalances, task difficulty, Air Training Command student flow, unit OJT impact, and so on. Workshop participants explore the pros and cons of each option and develop supportive reasoning for the option judged best. They also recommend changes to existing technical schools, career development courses (CDCs), field training detachment (FTD) courses, OJT, specialty knowledge test (SKT), and duty descriptions in AFR 39-1, Airman Classification.

The workshop findings are then sent to each Tiger Team (Classification, Personnel, Training, Manpower, Funding, Transition/Integration and Publicity) for analysis and coordination. This total effort culminates in a mature proposal for review by all major air commands. Differences in mission, aircraft, and maintenance organization (centralized versus decentralized) are always considered.

Once the restructure proposals are validated and approved, they will be phased in slowly. In fact, it will take several years to fully transition the entire maintenance workforce, thereby minimizing workforce turbulence and allowing mission needs to be met during the transition.

Now that we've reviewed the Rivet Workforce objectives, organization, and process, let's take a look at the approved proposal for the integrated avionics career fields. Effective April 1987, the on- and off-equipment 326XX AFSCs will combine into one on-equipment and one off-equipment AFSC for each weapon system which uses integrated avionics skills.

In the on-equipment effort, AFSC 326XX (integrated avionics attack control systems), 326X7 (integrated avionics flight controls and instruments), and 326X8 (integrated avionics communications, navigation, and penetration aids) will combine into one AFSC per weapon system using integrated avionics AFSCs. The AFSC will be shredded with the current breakdown of subsystems at the 3 and 5 level.

By reducing specialization in the maintenance career field, Rivet Workforce will ease the heavy burden of on-the-job training.

In the off-equipment effort, AFSC 326X3 (integrated avionics electronic warfare test stations) and 326X5 (integrated avionics manual test stations) will combine into one AFSC per weapon system. These AFSCs will be shredded with the current subsystem breakdown at the 3 and 5 level. The A-10 off-equipment AFSC will be the same as the F-16 off-equipment AFSC.

Also recommended for implementation in April 1987 is the Rivet Workforce proposal for the photo/sensors career fields. This effort will combine AFSCs 322X2A, B, and C (sensor systems), the 302X1 (airborne photography), and the 404X1 (airborne meteorology) fields into one common new AFSC with two shredouts. Specifically, sensor aircraft unique systems and airborne pods will be maintained by one AFSC with two shredouts to separate different technologies, radio and electro-optical.

Will the restructuring initiatives of Rivet Workforce cause changes in other aircraft maintenance AFSCs? The answer is yes. In the months to follow, SMEs (perhaps some of you who are reading this article) from maintenance career fields throughout the Air Force will continue to meet and develop proposals to restructure AFSCs or where applicable, transfer specific tasks.

As the Rivet Workforce process moves along, compromises and trade-offs on specific AFS restructures will be made, and Rivet Workforce will continue to review and integrate maintenance jobs, occupations, or AFSs, where feasible, in light of current and foreseeable Air Force combat needs now and for the 21st century. The end goal is a more mobile, flexible, and survivable work force. ■

Spring Forward or Fall B

LT COL JIMMIE D. MARTIN
Editor

■ Here it is February and spring is just around the corner. Boy, it's good to be able to start thinking about the balmy spring weather, green grass, flowers, no snow. Not so fast! It's too early for spring fever. Let's not spring forward just yet. Let's fall back and take another look. Winter is still with us with all the discomforts and hazards to flying that are a part of it. Let's wait awhile to think about those nice, sunny days and dry runways. Depending on where you're stationed, your aircraft, mission, etc., you can still expect to encounter some of those messy runways. Bear with winter and me a little longer and think about making sure you know how to deal with these situations.

As the weather begins to warm up and we see less of the white stuff covering the ground and runways, we may tend to get a little complacent. This lack of concern may also come as a result of becoming used to flying in the stuff and landing on slippery runways. To illustrate my point, I'll use two recent mishaps that happened about this time of year.

The first one involved an F-4 on a full stop landing after an uneventful two ship sortie. The pilot flew a normal approach and made an onspeed touchdown at 155 knots. At 120 knots with 4,000 feet of runway ahead of him, the pilot applied the brakes and felt the anti-skid doing its job. At 105 knots, he heard a pop and felt the right tire blow. The pilot immediately performed the boldface procedures for a blown tire and brought the Phantom to a stop 1,500 feet before reaching the end of the runway.

The tire failed because the right brake had locked even though the anti-skid system had been working properly. How did this happen? The problem was caused by a light coat of frost on the runway. The pilot landed with the right tire on the runway centerline. The frost on the painted centerline reduced the coefficient of friction enough for the wheel to slow to below 30 knots. When that happened, the anti-skid system reverted to manual braking, and the tire locked up when the wheel drifted off the centerline stripe at 105+ knots.

This wheel slow down is exactly the same reaction you would get if the tire was hydroplaning on a layer of water. If the runway has standing water, you expect a loss of braking. In this case, it was much more insidious. Be aware of the danger posed by a little frost on the runway, taxiway, and ramp markings. Not only can you lose braking and steering effectiveness on takeoff or landing, but you can also lose it while taxiing. As the weather warms up and the snows cease to fall, we can still experience frost and it is much more deceptive.

This next mishap involved a much larger aircraft, larger crew, and several mistakes. A KC-135 was returning for practice approaches after an uneventful refueling mission. The pilot made an en route descent

Back?

while navigator No. 2 called the pilot to metro service to get the latest weather. The arrival weather was a 400 foot ceiling, 5/8 mile visibility, and a temperature of 31 degrees Fahrenheit. When the pilot contacted approach control, he was advised of slush on the runway.

Copilot No. 2, who was sitting in the IP seat, computed the landing data and advised the pilot the landing roll would be 7,500 feet. Neither the pilot nor copilot No. 1 checked the landing data. The crew reviewed the flight manual data on landing under icing conditions. The information included a caution which suggested retracting the flaps to prevent damage if landing distance was not critical.

The ceiling and visibility slowly improved while the pilots were practicing multiple approaches. Navigator No. 1 kept checking the runway condition during this time, and the command post advised the runway was covered with two-tenths an inch of slush. However, all three pilots could see the centerline of the runway and considered the surface clear.

The pilot flew the fourth approach to a full stop landing. The weather at the time was an indefinite ceiling, 500 obscured, 1¼ miles varying in light snow, snow grains, and fog, 32 degrees Fahrenheit, RVR 4,000, and RCR: Slush on runway. The pilot still maintained the runway appeared to be in better condition than the official reading.

The pilot flew an on-speed approach to a smooth touchdown about 1,500 to 2,000 feet down the runway on centerline. He actuated the speedbrakes to 60 percent, and the copilot raised the flaps to reduce any possible damage from slush on the runway. The speed at that time was 120 knots and runway remaining was 8,000 feet. The pilot tested the brakes at 110 knots.

The pilot applied the brakes to start slowing down and noticed immediate, rapid anti-skid cycling. The aircraft appeared to slow normally to 80 knots with 5,000 feet remaining. The rate of deceleration then seemed to lessen, and at 2,000 feet remaining, the speed was 60 knots and the anti-skid system was still cycling rapidly. The pilot ordered the flaps lowered, and he released and reapplied brake pressure several times to try to reduce the anti-skid cycling.

With less than 2,000 feet of runway left, the pilot didn't think they would be able to stop in the remaining runway and overrun. To avoid hitting the approach end lighting, he started a gradual left turn onto the hammerhead. The INS indicated 39 knots at this time. The aircraft started turning left, but then went into a skid as it left the runway. The aircraft came to a stop on the hammerhead, but not before the No. 4 engine had hit the top of a snow bank.

The crew really didn't work together very well in this case. The No. 2 copilot miscomputed the landing ground roll as 7,500 feet when it should have been over 9,500 feet with a total landing distance of over 11,000 feet. Neither of the other

continued

There are many effective techniques for coping with slick runways. Use them, but don't neglect the basic need for good crew coordination and crossfeed.

two pilots questioned or checked the landing data.

Based on this erroneous landing data and the pilots' assessment of runway conditions being better than what the command post kept telling them, the crew decided stopping distance wasn't critical. Therefore, they decided to raise the flaps after landing. When they raised the flaps, they put themselves in a situation that required 600 feet more runway to stop than was available.

The pilot landed long (for a slippery runway) and made a smooth touchdown. The aircraft began to hydroplane on the slush, and there was no chance of stopping the aircraft in the runway available.

Techniques

There are tried and proven techniques for dealing with slippery runways. Begin by reading the cold weather section of your Dash One. Talk to the old heads around the squadron about their experiences. Also consider the following tips.

▪ **Conditions** Be pessimistic about runway condition. Plan on the worst case. Don't go by looks as our mishap crew did because appearances can be deceiving. If someone tells you there is slush or some other hazard on the runway, plan on it. What do you lose if you plan on the worst conditions? — Nothing. What do you lose if you plan on the best conditions? — Maybe nothing; maybe everything.

▪ **Performance** Know what performance figures to expect for various configurations and conditions. Have ballpark figures in mind for landing roll under good conditions and bad conditions. If the computed figures are out of line with what you expected under the worst case scenario, recheck them.

▪ **Approach and Landing Speeds** Use short field landing techniques and proper approach speeds. Make sure you don't land fast or long. Extra speed on landing will add distance to your flare and ground roll. If you land hot and stopping distance is critical, go around. This will allow you to set up for a better approach or to divert to better conditions.

▪ **Touchdown** This is not the time to grease one on. A firm landing will dissipate as much as 15 knots and help your tires sink through the slush or water. A smooth touchdown will increase your chances of hydroplaning and lengthen your landing roll.

▪ **Braking** Use the Dash One recommended braking procedures for your aircraft. Use whatever aerobraking your aircraft is capable of. Generally speaking, the best technique is to apply smooth, steady pressure to maximize the braking force without locking the wheels. But, make sure you're below hydroplaning speed before you apply the brakes. Don't know what that speed is? Short final or landing roll isn't the time to try to mentally compute 7.7 or 9 times the square root of your tire pressure. Precompute expected hydroplaning speeds and keep them in mind.

▪ **Taxiing** Once you have the landing roll complete and you're ready to turn off the runway, don't let down your vigil. You just may find the taxiways and ramp areas in worse shape than the runway. The time to relax is after you leave debriefing.

Don't let spring fever or complacency lull you into a false sense of security. Be alert for winter hazards for a little longer. Late winter can have some very changeable conditions. ■

The Early Days

LT COL JIMMIE D. MARTIN
Editor

■ Army aviation got off to a slow start. It took the Wright brothers from January 1905 to December 1907 to convince the government they had invented a flyable aircraft. Then it was 2 August 1909, before Signal Corps Airplane No. 1 was formally accepted. But, after all these hurdles were passed, Army aviation was off to a flying start and received enthusiastic support from everyone.

Well, that's not quite how it happened.

General Allen, Chief Signal Officer, asked for appropriations of $200,000 per year for fiscal 1908 through 1910 for aeronautics. He got nothing. One member of Congress reportedly said, "Why all this fuss about airplanes for the Army — I thought we already had one." That sounds like a few years back in my own career when a prominent member of government decided we should build one multipurpose airplane for all the different commands and services to use.

One of the provisions in the contract the Wright brothers signed for the first aircraft was to train two pilots. General Allen chose Lieutenants Frank P. Lahm and Benjamin D. Foulois. But, before instruction could start, Lieutenant Foulois was sent to France as the US delegate to the International Congress of Aeronautics. Lieutenant Frederic E. Humphreys of the Corps of Engineers took his place as a student pilot.

Wilbur Wright began instructing the Lieutenants on 8 October 1909. Lahm got the first lesson, but Humphreys soloed first. On 26 October, with a grand total of 3 hours, 4 minutes, and 7 seconds of instruction, Lieutenant Humphreys made his first solo. Lieutenant Lahm followed a few minutes later with his first solo flight after a total of 3 hours, 7 minutes, and 38 seconds of training.

Lieutenant Foulois returned from France late in October and got three flights with Wilbur, and then Lieutenant Humphreys took over his instruction. Foulois received 3 hours and 2 minutes of instruction, but didn't solo. On 5 November, Lieutenants Lahm and Humphreys were flying together and hit the wingtip on the ground during a low turn. They were unhurt, but the aircraft was so badly damaged that new parts had to be ordered from the factory.

While waiting for parts to repair the fleet, the Aeronautical Division suffered its next setback. Lieutenant Lahm was forced to return to the Cavalry because he had been de-

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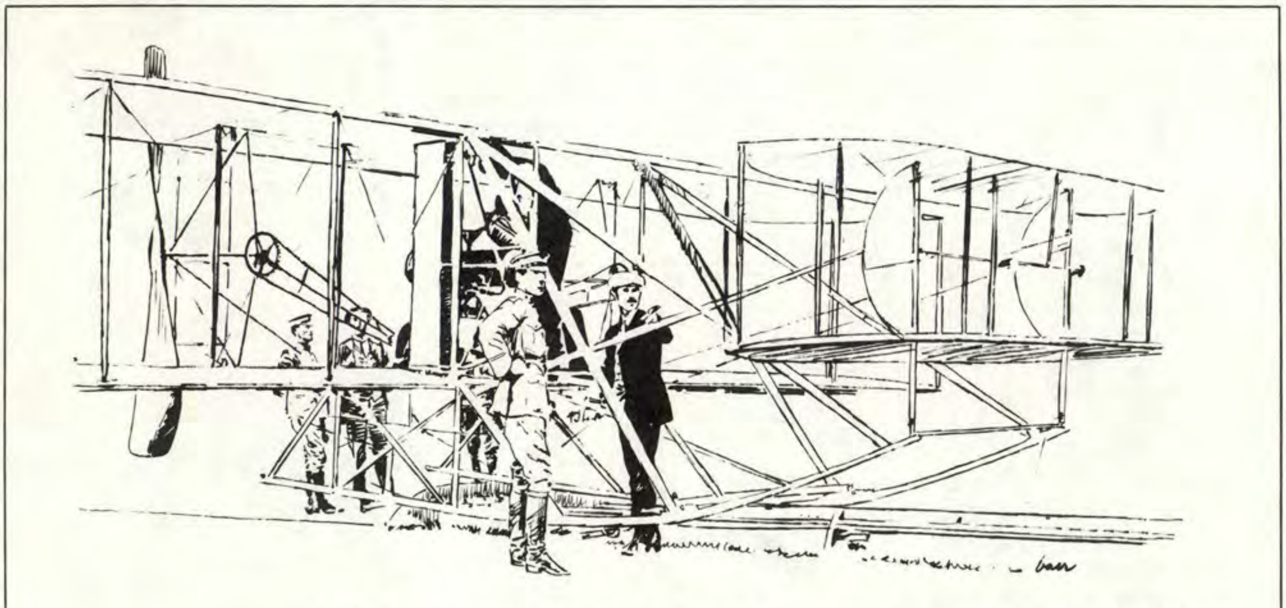


Orville Wright talks with Lt F.P. Lahm about the Army's first aircraft with Lt. Benjamin D. Foulois looking on.

Lt B.D. Foulois and Phil Parmalee
Collier Wright Flyer - Ft Sam Houston Texas - March 1911

Safety Warrior: The Early Days continued

tached for 4 years, the maximum allowed under regulations. Lieutenant Humphreys, who had been assigned only temporarily to the division, was returned to the engineers. That left only one pilot, Lieutenant Foulois, who had a little over 3 hours of flying time, but had not soloed.

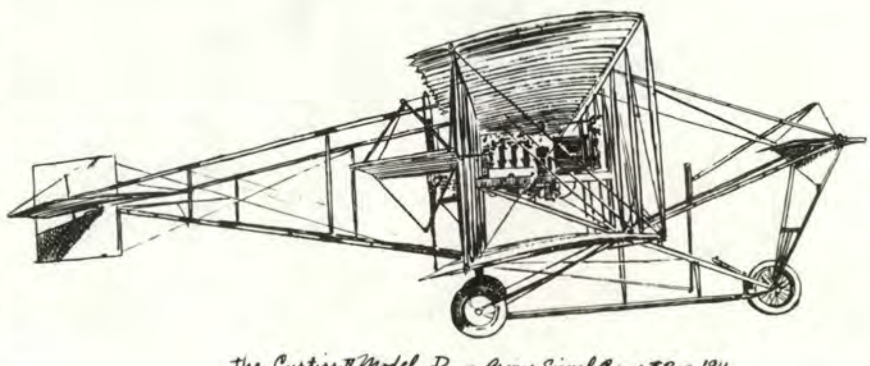
Winter in Maryland was no place to be flying in an open aircraft with no protection from the cold. So, the Army decided to move the airplane to Fort Sam Houston in San Antonio, Texas. General Allen told Lt Foulois, "Just take plenty of spare parts and teach yourself to fly." By the end of February 1910, everything was ready for him to resume his flying. Since he had no instructor, Foulois received instructions by mail from the Wrights. Thus, he became the first correspondence-course pilot in history. He made his first solo flight on 2 March and by September, had amassed a total of 9 hours in 61 practice flights.

Since the Signal Corps didn't get an appropriation from Congress to buy more aircraft or to maintain the one they had, they were only able to give Lieutenant Foulois $150 per year for gasoline, oil, and repairs. Since this was far too little, he was forced to use his own money for essential supplies and equipment. By 1911, in spite of Lieutenant Foulois' best efforts, the plane was in poor condition. Help came from the press.

No, they didn't start a media campaign to force Congress to allot more funds. The help came from Robert F. Collier, owner of *Collier's* magazine. He purchased one of the new 1910 Wright Type B airplanes and rented it to the Army for $1.00 per month. The Wrights even sent along one of their pilots to train Lieutenant Foulois in the new plane since it had a different control system from the one he was used to.

On 3 March 1911, Congress made its first appropriation for Army aeronautics — $125,000 for the year 1912. With $25,000 of the appropriation made available immediately, the Signal Corps ordered 5 planes at a cost of $5,000 each. Three of the aircraft were Wright Type Bs and the other two were Curtiss planes. Signal Corps (S.C.) Airplane No. 1 was in poor condition and completely outmoded by design improvements in the new aircraft, so the War Department donated it to the Smithsonian.

Since the War Department now had planes of its own, it returned the Collier plane in May of 1911. Both the Curtiss and Wright companies sent instructors with the new aircraft, and the Army began to train new pilots. There were 18 volunteers for aviation duty when the new aircraft arrived at Fort Sam



The Curtiss II Model D - Army Signal Corps #2 - 1911

Air Force fixed-wing pilots fall into two classes — tanker/transport/bomber or fighter/attack/reconnaissance. The first Army pilots also fell into two classes — left seat or right seat pilot.

Houston. The young officers were not relieved of their regular duties, but had to learn to fly in their spare time. After studying both the Wright and Curtiss planes, the student pilots were allowed to choose which one they wanted to fly.

As you might expect, their safety record was not very good and there were several crackups. The most serious occurred on 10 May 1911, when Lieutenant G.E.M. Kelly took off on his primary pilot qualification flight in S.C. No. 2, the Type IV Model D Curtiss plane. The aircraft crashed during landing, and Lieutenant Kelly died a few hours later due to a skull fracture. The commanding general of the Maneuver Division solved the safety problem by prohibiting further flying at Fort Sam Houston. Once again, the flying school moved to College Park, Maryland.

There were many differences in the two types of aircraft owned by the Signal Corps and differences in the training approaches. For instance, the throttle on the Curtiss plane worked the same as the foot throttles on our cars today. To speed up the engine, the pilot pushed the throttle down. To slow up, he relaxed the pressure.

On the Wright airplane, it worked just the opposite. To throttle back, the pilot had to push down on the foot pedal. The engine had so little compression that when the pilot glided in for landing, the engine continued to pump gas. The gas spilled over the side of the engine and ran down on the wing into a metal pan. At least 50 percent of the time, the dripping gasoline caught fire as the pilot added power to taxi in. Consequently, the ground crew had to be standing by to douse the fire as the plane arrived. How would you like to fly an aircraft you knew would catch fire on at least half your landings?

Another early problem with the Wright planes involved the control system. There were two elevator levers, one for each pilot, but only one wing warp/rudder lever. This lever was between the two seats so it could be used by both pilots. This resulted in "left seat" or "right seat" pilots depending on which seat they learned to fly in. This problem was corrected in 1912 when a complete set of dual controls was installed. This consisted of a left hand elevator control and a right hand wing warp/rudder lever for each pilot.

Pilot training was much simpler in 1911 than it is today, but there were significant differences in the way pilots were taught to fly. In the Curtiss section of the flying school, the students taught themselves by the "grasscutting" or "short hop" method. The Curtiss airplane didn't have enough power to carry two people, so all flying had to be solo.

The student began with the throttle tied back, so he only had enough power to taxi at about 15 miles per hour and couldn't get airborne. After the student learned to taxi in a straight line, he was given enough power to get about 10 feet in the air. After attaining this altitude, he took his foot off the throttle and landed. After perfecting takeoffs and landings, the student gradually worked into turns and finally was given full power for the first real solo.

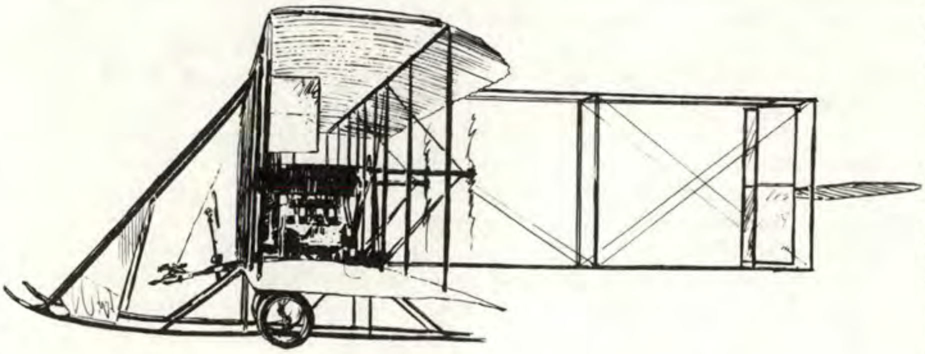
In the Wright section of the school, the student flew with an instructor and was not allowed to touch the controls for a few flights until he became accustomed to the sensation of flying. The student was then allowed to place his hands on the controls and feel what the instructor did to make the airplane perform the various maneuvers. The next step involved learning to use the control levers, one at a time, starting with the elevator lever.

After learning to control the aircraft at altitude, the student was taught takeoffs and landings. Once the student was cleared solo, the instructor told him how long each flight would be, how high to fly, and what maneuvers to practice.

Now we look back at many things these early fliers did and marvel at their lack of concern for safety. But, we have to remember we have learned safety as we have learned flying — in stages. These were pioneers feeling their way along with less than wholehearted support from their leadership.

Many of the line officers considered this newfangled toy a waste of time and money. They saw no practical use for it and preferred to stick to proven concepts. But the fliers persisted and experimented with new concepts that are the foundation for many of the ways we use aircraft today.

These were not daredevils with no regard for safety. They were serious aviators who were expanding the horizons of the Aeronautical Division, the Army, the War Department, and the Nation. ■



Wright B Model - U.S. Army Signal Corps No. 3. - 1911

Most of the material for this article came from *The United States Army Air Arm 1861 to 1917*, by Juliette Hennessy, Office of Air Force History.

FSO's CORNER

Emergency Procedure Cockpit Training

CAPTAIN DALE T. PIERCE
919th Special Operations Group
Eglin AFB Aux Field 3, Florida

■ Do you ever wonder whether you are doing all you can to ensure "your" aircrew members are getting everything possible from the lessons learned during mishap investigations? I wonder about it often.

The basic goal of the Air Force Mishap Prevention Program is to help commanders accomplish the mission by preserving resources. Additional goals are to prevent flight mishaps and to eliminate unsafe acts and unsafe conditions.

So, what more can we do to ensure lessons learned during mishap investigations are translated more effectively to accomplishment of the stated goals? On a recent TDY to Bitburg Air Base, I found something.

While visiting the 53d Tactical Fighter Squadron (53 TFS), I had an opportunity to talk to Captain Mark Peterson about his flight safety program. During our discussion, he told me about a program started by his predecessor to enhance the monthly F-15 emergency procedures cockpit training (EPCPT) sessions. He developed a training scenario book (nothing new). The training scenario book consists of "actual" mishap information (still nothing different). The enhancements are twofold.

First, the scenarios are tailored to the local flying environment, and second, the book is updated at least quarterly using the most recent actual flight mishap reports. This enables each pilot in the squadron to "re-fly" the most recent actual F-15 mishap sorties within the quarter following transmittal of the final mishap report.

In addition to keeping EPCPT current, it helps to keep it as meaningful and as interesting as possible. This is one of the most effective systems I've seen for conveying the lessons learned during mishap investigations to those who can benefit most.

Captain Mark Peterson provided this month's FSO's Corner idea. He's the FSO for the 53 TFS at Bitburg Air Base, Germany.

The FSO's Corner needs your ideas. What are you doing in your program that could help other FSOs if they knew about it? Call me (Dale Pierce) at AUTOVON 872-8537, or send your name, AUTOVON number, and a brief description of your program idea to 919 SOG/SEF, Eglin AFB Aux Fld 3, Florida 32542-6005. ■

Survival Tip

Dry Feet

USAF SURVIVAL SCHOOL
Fairchild AFB, Washington

■ During the winter months, you may notice children wearing plastic bags over their socks and inside their boots. Their parents apparently know the importance of keeping the children's feet dry when it's cold. This technique will definitely keep outside moisture from getting to the socks or feet. Sounds like a good way to keep your feet dry while you're working out on the flightline, or flying during the winter, or involved in other outdoor activity.

However, although this arrangement may be safe for a few hours, serious problems could develop. The plastic bags will prevent foot perspiration from evaporating. The moisture will instead be absorbed by the socks, making the feet damp. This, in turn, speeds cooling of the feet and can easily lead to frostbite.

We don't recommend this technique for keeping your feet dry. But, if plastic bags are the only thing available to keep outside moisture from your feet, it is extremely important to change your socks often. Don't wait for your feet to feel cold. Check your feet and socks after the first hour and every half hour after that. At the first sign of cold feet, put on dry, clean socks.

It is much easier to prevent frostbite, or even cold feet, than to bear the pain and discomfort these conditions can bring. Take care of your feet. ■

IFC APPROACH

By the USAF Instrument Flight Center, Randolph AFB, TX 78150-5001

SIDE-STEPPIN'

MAJOR JAMES C. JOHNS

■ No, this isn't a new dance step we've come up with down here in Texas, it's actually done in an airplane. The Pilot/Controller Glossary defines it as:

> "Side-Step Maneuver — A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1,200 feet to either side of the runway to which the instrument approach was conducted."

A recent change to AFR 60-27, Flying Instrument Procedures, provides for the development of Side-Step Maneuver (SSM) minima from existing straight-in instrument procedures for airports with parallel runways. The FAA uses similar criteria to develop similar procedures at large airports (see figure). However, Air Force procedure designers have not been permitted to use FAA criteria since it was not included in AFM 55-9, Terminal Instrument Procedures (TERPS). Now included in AFR 60-27, SSM minima should be appearing on Air Force procedures soon.

Since this is a relatively new concept for Air Force aircrews, let's examine SSM construction and then how they are flown. AFR 60-27 sets strict parameters on just what airport/approach configurations qualify for side-step procedure development. First of all, the runways must be parallel and have no more than 1,200 feet between centerlines. The primary instrument procedure must be a straight-in procedure in accordance with AFM 55-9, and the final approach course must be within 3 degrees of side-step extended runway centerline.

This restriction could limit development of SSMs at many locations because of excessive angular offsets (more than 3°) between the primary final approach course and the side-step extended runway centerline. These offsets adversely affect the side-step geometry and, consequently, increase required visibility above circling minimums, or make the SSM impossible to fly. The same obstacle clearance applies to the primary final approach area and to the side-step final approach area. Published visibilities are computed in accordance with AFM 55-9, then adjusted for staggered runway configurations and will normally be higher than straight-in, but lower than circling.

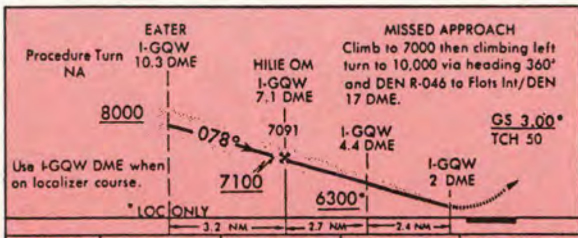
Now that we've reviewed SSM development, let's go to the cockpit and see what information is available to tell the aircrew how to fly them. AFM 51-37, Instrument Procedures, Chapter 14, states the major points to be remembered when flying side-step procedures:

- This is a *visual* maneuver.
- The clearance will include the runway to fly the instrument approach to, and the side-step runway for landing.
- Commence the SSM no earlier than the final approach fix with the side-step runway in sight.
- In the event of missed approach after the SSM has been initiated, use the published missed approach for the instrument procedure, unless otherwise directed by ATC.

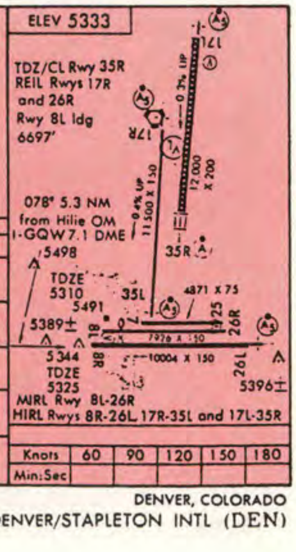
Additionally, the pilot is expected to maintain all published step-down fix altitudes until commencing the SSM in visual conditions.

This article is only a simple introduction to the SSM. It is obvious from the various geometries, final approach airspeeds, and skill levels that a unique SSM envelope will develop for each individual pilot. It follows that the prudent pilot will take the time to experiment with these procedures in VMC when they are first published to get a feel for his/her side-step envelope.

Look for these procedures in FLIP within the next 8 to 10 months and get out and do a little side-steppin'! ■



CATEGORY	A	B	C	D
S-ILS 8R	5575-¾ 250 (300-¾)			
S-LOC 8R	5660-1 335 (400-1)			
CIRCLING	5880-1 547 (600-1)		5880-1 ½ 547 (600-1 ½)	5900-2 567 (600-2)
SIDESTEP RWY 8L	5660-1 350 (400-1)		5660-1 ½ 350 (400-1 ½)	5660-2 350 (400-2)



Knots	60	90	120	150	180
Min:Sec					

ILS/DME RWY 8R 39°46'N-104°53'W

DENVER, COLORADO
DENVER/STAPLETON INTL (DEN)

MAIL CALL

OPS TOPICS

"F-16 Flight Controls"

■ In your October 1986 issue Ops Topics feature, you had an article concerning F-16 flight controls. The message concerning this incident crossed my desk in April of 1986.

The problem, as you accurately stated in your article, was a flaperon that did not deflect properly, but FLCS self-test passed and this lack of deflection wasn't noticed until taxi out.

To make my point, I must first elaborate on some system operational points and some information that was in the incident message but not in your article.

The F-16 flight control system self-test, during flaperon checks, looks for positive deflection (down) of greater than 1.65°, and this deflection from neutral must be accomplished in approximately 4 seconds. In a nutshell, the OFP in the flight control panel is looking for a deflection response from the flight control computer within a programmed time constant. All F-16 surfaces require this at different points during test, and this is checked more than once.

The problem that occurred to the F-16 in the article was the flaperon was excessively slow/stuck in a down position greater than 1.65°. Because of this, self-test read it as good deflection and within the specified time restraints. The owners of this aircraft, in the earlier referred to message, asked that the FLCS self-test be changed to incorporate a check that would detect this type of fault. Yes, an OFP change could be made, I'm sure, and it would solve the problem, for the right price $$. In this case, why do the high dollar change when there is a fix that is a cheaper mode called AFTO 22s, AF 847s, and the old standby, "Watch the aircraft. It will talk to you."

What bothers me is there is no mention of the aircraft's takeoff/land light or the fact that the flaperon was not neutral after self-test initiation. I say either/or because I'm not sure of the exact position of the flaperon during the problem.

In either case, if the surface was hanging up greater than or equal to 8 inches down, the takeoff/land light would *not* have illuminated, as it should when the self-test switch is engaged. This light should be *on* because the aircraft is not in the proper takeoff configuration (landing gear down and locked, and flaperons greater than or equal to 8 inches down) when the switch was initiated. Switch initiation causes both flaperons to go to neutral.

If the flaperons were hanging up less than 8 inches down, the takeoff/land light would have been "ON," but ground should have noticed the flaperons were not at neutral when self-test was initiated or seen the anomaly during controllability check.

Points are as you stated: "All F-16 users be aware of the limitations of the FLCS self-test and ensure you visually check flight controls for movement." Don't forget the other long-time visual indications, "lights." Takeoff/land light operation should have the same priority as any other FLCS lights.

In this day and age of more integration and sophistication of systems, the basics still apply and should never be overlooked.

David E. Lafferty
58 TTW/AFETS
Luke AFB, AZ

Thanks for the additional information. By checking the flaperons up and the TO/land config light on at initiation of the flight control self-test, along with visually checking proper control surface movement while operating the controls, the pilot can get a more complete picture of flight control operation. There is no question that we must use every possible indicator and never overlook the basics.

"Governor's Safety Award"

On 7 October 1986, at the Seventh Annual Governor's Safety Conference in Anchorage, Alaska, Kulis Air National Guard Base was recognized by the Governor of the State of Alaska for its superb safety record in 1986. Lieutenant Colonel Gene L. Ramsay, Chief of Safety, received the Governor's Safety Award of "Safety Professional of the Year." Two of the contributing factors were 70,000 mishap-free flying hours and no on-the-job injuries resulting in lost work days for calendar year 1986 to the latter part of October.

Lieutenant Colonel Ramsay said the award belongs to all the members of the Alaska Air National Guard for their efforts in making "*Safety First*." He also thanked the base commander and his staff for their sincere belief that safety *does* preserve and protect people and resources. He ended by telling everyone to keep up the good work, and take your safety practices home with you.

It is noteworthy to mention that in 1984, the Alaska National Guard received the Governor's Safety Award of "Outstanding Program Achievement." Not bad for a little guard unit in a state that's twice the size of Texas, don't you agree?

MSgt Michael E. Leahy
Kulis ANG Base
Anchorage, Alaska

Thanks for writing to let us know about your accomplishments. Congratulations on your safety record and awards! We always enjoy hearing a good success story. Keep up the good work. ■

King of the Air

SQN LDR ALASTAIR G. BRIDGES, RAAF
Directorate of Aerospace Safety

■ Fuel caps coming off in flight, along with oil caps and cowlings, was one of the issues discussed in the December magazine. This time, on a related subject, I'd like to look at fuel leaks in flight — a problem sure to get the attention of all aviators. I did promise, too, that by this time I'd be in Australia; well, I am by the time you *read* this (assuming those civilian pilots get us safely there), but now I'm still at Norton *writing* it. But, as March is autumn in Australia and spring in the US, both good times for thunderstorms and lightning, I'll talk a little about that, too.

First, however, I received my first bit of feedback, a very nice letter from the Naval Safety Center. The writer mentions some topics for me to write about. I wish I had the time left, but I'll exhort Major Phil Simpson to explore these topics in the future. There is one very important point he does bring up which I must comment on, however.

He points out because the C-12 is so reliable and easy to fly, complacency is a danger, as nothing very bad is likely to occur (maybe our C-12F pilots might disagree with the flight instruments and gear motor problems). He goes on to say, "All of us who fly the C-12 came from other aircraft which routinely had more things to go wrong and were used to expecting something adverse. We were afforded more opportunities to practice simulated emergencies in our previous aircraft because we were not carrying passengers."

How well most of the Air Force C-12 operations fit into this scenario. Even the C-12F units with very young pilots can fill the complacency mold; an easy aircraft to fly, a less exciting mission than some, and lots of passengers with fewer training opportunities.

You ANG pilots with your brand spanking new C-12F and C-12J aircraft need to be extra cautious. Not only do you fit the same mold as the Navy, but many of you are probably flying the C-12 as a second aircraft, and you are operating on your own without a squadron of C-12 pilots to talk to.

My techniques for fighting complacency include keeping a half-hourly log of aircraft instruments: Fuel, fuel flow, ITT, Nl, oil pressure and temperature, cabin pressure, aircraft altitude, IAS, OAT, etc. Such a log gives an instant indication of changes, and it can be used for troubleshooting. I also use it to determine TAS, which is an indication of aircraft performance, and use this to do my own navigation to keep me in touch with the aircraft, where we are, and what's going on around me.

A further technique I enjoy is having both pilots think of various scenarios and ask the other what he would do, what limitations must be considered, and what alternative solutions exist. Any way you can, guard against complacency.

Now, on to fuel leaks. After a C-12F engine-driven boost pump failed, the pilots noticed fuel fumes in the cabin and, on shut down, the entire cold section of the engine compartment was found bathed in fuel. The pilots did not see this fuel leak. Many other leaks have been seen by pilots and passengers alike. Fuel leaks often occur around a deteriorating seal, whether external,

continued

KING OF THE AIR

continued

such as the fuel cap, or internal, such as a fuel tank.

The failure of fuel quantity probe O rings resulted in passengers noticing fuel coming from engine nacelles in both an Army and Navy C-12. Deformed, ill-fitting, or overtorqued parts have resulted in many other visible fuel leaks, some of which were not noticed until on the ground.

One fuel leak was noticed just after leaving icing conditions. For 10 minutes, the crew thought the leaking fuel was ice melting.

Another fuel leak was identified even though flying through heavy rain; the C-12 was slowed as much as possible and landed, although the engine was not shut down.

Other instances have turned out to be normal venting or not fuel at all, but the aircrew played it safe and landed as soon as possible.

What should you do if you think you have a fuel leak? Obviously, different situations call for different responses, but here is my basic plan. Land as soon as possible, even if unsure whether it is fuel or water. If fuel is coming from the vicinity of an engine, I would consider shutting the engine down. However, other factors such as weather and terrain may be more critical.

Although the leak may appear to be well clear of the hot section, I would be concerned at the site of the actual leak inside the cowlings. It may be in a more critical area than it appears. My feeling is that higher airspeeds would give me better control over the leak flow pattern, although I would prefer not to use high power settings on the leaking engine. Once on the ground, I would certainly shut the engine down.

Fuel fumes are more difficult to cope with. Oxygen would be my first move and, even if the fumes stop, I'd stay on oxygen until after landing as the fumes may return. It may be possible, while diverting, to isolate the engine responsible for the fumes if, indeed, it is an engine source. Once on the ground, I would pull off the runway, shut the aircraft down, and evacuate. Maybe this might make a good topic for you to discuss with your other crewmembers to avoid complacency.

Now we will move on to a weather aspect we often tend not to worry too much about — the problem of lightning. A remarkable number of strikes occur with no cells painting or visible, and a remarkable amount of damage is often inflicted. A C-12F, flight level 210, minus 15° C, and in moderate rain was struck even though no cells were detected.

The mission continued as the crew found no problems with the aircraft. The lightning had entered through the left propeller tip, traveled through the engine, and departed the aircraft via the left outboard flaps, right elevator, and elevator static wick. Parts requiring repair or replacement included the left propeller and slip ring, the generator, fuel control unit and primary governor, right elevator and static wick, and the left outboard flaps, which had a piece missing.

Another military C-12 was cruising at flight level 240, in clouds, with the nearest cells painting 20 miles away. Lightning was observed to enter one wing tip. The mission continued as the aircraft seemed to be OK. On landing, it was found damage was so extensive both engines and propellers were changed and repairs made to numerous holes and various lights, antennae, and static wicks.

Other lightning strike incidents show the C-12 may come through unscathed but is more likely to experience damaged engine components and propellers, flaps, elevators, and other extremities such as lights or antennae. However, no damage is evident to the crew, and all electrical equipment seems to continue to operate normally, although a momentary failure may occur to some items.

All those incidents I have access to, and have full details on, occurred around flight level 200, about 5° to 20° C below freezing, in clouds, and at least 20 miles from buildups. Some have occurred with no buildups in evidence.

The bottom line is: Continue to be cautious of areas where a potential for lightning strike exists; stay as far as possible from those areas; and, if hit, consider diverting to check the aircraft, but don't continue after landing until the experts check it over.

After our discussion of fuel leaks and unexpected lightning strikes, you should have at least those subjects to discuss on your next mission to help avoid complacency. I do have several other issues I'd like to write about, but I'll leave them with Phil. Until Phil's first article, then, keep up the great professional job you are all doing, do it with pleasure, and do it safely. ■

OPS TOPICS

PAT MACK
Retires

In July, 1974, Pat Mack became the Editorial Assistant for what was then *Aerospace Safety* magazine.

Since that time, she has been a driving force on the magazine and a strong contributor to the USAF Mishap Prevention Program. On 28 February, she will retire with over 23 years of Federal service. Her interest, enthusiasm, and knowledge will be sorely missed.

Happy retirement, Pat!

Cabin Pressure

■ An F-15 pilot was flying a mission in support of an ORI. Ground operations, takeoff, and climb had been uneventful until FL300. At that time, the pilot noticed he was pressure breathing. He checked the cabin pressure and found the cabin was not pressurized. He aborted the mission and returned to base with no further problems or physiological symptoms.

Postflight inspection revealed the emergency vent handle was rotated 45 degrees which automatically dumps cabin pressure. The pilot had failed to notice the position of the handle on his preflight. As a result, the cabin never pressurized. The pilot should have discovered his error during the climb check, but he didn't check cabin pressure as required. So, the error went undetected until he noticed the pressure breathing.

Nothing serious happened to the aircraft or the pilot as a result of these errors. But, an ORI sortie was lost because of a lack of attention to detail and failure to follow checklist procedure. Our modern aircraft are extremely reliable, but they're not Murphy proof. Only the aircrew can prevent these needless mistakes.

On and Guarded

All ground operations had been normal for the F-16 pilot up through engine start. However, about 10 seconds after the engine had reached idle speed, the pilot noticed the engine sounded like it was running rough. As he checked the engine instruments, he noted the RPM decreasing through 50 percent as the engine flamed out. The pilot shut the throttle off and called for an engine specialist.

The engine specialist asked the pilot to verify the engine master switch was in the on position. The pilot had visually checked this guarded switch during his preflight. However, when queried by the specialist, the pilot cycled the switch to off and back to on. The engine subsequently ran normally and passed a complete maintenance check with no discrepancies.

The conclusion was that although the engine master switch guard had been down, the switch was not fully in the on position. This was based on two previous engine flameouts after start in other F-16s. In both cases, the engine master switch was in the guarded position, but when the switch was touched, it had moved slightly and clicked into the on position.

The problem occurs when the switch has been turned off and is then turned back on by just closing the guard over it instead of moving the switch by hand. When this is done, the switch will sometimes stop just short of the on position. The switch then appears to be on when it is actually at an intermediate position and still off.

This problem with guarded switches is not unique to the F-16. It has happened at irregular intervals with various guarded switches in different aircraft over the years. There are two good techniques to deal with this problem. When turning a guarded switch on, don't just flip the guard down. Turn the switch on and then place the guard over it. When checking the position of switches and handles during preflight and inflight checks, actually push the switch or handle in the direction it should be. This will help ensure the switch or handle is really in the position it appears to be in.

OPS

Two Wrongs

A T-37 student pilot (SP) and instructor pilot (IP) had completed the high altitude portion of their flight and descended to a lower altitude. After 10 minutes of work at the lower altitude, the SP developed an earblock and complained of pain in his right ear.

The IP began a slow descent to the auxiliary field which was just below the aircraft. The SP wanted to continue the flight and completed one approach at the auxiliary field. The IP then asked the SP how he was feeling. The student said his ear was still hurting and he now wished to terminate the mission. The IP declared a physiological advisory and returned to the base where they were met by the flight surgeon.

There were two errors made here. The SP knew he had a head cold before he went to fly, but didn't tell the IP. He took a chance nothing would happen. When the SP developed the earblock, the IP let him continue the mission until he couldn't take it any more. The IP should have terminated the mission *immediately*.

Two wrongs don't make a right. Avoid physiological problems by taking care of yourself and seeing the flight surgeon when you're not up to par. If you experience a physiological problem, don't try to tough it out. Let the flight surgeon handle it.

Masked Saboteur

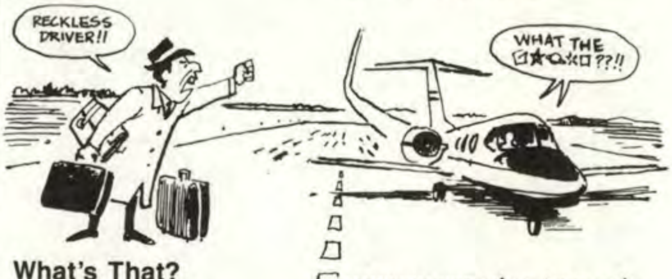
An A-10 was undergoing routine troubleshooting for inoperative pitot heat, right wing position light, and right anti-collision strobe. When the leading edge panels were removed from the right wing, extensive damage to the wiring bundles and mounts was found. Canine tooth marks in the area indicated the damage had been caused by an animal.

Paw prints, fur, and fecal matter found inside the wing confirmed the damage was caused by one or more raccoons. Paw prints were also found on the main landing gear strut, indicating entry to the wing had been gained through the wheel well. Sure enough, the A-10 has an opening in the main landing gear pod large enough to allow a raccoon to enter the open area in the front of the wing.

Further investigation found paw prints on the landing gear of several other A-10s. All aircraft were inspected and eight were found damaged by the raccoons.

A locally designed plug with a "Remove Before Flight" streamer attached is being used to block the hole in the landing gear pod. Use of the plug has prevented any further damage to the aircraft.

Whether you're a flier or fixer, be alert for signs of animal entry to various areas of your aircraft. A very small animal can cause a lot of damage that may not be found until something serious goes wrong. So, don't ignore any clues you see. Get the area checked out.



What's That?

The following accounts were extracted from the October 1986 issue of ASRS *Callback*. They are very appropriate for transport crews who land at a lot of unfamiliar fields as well as for those who fly light aircraft.

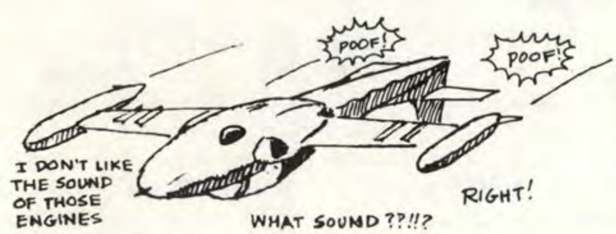
■ On landing approach, we had to maneuver to avoid hitting a pedestrian crossing the runway carrying two suitcases. Pedestrian was not observed by local controllers due to distractions (multiple runway operation) . . . Upon questioning, the pedestrian said, "I didn't think the runway was being used." . . . It needs to be stressed to all pilots and people around airports that any runway may be used at any time . . . .

TOPICS

■ . . . On final, I cautioned the copilot (flying) that it looked as if there were loose pieces of paper on the approach end of the runway. On short final, I instructed him to land long to avoid a FOD hazard. Upon overflying the "numbers," it was obvious that the numbers and cross lines were pieces of tape. The tape was coming loose, and strips as long as 6 feet were blowing around with the ends taped to the runway — a very hazardous condition. Had we been landing a little later, we could have failed to see the strips and landed right on top. . . .

■ . . . I followed the other small aircraft in for landing. Just prior to touchdown, I noticed a pile of rags on the runway. After landing and clearing the active runway, I was told that the airport was closed between 4 and 6 p.m., and the pile of rags on the approach end of the runway was an "X" that the wind had blown loose there. . . .

Don't get lulled into a false sense of security during a routine flight only to have your landing marred by an unexpected and unobserved runway hazard. The same thing applies during taxi and parking.



0 Gs = 0 Engines

An OA-37B was being flown on a functional check flight (FCF) after a phase inspection. Approximately 5 seconds into the inverted flight portion of the FCF profile, both engines flamed out. The pilot rolled the aircraft upright and started both engines normally. The return to base and landing were uneventful.

The most likely reason for the flameouts was fuel starvation. Maintenance checked the fuel system thoroughly and could find no discrepancies. However, TO 1A-37B-1 contains a warning "Maneuvers at zero G for short periods (less than 10 seconds) may result in double engine flameouts."

The most likely cause of the flameouts is that during the inverted flight portion of the FCF, the pilot maneuvered the aircraft to zero G for a short time. So, OA-37 pilots should make sure they avoid zero G conditions. When transitioning from positive to negative Gs or vice versa, be sure you make a positive transition and avoid any pause at zero G.

Atta Boy!

A flight of two T-38s was being led by a solo student pilot. After about 20 minutes of flight, the instructor pilot (IP) began to suspect hypoxia in the leader. The solo student was having some difficulty remaining within his assigned area, was slow to respond to instruction from the IP, and began to sound unusual on the radio.

The IP told the student to select 100 pecent and emergency on his oxygen regulator, check his connections, and monitor his rate and depth of breathing. After directing a descent to below 10,000 feet, the IP asked the student to check his cabin altitude. The cabin altitude was correct and read 7,000 feet.

The student began to sound more alert and became more responsive after the descent. The remainder of the return to base was uneventful.

Maintenance found some minor malfunctions with the oxygen regulator, but they weren't serious enough to cause hypoxia at a cabin altitude of 7,000 feet. After all possibilities had been examined, the investigators concluded the student had suffered from hyperventilation.

The important point is that the IP was alert to subtle changes in the student's speech and actions. He then took immediate corrective action before the situation could get out of hand. But, don't think this lesson only applies to solo students.

Whether you're flying in a formation of single-seat fighters or in a multicrew-member aircraft, it still applies. Be alert to subtle changes in others as well as in yourself. The onset of hypoxia and hyperventilation can be very difficult to detect, especially during heavy demand situations. Regardless of your position in the flight or crew, don't hesitate to act if you think someone may have a problem. ■

tech topics

BAY 5 CALAMITY

■ When the F-15 pilot reached for the landing gear control handle after takeoff, the canopy suddenly moved up and aft, departing the aircraft. Fortunately, the pilot landed the Eagle jet uneventfully.

Prior to the mishap flight, maintenance personnel had packed Bay 5 (the empty area behind the ejection seat in a single-seat F-15) with an integrated drive generator and aircrew bags which were all secured with bungee cord. Since neither the crew chief nor the pilot ensured the required clearance from the top of the baggage to the canopy mounted "catcher's mitt," a portion of the baggage was pulled forward and trapped in this area when the canopy was closed. Use of the F-15 Bay 5 hard-sided container or soft bag would have secured the baggage properly. The unauthorized use of bungee cord allowed the stored items to shift as the canopy moved forward, thus preventing the canopy from fully locking. During takeoff, the canopy moved aft, unlocking the canopy hold down hooks from their securing rollers.

Although F-15 maintenance personnel do not receive formal training on properly packing the Eagle's Bay 5, they need to remember bungee cord is not authorized for use in securing items in this area.

LOOSE DUST CAPS/STREAMERS

Two jet engine technicians were operating the right engine on a T-38 at the sound suppressor with the canopy open. At a power setting of 85 percent RPM, they suddenly heard a loud pop and immediately shut down the engine. With the intake screen removed, a visual intake inspection revealed foreign object damage. Inspection also found a dust cap and streamer were missing from the rear ejection seat catapult hose.

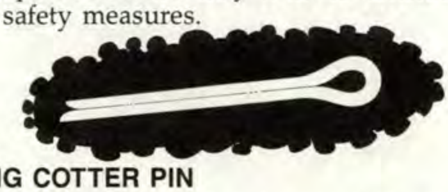
Egress system technicians had previously installed the dust caps/streamers when they dearmed the seat to allow other maintenance personnel to work a throttle problem. When the engine folks inspected the engine, they found the dust cap and streamer in the compressor section.

During the engine run, the catapult hose dust cap was most likely unscrewed by the streamer blowing in the wind. The cap and streamer apparently then migrated through the sound suppressor seal and were ingested by the engine.

This unit's egress shop personnel reviewed their policy on installing dust caps on the seat catapult hose to ensure: (1) The dust cap is properly tightened to prevent it from becoming unscrewed, and (2) the hose is securely stowed after a seat is dearmed.

In addition, engine run people were briefed on the critical nature of operating engines with the canopy open, increasing FOD potential. They were also reminded to ensure all ejection seat dust caps/streamers are secure prior to operating engines.

Perhaps other units may want to consider taking similar safety measures.



MISSING COTTER PIN

The TR-1 pilot was performing an acceleration check during a functional check flight. After retarding the throttle to idle, he noticed the engine RPM remained at 92 percent while the aircraft continued to accelerate. Not only was the engine completely unresponsive to the throttle movement, but the throttle was also binding and could not be advanced any farther than half way.

The pilot lowered the landing gear, extended the spoilers, and began a shallow descent. Using the cutoff switch, he then shut the engine down and landed the aircraft uneventfully.

Investigation showed the throttle linkage had become disconnected from the fuel control. The nut and bolt which secures the linkage to the fuel control were found laying on the panel below the fuel control. The cotter pin which safeties the linkage was not found.

The lack of a cotter pin could very well have led to a major mishap. Engine and throttle linkage areas are critical. Taking a few minutes to ensure proper installation of safety wires and cotter pins can provide big dividends in flight safety. Also, don't forget to make the proper entry in the aircraft forms whenever disconnecting any throttle/fuel control linkage.

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tech topics

JAMMED SYNC

Shortly into the flight, the F-16 pilot selected afterburner but it failed to light. A few minutes later, the engine began to intermittently vibrate for 3 to 5 second periods followed by 2 audible stalls. The pilot then started the jet fuel starter and emergency power unit, diverted to the nearest airfield, and landed the aircraft.

After removing the engine for troubleshooting, maintenance folks found a 3000 trailer engine mount forward pin assembly lodged between the syncronization (sync) ring and the anti-ice line at the 10 o'clock position. The pin assembly is part of the hardware from the hardback assembly used to transport the F100 engine.

When the mishap engine was transferred to the removal and installation trailer and then into the aircraft, someone placed the loose pin assembly on top of the engine. Subsequent visual inspection failed to detect the pin assembly on the engine or detect that a pin assembly was missing from the transportation trailer hardback assembly.

Between the engine installation and the mishap flight, the aircraft flew 12 sorties with no engine malfunctions. During this time, the pin assembly was loose between the engine bay and the engine until it lodged between the sync ring and the anti-ice line. Once the loose pin assembly jammed the sync ring, it caused a mis-scheduling of airflow and subsequent engine stall.

Here was a pin assembly that was not properly secured to the engine transportation trailer with the required lanyard. In addition, the improperly secured pin assembly was not documented in the transportation trailer's AFTO Form 244, Equipment Inspection and Condition Record. Even though engine change procedures require a general engine inspection prior to installation, the loose pin assembly was not seen.

The circumstances are not new. The problem is to prevent them from combining to produce a mishap. You may want to look at your engine trailers, as well as other aerospace ground equipment, and ensure all of the pin assemblies are attached with lanyards.

An experienced pilot was able to work his way out of this maintenance-induced condition. But it is always well to remember that the next time, another pilot may not be so well-qualified.

IT SHOULDN'T HAVE HAPPENED

In preparation for a 120-day inspection on an OV-10A personnel parachute, the technician placed the chute pack on the work table, unzipped and opened it, and removed the pilot parachute mechanism. At this time, he should have located the static line cutter assembly, removed the lightweight canvas sheath surrounding it, and carefully installed a mechanical safety pin. The purpose of the safety pin is to prevent inadvertent cartridge firing during handling operations.

The technician in this explosives mishap failed to perform the safing sequence in the previous paragraph. Instead, he proceeded to remove the protective cover from the main parachute and remove the main parachute from the pack. Consequently, during removal of the main parachute, enough tension was inadvertently placed on the static line to cause the static line cutter cartridge to fire.

Technical data warnings are there to protect people and property from damage or injury and must be complied with at all times. Remember, failure to follow a technical data "warning" is failure to obey an order.

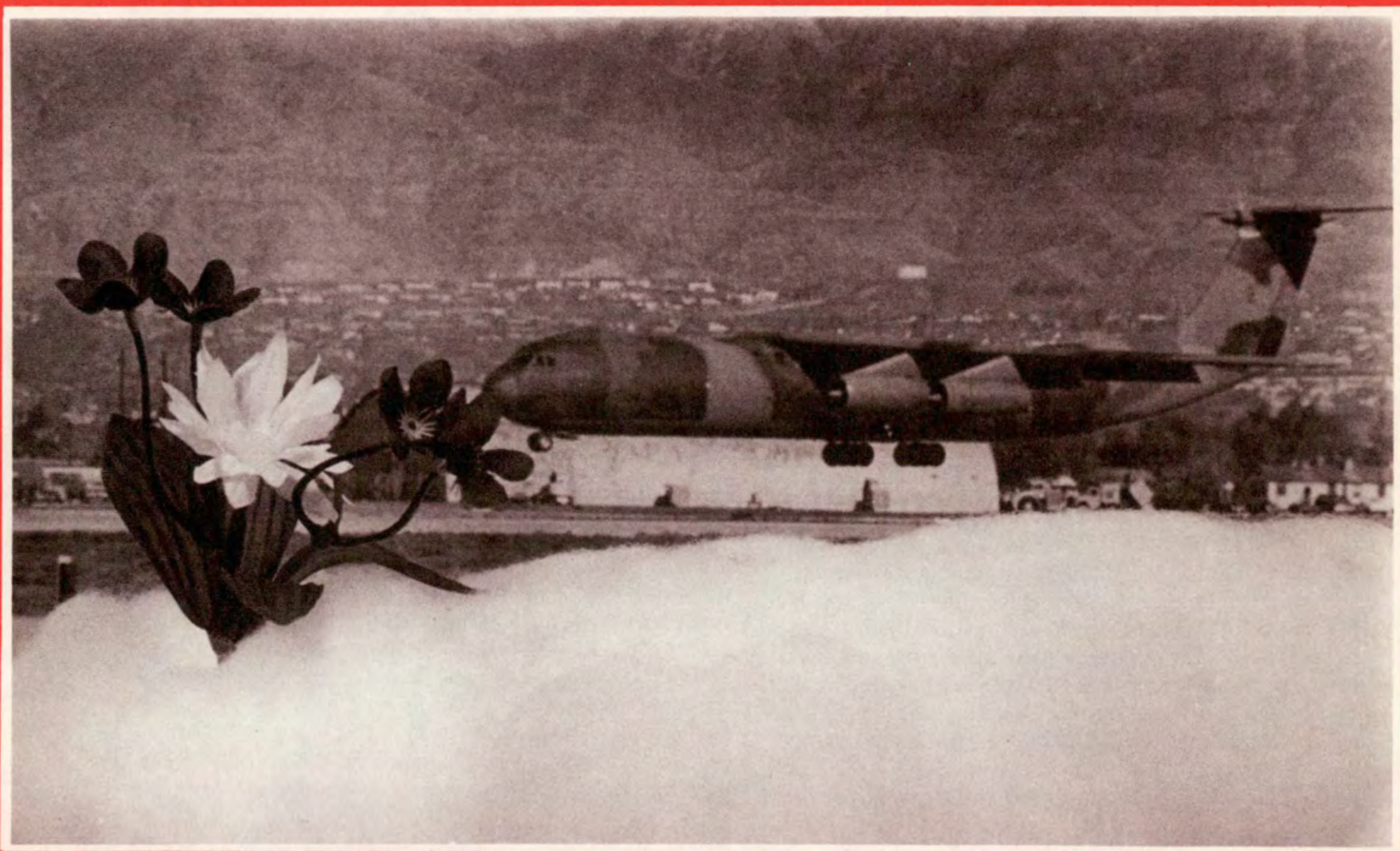
Maintenance tasks that seem routine and repetitious can lull us into a false sense of security. Even with sufficient training and routine supervision, personal integrity is the key. This explosives mishap shouldn't have happened, but it did. ■

TIPS FROM THE FIELD

MSgt Greg Carollo from one of our KC-135 maintenance units shares the following item and photo with our readers. A crew chief in his unit was installing a battery in a KC-135 when the metal wristwatch he was wearing contacted both the negative and positive terminals, melting the band and burning his wrist. This photo illustrates the reason for not wearing jewelry on the flightline, especially while working around electricity.

Spring or Winter?

Maybe Both!



BE PREPARED