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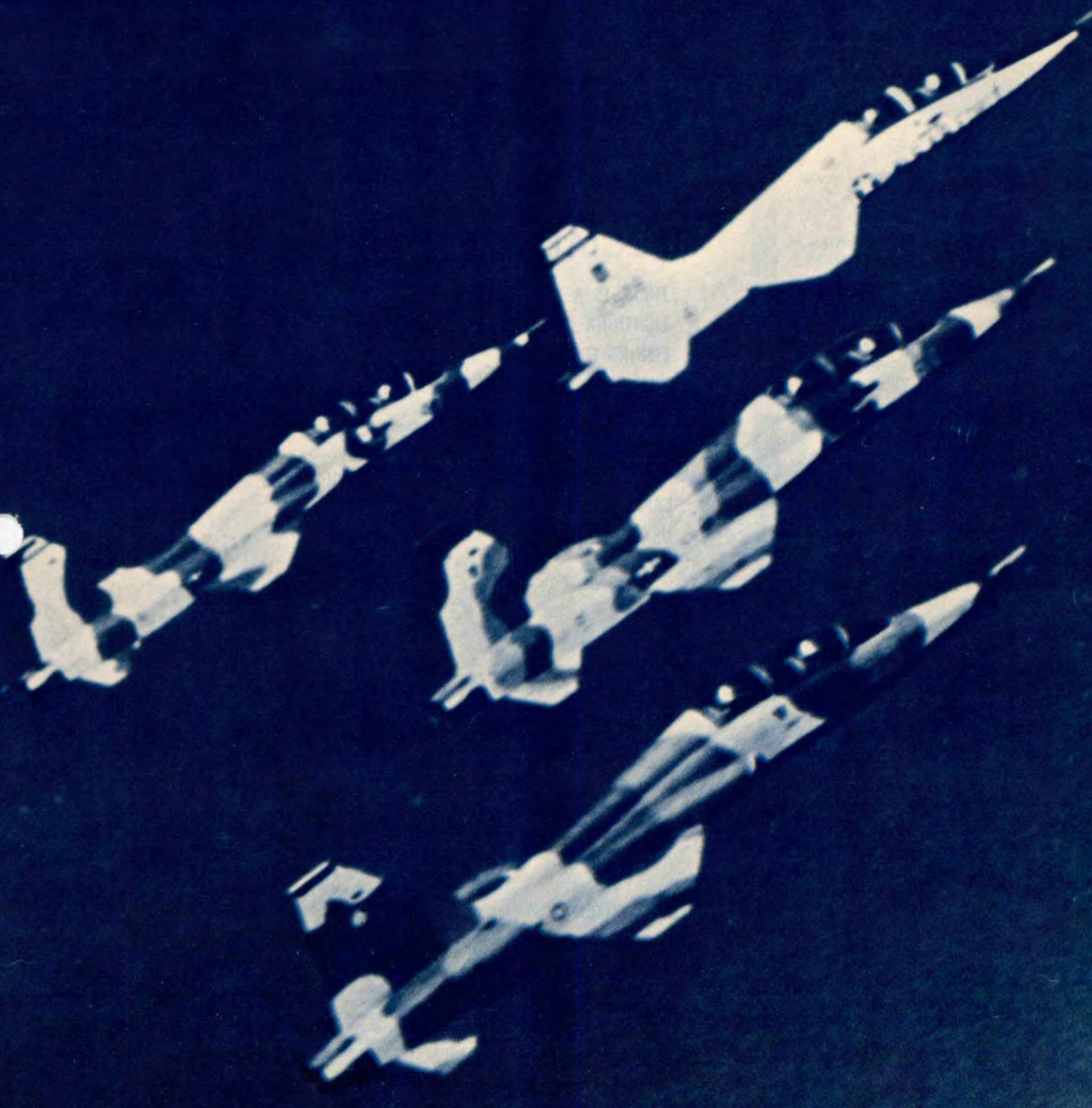
JUNE 1977



JUNE 1977

UNITED STATES AIR FORCE

aerospace SAFETY

THE MISSION - - - - - - SAFELY!

SPECIAL FEATURES

REGULAR FEATURES

NAME THAT PLANE

DOUGLAS B-18 BOLO

The Air Corps Bomber Competition of 1936 resulted in Douglas Aircraft Co getting an order for 177 B-18 Bolos. Quite similar in appearance to the famed DC-3 commercial airliner just coming off Douglas production lines, the Bolo was a very reliable, well performing plane. Although not exactly what proponents of strategic bombing desired, the General Staff felt it was adequate for the time, and 350 were delivered. A radar equipped version was used early in World War II for anti-submarine patrols. Other models of the B-18 were used to train bombardiers.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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JUNE 1977 AFRP 127-2 VOLUME 33 NUMBER 6

There Is A Way

Annually the Air Force recognizes a given number of individuals, units, and commands for outstanding performance. This is good. However, competition for these awards is keen, and there is a very fine line between first place and also-ran. The winner receives a trophy, and no one ever hears again about those who didn't win. We want to correct that and see that all of those who did an outstanding job are acknowledged. Therefore, each month Aerospace Safety *will feature one or more individuals or units that were nominated but didn't win a major award. In this way, we can all share in recognizing the fine performance and dedication of those who came so close. Also, there are some excellent lessons to be learned and shared.*

RICHARD E. MERKLING, Maj Gen, USAF
Director of Aerospace Safety

CAPTAIN CURTIS A. GRAYBURN

916th Air Refueling Squadron
Travis Air Force Base, California

The mission for Captain Grayburn and his KC-135 crew was to refuel a formation of four fighters flown by student pilots. All was routine until the final receiver encountered severe pitch oscillations and collided with the tanker.

After the initial confusion, Captain Grayburn noted that the aircraft was stable and holding cabin pressure, and did not have the crew bail out. The fighter crew, meanwhile, had ejected.

One of the receivers stayed with the tanker and reported the damage: a hole in the lower fuselage, damage to the left side of the stabilizer, tear in the left elevator, all but five feet of the boom torn off. There was major structural damage and fuel was leaking from the aft section. The loss of the boom caused failure of the right hydraulic system, leaving only partial spoilers and no nose wheel steering or powered rudder.

Captain Grayburn ordered the crew to keep their helmets and parachutes on, in case of an immediate bailout, and decided to head for Edwards AFB, California.

Edwards was close, with no populated areas enroute, and it has a 10,000 foot runway and several miles of dry lake bed suitable for rollout.

Upon arrival at Edwards, the navigator and boom operator lowered the flaps—a 20-minute job. A controllability check determined the aircraft could be flown safely if nothing else went wrong. A chase A-37 checked the aircraft configuration and flew chase throughout the approach. Control after landing was maintained with rudder, and differential thrust and braking.

Captain Grayburn at the time was a young aircraft commander with less than 250 hours since upgrading to aircraft commander. His performance and that of his crew were of highest caliber and resulted in saving a valuable aircraft and possibly five lives.

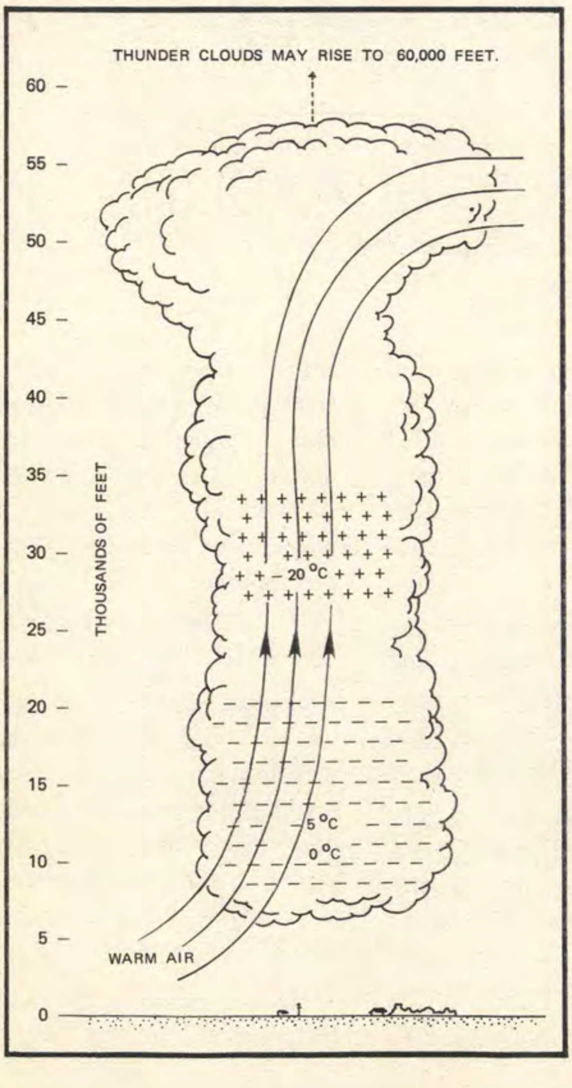
He was nominated for the Koren Kolligian, Jr., trophy. ★

Anytime you fly you are likely to become entangled with one of nature's most beautiful but awesome phenomena—lightning.

Even though April, May and June are the worst months for lightning strikes, some are reported in each of the other months, too, and so for some of you with many flight hours, these encounters may seem routine. But on very rare occasions lightning has brought a plane out of the sky, and on less rare occasions it has caused some very frightening close calls. Thus, it is well to review what lightning is, why your aircraft sometimes gets involved with it, what to expect from it, and how you can help researchers learn more about it and design even better protection from its effects in the future.

Lightning And

FIG. 1



A lightning flash is a very long electrical spark which extends between one center of electrical charge in a cloud and another center of opposite polarity charge in the ground, in another cloud, or sometimes even in the same cloud. The energy that produces lightning is provided by warm air rising upwards into a developing cloud as shown in Figure 1.

As the air rises, it becomes cooler and at the dew point its excess water vapor condenses into water droplets, forming the cloud. When the air has risen high enough for the temperature to have dropped to minus 40°C, all of the water vapor will have frozen to ice. Some of the ice crystals coalesce into hailstones which are heavy enough to fall through the cloud, gathering supercooled water droplets as they do so. According to one theory, as these droplets freeze onto a falling hailstone, small splinters of ice chip off, carrying away with them a positive charge and leaving the hailstone with a negative charge. The vertical air currents carry the ice splinters to the upward part of the cloud, leaving the base of the cloud with a negative charge center. The air currents and electrical charges tend to be contained in localized cells, and there may be several such cells in a single cloud.

Surrounding any electrical charge is an electric field which extends outward a long distance from the charge itself. Close to the cloud charge center the electric field is very intense, and when sufficient charge has accumulated, this field may be strong enough to *ionize* the air, creating a conducting path in the form of a luminous spark which jumps outward towards a region of uncharged or oppositely charged air. Some of the charge from the cloud flows along this spark, charging up a column of air, perhaps a meter in diameter around the spark, and intensifying the electric field in front of it. This causes more ionization and further extension of the spark, and the process repeats itself for many extensions and forms a zig-zagging, luminous column of ionized air called the *stepped leader*. The leader zigs or zags about 50 meters in each step, travelling

FIG. 2

Aircraft

MR. J. A. PLUMMER, General Electric Co, Pittsfield, MA

at about 100,000 meters per second, and pausing for about 50 millionths of a second between steps while it is supplied with more charge from the cloud.

As the stepped leader approaches the earth, it attracts electrical charges of opposite (positive) polarity and produces ionization from sharp objects such as tall buildings and trees. Fed by the attracted charges, sparks called *streamers* emanate from these points and propagate upward a short way to meet the downcoming leader. When the two meet, a conducting path is formed so that the charge in the leader can combine easily with the opposite polarity charges in the ground.

The process thus far takes only a few thousandths of a second to accomplish. When it begins, the leader moves in the general direction of an opposite polarity charge source, but it does not "know" where it will finally strike. There may be several possibilities, and the leader frequently splits into several *branches* on its way, as happened in the flash of Figure 2. The first branch that reaches a source of opposite charge completes the path and wins the race, so to speak. The leader that began the flash of Figure 2 found this opposite charge in the earth, but it might also have found it in another cloud, or even within the same cloud as the original source of charge. When the leader reaches the ground (or other opposite charge center), the positive charge in the ground rapidly flows into the leader, neutralizing the negative charge in it from the ground up. The head of the region in which this neutralization takes place moves up the leader channel at a velocity of 100 million meters per second—creating a current which reaches, on occasion, as high as 200,000 amperes. This current is called the *return stroke* and is responsible for the bright flash and loud noise we associate with lightning.

Once it reaches the cloud, the return stroke dies out but the charge remaining in the cloud may drain off through the conducting channel to ground, forming *continuing currents*. If additional charge centers are present in the cloud, they may also discharge to ground through the same channel, forming additional strokes, called *restrikes*. Neither the return stroke nor the restrikes last for more than a few thousandths of a second. The continuing currents are of lower amplitude—a few hundred amperes—but last for a much longer time than the strokes. Together, the strokes and continuing currents make up the complete lightning *flash* and flashes may persist for up to a full second. If more than one stroke occurs, the main channel will brighten during each one, causing the channel to flicker.

If your aircraft happens to be near a charge center or an advancing leader, the electric field around the aircraft may be intense enough to ionize the air about its extremities. This ionization often occurs in the form of a corona—a bluish glow visible at night and frequently called St. Elmo's fire. If sufficiently intense, streamers may also form and propagate outward from the aircraft toward the leader or charge center. As this happens, the intervening field will become even more intense and the leader may advance more directly to-

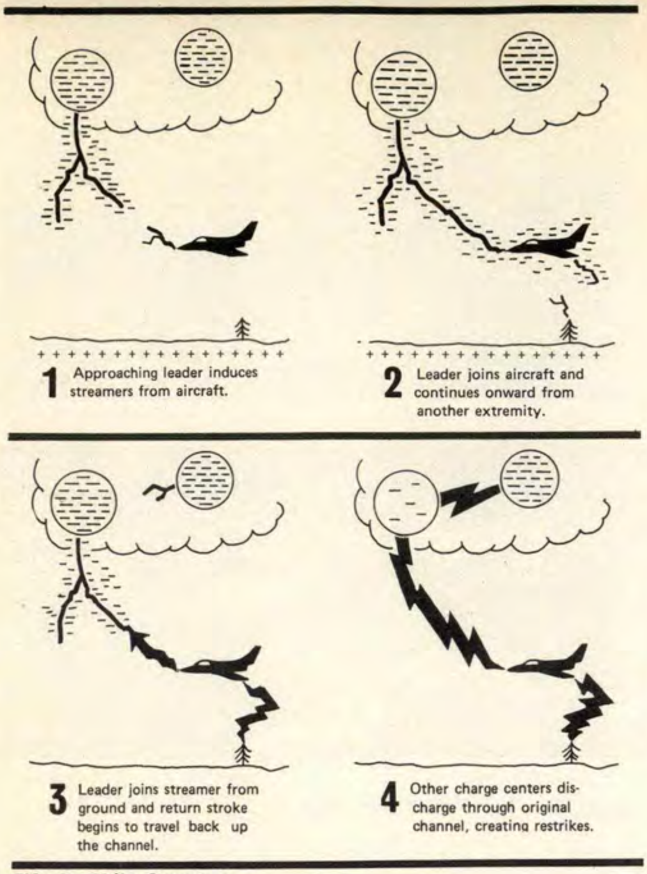


FIG. 3 Strike Sequence

ward the aircraft and meet one of the streamers emanating from it, completing a conducting path through which charge may flow onto the aircraft. Since there is not room for very much charge to remain on an aircraft, charge will "overflow" in the form of intense streamers from other extremities and enable the leader to progress onward, as shown in the sequence of Figure 3.

Thus, your aircraft becomes a link in the conducting channel from the cloud to the ground or another cloud. Whatever strokes and continuing currents pass through the channel will also have to be conducted through your aircraft.

Once within its clutches, you cannot fly away from a lightning flash. When the return stroke passes through the channel, you will experience the bright flash and loud bang so often reported. You will be "let go" only when the flash dies out naturally.

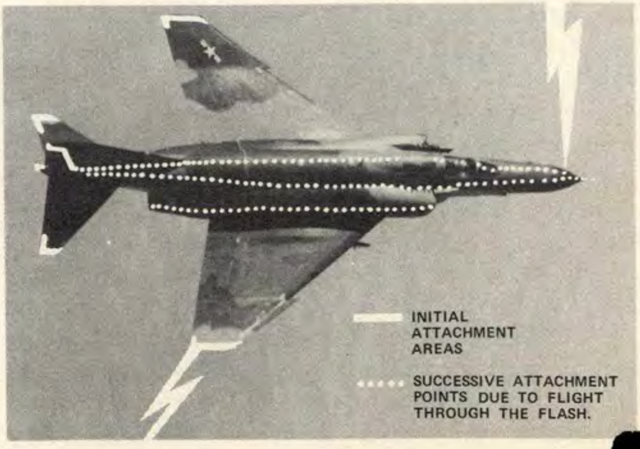
From your perspective in the cockpit, the foregoing events may appear to be caused by the aircraft becoming charged up by some other process and then suddenly discharging itself into the surrounding air, accompanied by a bright flash and loud bang. Sometimes at night the corona and streamering will persist and brighten for many seconds, appearing as a fluctuating column of fire snaking outward from the nose of the aircraft. When the flash finally occurs, the corona and streamering cease because the electric field has collapsed, and it appears as if the aircraft has suddenly discharged. Hence the event is termed a *static discharge* and not a lightning strike. However, a rather large amount of electrical charge is necessary to produce either a bright flash or a loud bang—far more than can be stored on an aircraft, so if either of these symptoms occur, you almost certainly have been struck by lightning. In fact, the loud bang does not even occur on some strikes; only a "whoosh" sound. This is thought to be a cloud-to-cloud flash whose return stroke occurs less rapidly, producing less current and noise.

WHAT PARTS OF AN AIRCRAFT GET HIT?

Since it will be part of a path between two charge centers, there will always be at least one entry and one exit point on your aircraft. *Initially,* these are places from which streamers came during the leader phase described earlier, and may be any of the extremities such as the nose, wing tips, horizontal or vertical stabilizer tips, tail cones and, somewhat less frequently, other protrusions such as propellers and blade antennas.

But, an aircraft flies quite a distance during the lifetime of the total flash, and this may expose other surfaces to flash attachment. A flash striking the nose, for example, may reattach at successive points along the fuselage until a trailing edge is reached, where it will then remain until the flash dies. If an initial attachment point was already at a trailing edge, the flash will simply hang on there. Figure 4 illustrates this process and shows other likely attachment points on a typical aircraft. *(Continued on page 22)*

FIG. 4 Lightning Attachment Points



Colonel Olsen is a command pilot with extensive experience in tactical aviation. Prior to assuming his present position as Chief, Rated Officer Career Management Branch, AFMPC, he attended the Air War College and served a tour as an F-111 squadron commander.

WHAT'S NEW IN RATED ASSIGNMENTS? IN THE DYNAMIC ENVIRONMENT AFFECTING PRESENT AND FUTURE RATED FORCE MANAGEMENT, IT IS INDEED A CHALLENGE TO RELEASE BRAKES AND LAUNCH INTO A SHORT, MEANINGFUL DISCUSSION OF NEW ITEMS OF INTEREST IN RATED ASSIGNMENTS. MOST RATED OFFICERS POSSESS A FUNDAMENTAL UNDERSTANDING OF THE TRADITIONAL UNIT-MAJCOM-AFMPC INTERACTIVE ASSIGNMENT PROCESS IMPORTANT TO EACH OF US. THOSE ON BOARD THROUGH SOUTHEAST ASIA RECALL THAT WE NEARLY ALL HAD OPERATIONAL JOBS AND DID A LOT OF FLYING.

OF COURSE, SOME THINGS NEVER CHANGE. TOP PERFORMERS CREATE DEMANDS FOR THEMSELVES AND TEND TO PROGRESS RAPIDLY TO POSITIONS OF INCREASED RESPONSIBILITY. FORM 90S ARE A MOST IMPORTANT DOCUMENT AND RECEIVE FULL CONSIDERATION THROUGHOUT THE ASSIGNMENT PROCESS. BUT AS ALWAYS, AIR FORCE REQUIREMENTS ARE DOMINANT AND WILL BE FILLED—IN SOME CASES BY NON-VOLUNTEERS. WITH THAT BACK-DROP, LET'S LOOK BRIEFLY AT TWO IMPORTANT CONSIDERATIONS REGARDING WHAT'S NEW IN RATED ASSIGNMENTS?

COLONEL TOM OLSEN, Chief, Rated Officer Career Management Branch AFMPC

INCREASED OPPORTUNITY IN OPERATIONAL DUTY

THE ADJUSTMENTS REQUIRED TO SHIFT THE RATED FORCE TO A STABLE, PEACETIME FOOTING IN THE POST-SEA ERA ARE LARGELY COMPLETE. THE SIZEABLE SURPLUSES OF RATED OFFICERS IN SOME WEAPONS SYSTEMS IS DWINDLING RAPIDLY IN EVERY AREA AND IS COMPLETELY GONE IN SOME. OVERALL, THE TOTAL INVENTORY OF RATED OFFICERS IS MOVING RAPIDLY INTO BALANCE WITH TOTAL REQUIREMENTS. WHAT THIS MEANS TO THE INDIVIDUAL OFFICER IS THAT WE ARE INTO A PERIOD OF "FULL EMPLOYMENT" OF HIS RATED EXPERTISE. APPROPRIATE POSITIONS FROM UNIT TO HIGHER HEADQUARTERS WILL BE THE MAJOR GROWTH AVENUES FOR RATED OFFICERS. EVEN WITH PLANNED PILOT AND NAV TRAINING INCREASES ACROSS THE FYDP, DIFFICULTY MAY BE ENCOUNTERED IN SUPPLYING RATED OFFICERS FOR ALL REQUIREMENTS. IN KEEPING WITH THIS FORECAST, INDIVIDUALS WILL BE ASKED TO SERVE THEIR FULL ACTIVE DUTY SERVICE COMMITMENT. WITH THE REQUIREMENTS OF THE SOPHISTICATED, EMERGING WEAPONS SYSTEM SUCH AS THE F-15, A-10, F-16, AND B-1, FLIERS ON BOARD INTO THE MID-1980S FACE A BRIGHT FUTURE OF PLENTY OF OPERATIONAL JOBS, CHALLENGES, AND RESPONSIBILITIES.

INCREASED FOCUS OF AVIATOR CAREER MANAGEMENT RESPONSIBILITY

CREATION OF CAREER MANAGEMENT TEAMS FOR ALL RATED OFFICERS AT AFMPC IS NEARING COMPLETION. IN THE FUTURE THESE TEAMS WILL PROVIDE ASSIGNMENT SERVICES TO USING AGENCIES AND CAREER MANAGEMENT SERVICES TO INDIVIDUALS SIMILAR TO THOSE PROVIDED IN SUPPORT SPECIALTIES UNDER THE PALACE TEAM CONCEPT. INDIVIDUAL RATED OFFICERS WILL ENJOY INCREASED ABILITY TO PINPOINT RESPONSIBILITY FOR PRESENT AND FUTURE CAREER MANAGEMENT. THE TEAM WILL BE COMPOSED OF PILOTS AND NAVS "WHO HAVE BEEN THERE" AND THEY WILL BE ABLE TO GIVE YOU THE REAL ANSWERS TO THE QUESTION, "WHAT'S IN STORE FOR ME?" INCREASED BENEFIT TO THE AIR FORCE WILL BE REALIZED VIA REVIEW OF THE ENTIRE RATED FORCE TO ARRIVE AT THE BEST MAN-JOB MATCH POSSIBLE. ★

NEWS FOR CREWS

THE IFC APPROACH

WHAT'S IN A NAME

The new edition of AFM 55-9, Terminal Instrument Procedures (TERPS), has added several changes to the system for identifying an approach procedure. Since it will be quite a while before every Instrument Approach Procedure (IAP) reflects the new format, you should be familiar with both the new and old systems.

STRAIGHT-IN PROCEDURES

Procedures with straight-in minimums are identified by the type of NAVAID which provides the final approach course guidance, followed by the runway to which the final approach course is aligned.

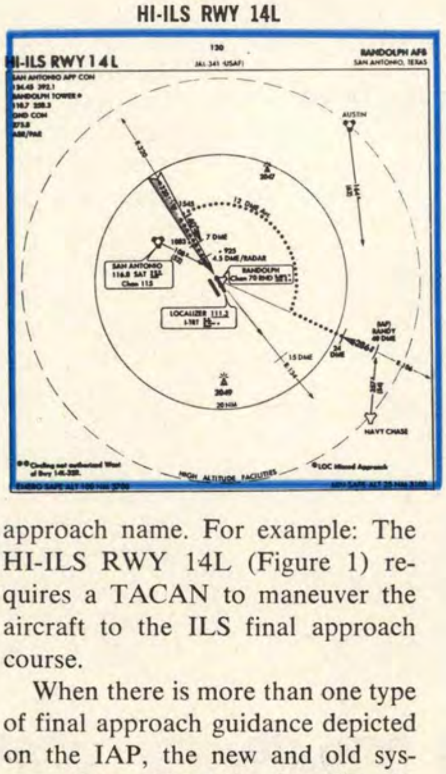
Examples: ILS RWY 18, TACAN RWY 36, NDB RWY 21

If there is more than one procedure serving the same runway and using the same navigational aid, each procedure will have a number following the NAVAID.

Examples. TACAN 1 RWY 36, TACAN 2 RWY 36

It is important to note that additional NAVAIDs may be required for maneuvering prior to the final approach without being listed in the

Fig. 1
HI-ILS RWY 14L



approach name. For example: The HI-ILS RWY 14L (Figure 1) requires a TACAN to maneuver the aircraft to the ILS final approach course.

When there is more than one type of final approach guidance depicted on the IAP, the new and old systems of procedure identification differ.

Under the old system, if two final approach courses (defined by different NAVAIDs) were depicted on the same IAP, the NAVAIDs in the identification would be separated by a slash (/) such as: HI-TACAN/ILS RWY 15, see Figure 2. Also under the old system, if TACAN azimuth could be used on a "VOR" approach, "TAC" would be in parenthesis after the primary IAP identification, like this: VOR RWY 13 (TAC), as in Figure 3.

Fig. 2
HI-TACAN/ILS RWY 15

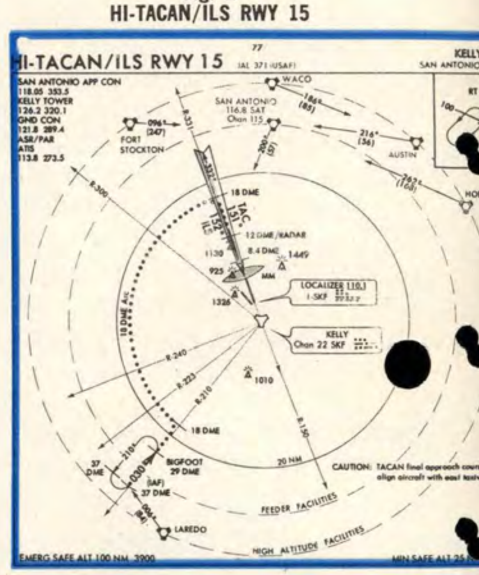
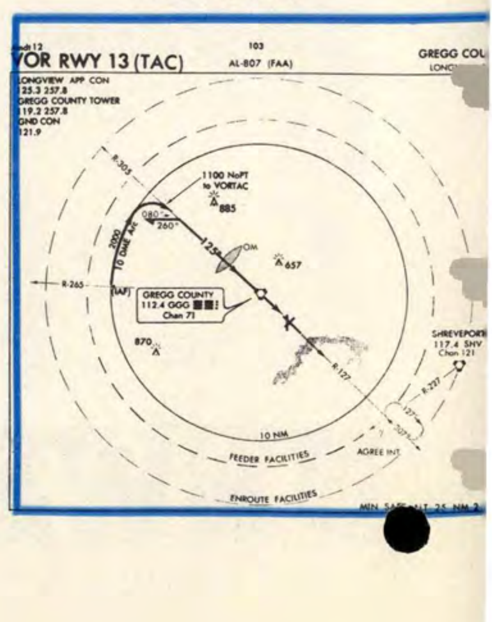


Fig. 3
VOR RWY 13 (TAC)



By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

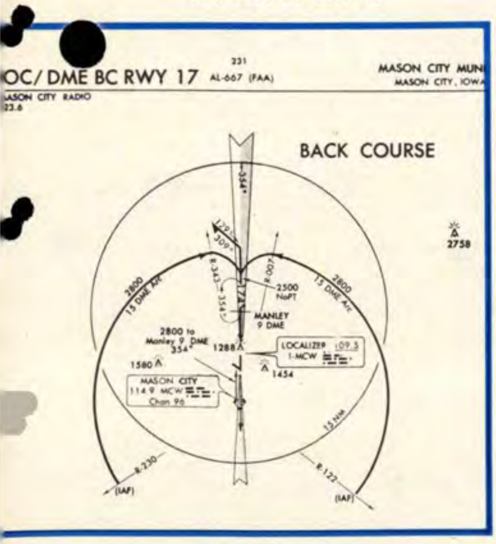
Under the new system, if two final approach courses to the same runway (defined by different NAVAIDs) are depicted on the same IAP, they will be separated by the word "or."

Examples: ILS or TACAN RWY 1, VOR/DME or TACAN RWY 36.

Under the new system, the slash (/) between two final approach NAVAIDs will indicate that more than one type of equipment must be used to execute the final approach.

Example: LOC/DME BC RWY 17, see Figure 4.

Fig. 4
LOC/DME BC RWY 17



Because both systems for identifying the IAPs will be with us for a while, reviewing your approach carefully becomes increasingly important. Let's look at the approach procedure in Figure 2 again, the HI-TACAN/ILS RWY 15. Depending on the identification system used, it could mean that there are two types of final approach guidance or that both TACAN and ILS are required to fly the final approach. A close study of the approach shows that either the ILS or TACAN can be used to fly the final approach course. Don't take anything for granted; study the approach and know what equipment you'll need.

CIRCLING PROCEDURES

Procedures with only circling minimums will be identified by the NAVAID which provides the final approach course guidance, followed by a "letter suffix." NOTE: A circling approach procedure identification will never depict a runway. If there is only one circling IAP, the letter suffix will be "A"; if there is more than one circling IAP, the suffix will be alphabetical, in sequence, regardless of the final approach course NAVAID. An example of this sequence would be: VOR-A, NDB-B, VOR/DME-C.

The last approach identification we want to look at is the Non-Directional Beacon (NDB) approach using UHF frequencies. If an NDB approach uses final approach guidance from a UHF beacon, the IAP identification may have a "UHF" in parenthesis after NDB, as in: HI-NDB (UHF)-A, (Figure 5). However, not all NDB approaches which use UHF will have the (UHF) in the identification. Plan ahead by checking the planview of the approach to see if it can be flown using a UHF beacon. Look at Figure 6; in the frequency block, a 3-digit frequency, such as 248 (kHz), is the low frequency beacon and a 4-digit frequency, like 284.2 (mHz), is the UHF beacon. Either beacon can be used for course guidance.

Fig. 5
HI-NDB (UHF)-A

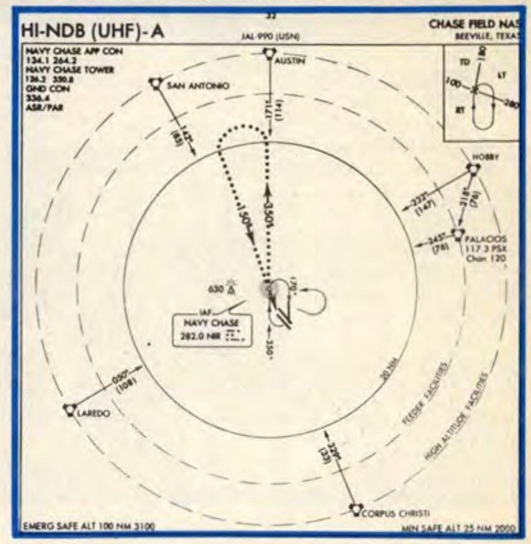
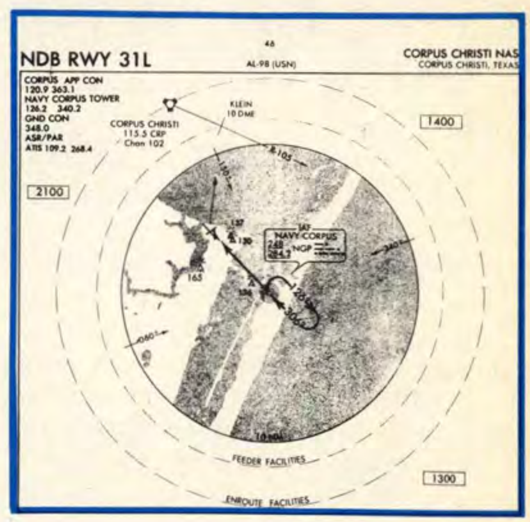


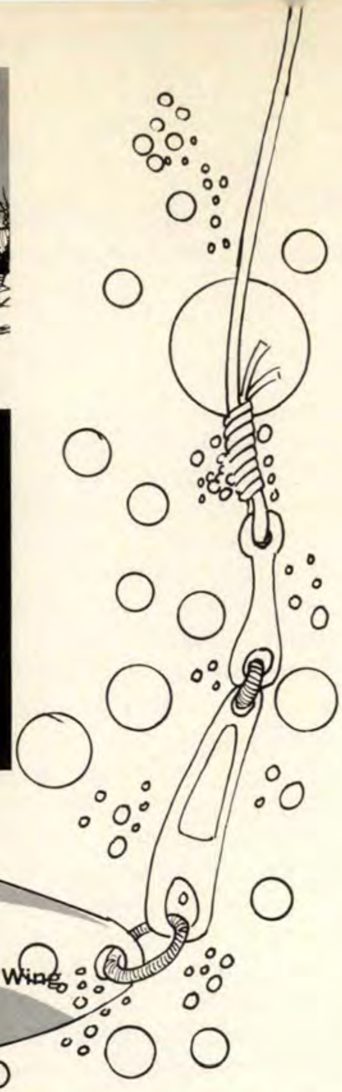
Fig. 6 NDB RWY 31L



What does all this mean to the pilot? It means that there may be more to the approach than is indicated in the name. Regardless of the identification system used, careful study of each approach will reveal any "hidden" requirements and keep the pilot informed, legal, and safe.

Do you have a question related to instrument flying? Call or write the USAFIFC/FSD, Randolph AFB, TX 78148. Our AUTOVON is 487-4276/4884. ★

fishing for food



CAPT THOMAS E. DILLON
Asst Chief, Operations and Requirements Branch
3636th Combat Crew Training Wing
Fairchild AFB, WA

The evening mists are beginning to rise from a smooth stretch of the river bend, and that old, lunker trout silently rises to suck in a struggling artificial grasshopper from the mirror-slick surface . . . the glassy water far back in a lily pad-infested cove is suddenly torn apart by an eight-pound bass hitting your surface plug . . . scenes continue to change with kaleidoscopic swiftness as you recall some of the more memorable fishing trips of your boyhood. Finally, they all merge into a vision of freshly-caught fillets, browning in a cast-iron skillet with fried potatoes and hushpuppies. That's about all your stomach can stand, and you awaken to the sound of its hollow rumbling.

As you open your eyes, you see nothing but orange. It takes only a few moments for you to realize where you are, and that all of those memories were only parts of a frustrating dream. Yesterday afternoon, before you bailed out, you had been looking down at the many lakes and streams, wishing that you could have the opportunity to take a few days off to fish some of them. Suddenly, with alarming swiftness, the situation changed. Now, after a cold, hungry night under your parachute-nylon shelter, you realize that the opportunity is at hand; but this time, pleasure is not your primary motive for fishing . . . you must survive until SAR forces can pick you up, and that means shelter, warmth, water and food.

It also means signaling, but you took care of that problem yesterday before dark. Contacting rescue forces on your PRC-90 radio, you learned that help should arrive sometime late this afternoon—if the weather holds. Water is no problem, since there is a good-sized stream just down the hill. You laid out your ground-to-air signal last evening, and your signaling equipment is ready to use. You're not hurt, but you're hungry. With some time on your hands, you decide to try your hand at fishing.

Super . . . but what can you use? Looking through your seat kit, you find a small plastic box labeled FISHING KIT, SURVIVAL. Let's dig into the box and see what's available.

The components of the kit are listed on a card, visible through the clear plastic case. In addition to a small booklet of fishing instructions under survival conditions, the kit contains various hooks and sinkers, two sizes of line, a razor blade, leaders (both steel and monofilament), safety pins, needles, and a variety of artificial lures: eight assorted wet flies, six tiny feather jigs with willow-leaf spinners, a red and white spoon, a tiny copper spoon, and a larger, weedless spoon.

Great, you think, there should be something here that I can use instead of having to improvise. Looking down at the stream, you notice that it's probably trout water—the kind of stream that causes some people to travel thousands of miles and spend thousands of dollars, just for the chance at wild-country trout. With a little fishing experience behind you, you realize that some of the kit's components will be almost useless for this stream's fish. As you walk down to the stream, you mentally discard the huge 9/0 hook and the large, weedless spoon; you ignore the steel leaders, as well as the spare snap swivels. The treble hooks probably won't help either, but you realize that they might prove useful for snagging a meal if the trout won't hit your lures.

You find a bunch of willows and cut yourself a pole, since it will enable you to cover more water than you could by hand-lining. You put away the 63-pound test line and settle for the 50 feet of 18-pound line, cutting off a length a couple of feet shorter than your willow pole. You secure the line to the pole, and open the leader packet. "Good grief!"

The nylon leaders must be at least 25-pound test, and you hope that the trout are hungry enough to ignore that highly-visible leader. You know enough about fishing knots to realize that the one illustrated for "attaching spinners, etc.," is a simple overhand knot, and totally worthless for your purposes. You recognize the picture of the Turtle Knot as sufficient, so you use it. An Improved Clinch Knot would be better, but the leader material is too thick and stiff to use those knots with the small lures. Recalling earlier fishing experiences, you straighten out the stiff kinked leaders by getting them wet and then stretching them.

Since you're in pretty "wild" country, you decide to try the small, copper spoon, flies, and jig spinners instead of wasting your time searching for live bait. "After all," you think, "those guys at Fairchild told me to conserve my energy, and I'd rather fish than hunt grasshoppers or dig worms." Good thinking, survivor! You're right. Just remember to put the items you're not using back into the kit, for you may need them later.

You're ready to try your luck, so you approach the stream and notice that there aren't any fish visible in the riffles. Looking both ways, you notice a small waterfall downstream and nothing upstream but more fast water. Downstream, then, will be the way to go.

Instead of merely stomping down the bank, though, you decide to circle through the brush and approach the stream again below the falls. This will prevent spooking the fish, and will put you into position from which you can flip your little lure upstream, letting the current carry it down through the pool below the small waterfall.

As soon as you reach the water again, you get down on hands and knees, trying to keep as low a silhouette as possible. You can't wait any longer, so you flip the lure up into the head of the small pool. Immediately, a chunky trout strikes. You attempt to set the hook, but nothing happens. Looking down at the spoon, you see that the small rivet which attached the hook has pulled out.

Tying on a small feather jig and spinner, you try again. This time all works well, and you soon have a nice, 15-inch Brook Trout flopping on the bank. Another flip, and a twin to the first is caught. Since rescue is imminent, you decide that you have enough. You clean and gill the two fish and take them back up to your shelter. A small, hot fire, and you roast the Brookies on a willow stick. Ever tasted fish that good before? Probably not, and there are a lot more of 'em in that little pool if the chopper can't get in today.

Obviously, the hypothetical situation just described is purely a figment of my imagination; the chances of a survivor finding such willing fish, with such little effort, are fairly remote. Even so, the fishing kit in your survival equipment could easily prove to be your primary source of food, should you ever find yourself in a situation similar to the one I outlined above.

It contains many items which can be used for a multitude of purposes: the razor blade, fishing line, needles, and safety pins could prove useful in any survival experience, whether water is nearby or not. The instruction booklet and other paper can be used for starting fires, and simple game snares can be made from the steel leaders; the large hook can be straightened out and made into a gig or spear, etc.

Even if you know little or nothing about fishing techniques, this kit can be very handy. With the instructions provided, you should be able to procure some tasty food with the components whether in fresh water or from a life raft on the open sea. Although it's far from perfect, the kit is adequate, and it definitely belongs in your survival gear. With a small, simple personal survival kit, you can easily supplement the stock kit with other items of your choice. I urge you to do so, and to carry it with you on all missions.

Who knows . . . even your NEXT flight could turn out bad, and you want as many things going for you as possible.

Questions or comments concerning this article should be referred to the 3636th Combat Crew Training Wing/DOTO, Fairchild AFB WA 99011 or AUTOVON 352-5470. ★

THE WAY I SEE IT

I had just pulled off the bombing target and was safing up the switches on our Phantom, searching the friendly skies for Lead. I knew I'd acquire him soon because the "brown and green lizard" sticks out like a sore thumb against a blue azure sky like we had today.

"Check right, 1 o'clock, 5 degrees high, 2 miles out" said Hal, my back seat pilot.

Immediately my eyes moved to the small patch of sky he so cryptically described. There was our leader. I keyed the mike, "Tally-ho, Lead, we're at your left, 8 o'clock closing."

"Roger, leader's sight caged, switches safe," he hinted for a response.

"Two's sight caged, switches safe," I radioed back. Releasing the mike button I asked Hal if it was his turn or mine for the rejoin. I felt the stick shake in my hands when Hal took control with the standard "I got it" call over the intercom.

"Roger," I said, taking my eyes off Lead to clear the area for other bogies. I checked deep six and continued my search; first 7 o'clock, then 8 o'clock, then 9. My mind wandered for a fraction of a second as I said to myself, "This is the last mission. I'll finally get over to SEA to do what I've been trained for—fly combat."

Back to reality. No bogies at ten, let me see how Hal's doing on the rejoin. As my eyes came off the left quarter panel I conveniently checked the airspeed, at 300 knots. I sure wish Hal would get off these darn pilot training, co-speed, pussy cat rejoins. My eyes came to rest on the Leader at a mile and a half range and I retracted my previous judgment. Hal's way ahead of the rejoin line (too much cut off) and he's going to "tiger" it in. I decided to devote full attention to the rejoin now for a couple of reasons. My personal preference is to come in on or slightly behind the line, 50-100 knots above rejoin airspeed, and having flown only seven missions with Hal I'm not positive that he has a technique for converting from his present position ahead of the line back to the normal rejoin. I knew if we maintained our present relationship it's likely one of three things would happen:

One, we could stay in this geometric plane, maintain our airspeed and overshoot.

Two, we could maintain the same plane and remain on the inside of the turn by reducing our airspeed drastically.

Three, we could maintain our airspeed, pull up nose high in the vertical and roll to the outside wing of the leader. This vector roll maneuver keeps you from overshooting Lead's radius of turn.

As I observed Hal proceed past the point of conversion to a normal rejoin, I immediately started looking for indications that he was going to perform one of the three options mentioned.

At 4,000 feet slant range I felt seat pressure as the nose started up. With the nose 20° high, Hal began a slow roll. We hit the wings level inverted position and passed canopy-to-canopy with number one. I anticipated an unloaded half roll to the upright position, but instead we continued a loaded roll. This was wrong. As our nose came through the horizon I advised Hal "Okay, we've messed up the rejoin, just abort it and pull us out of this mess."

As the word "pull" came out I recognized it as a poor choice of words. Immediately I felt four Gs and the aircraft shuddered. Being inverted he's buried our nose.

"I've got it!", I yelled. I unloaded and threw the stick full right. My mind raced! Why is it taking so long to roll? Check airspeed! Of course, the nose high pull up cost us 50 knots and Hal's ham-fisted pull cost another 50. We've got 200 knots. The rejoin was at 2,500 feet. It's going to be close when I get it upright. We're almost there! Analyze the situation, quick! Altitude 1,600 feet, dive angle 60°, airspeed 200 knots.

I set the bird at optimum angle of attack (AOA) and evaluated whether we can make the pull out

Too close. The decision is made. "Bail out, bail out, bail out" I commanded my back seater. I expected a blast of wind and a muffled explosion as his seat fired; instead I heard him over the intercom "I pulled the emergency harness release handle."

Oh great! He's just disconnected himself from his seat instead of ejecting. He's dead for sure if he tries to bail out now. We'll just have to hope we make it. I could see the ground coming up and fixed my full attention to the AOA gauge. As I stared at the gauge I thought of all the things we learned about AOA in aerodynamics at the Academy. I thought my coefficient of lift must be very high. I thought of the air foils I'd seen in the wind tunnel. I thought my induced drag is also high. I thought the wings were generating 1000's of pounds of lift. I thought. . . .

By now most of you pilots have said to yourselves "I'd never let that happen to me." Perhaps not, but loss of control cost us 11 aircraft in 1977. By loss of control I mean pilot induced departure from controlled flight.

There are several "operations" causes which could lead to a loss-of-control accident. They include pressing, overcommitment, lack of knowledge or proficiency, poor technique or lack of air discipline. In the case we've described at least three of these have a bearing.

Overcommitment

Hal was overcommitted when he moved ahead of the line. In an attempt to perform according to his image of "fighter pilot" he tried a maneuver for which he was ill-prepared. Any pilot can become overcommitted. Have you ever made a night IFR emergency recovery? Was it a bit "hairy?" The AC in this accident was overcommitted when he tried the recovery at less than 500 feet. The point is not that you shouldn't—but that you can become overcommitted. Be aware of the danger and avoid that final "coffin corner" situation.

Lack of Knowledge and Proficiency

Hal had neither the knowledge nor the proficiency to accomplish the maneuver he attempted. He also reverted to an earlier habit pattern when he forgot the proper ejection sequence for an F-4. In the current regime of minimum flying time each of us must be doubly alert to a loss of proficiency. The procedures trainer or simulator is your best remedy for this cause.

Poor Technique

This is a large "gray" area. Each pilot has his own cherished techniques for accomplishing the myriad of maneuvers necessary for a successful flight. And this is right and proper. It is only when technique is allowed to supplant the dictates of procedure and good judgment that it becomes poor. In this instance, the high cut off angle was a poor technique. Even the AC recognized that. The problem with technique is—where do you draw the line? This same technique used by the AC might have been successful. The answer is, make sure techniques are consistent with established procedures, then there will be little doubt.

Loss-of-control cost us more aircraft than any other single cause in 1976. And each of the underlying factors relates to everyday situations faced by pilots. The accident described in this article happened years ago. Yet the same type is still happening even in 1977. They will continue to happen as long as we—the USAF pilot community—continue to make these same errors. We can reduce this category of accidents. Let's strive to take control loss accidents out of the number one spot in 1977.

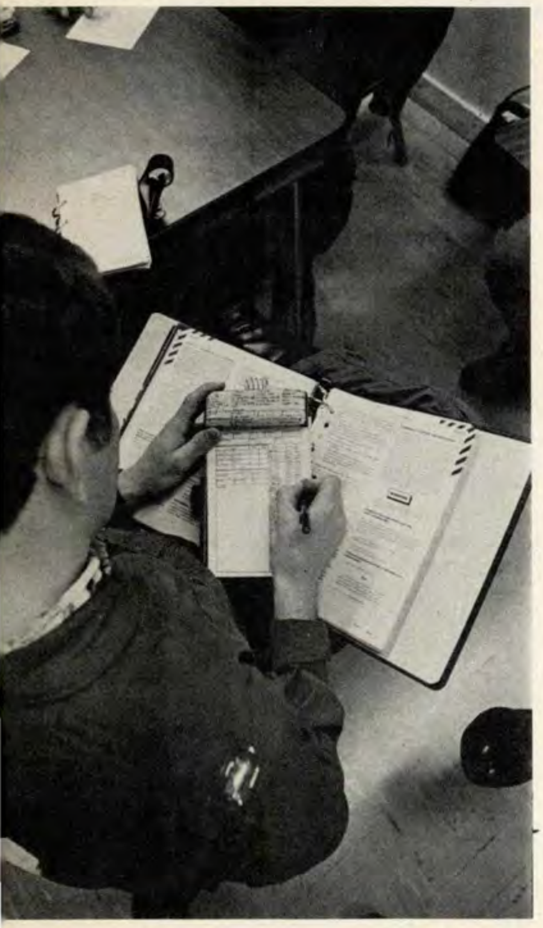
Ed Note: The mishap described in this article was contributed by Capt Ed Durocher, 33 TFW, Eglin, AFB, FL. ★

REX RILEY Transient Services Award

LORING AFB	Limestone, ME
McCLELLAN AFB	Sacramento, CA
MAXWELL AFB	Montgomery, AL
SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, SC
EGLIN AFB	Valparaiso, FL
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
LUKE AFB	Phoenix, AZ
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, GA
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
ENGLAND AFB	Alexandria, LA
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AL
PETERSON AFB	Colorado Springs, CO
RAMSTEIN AB	Germany
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
TORREJON AB	Spain
TYNDALL AFB	Panama City, FL
OFFUTT AFB	Omaha, NE
McCONNELL AFB	Wichita, KS
NORTON AFB	San Bernardino, CA
BARKSDALE AFB	Shreveport, LA
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RICHARDS-GEBAUR AFB	Grandview, MO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
POPE AFB	Fayetteville, NC
TINKER AFB	Oklahoma City, OK
DOVER AFB	Dover, DE
GRIFFISS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK
LAUGHLIN AFB	Del Rio, TX
FAIRCHILD AFB	Spokane, WA
MINOT AFB	Minot, ND

The Specialized Pilot

MAJOR TONY HELBLING, Directorate of Aerospace Safety



During the past decade, the USAF has been driven to a universal pilot concept. The universal pilot, by definition, can be cross-trained into any weapons or support system as requirements dictate. This was required due to the long-term demands of the Vietnam era and remote manning requirements of our various weapons systems.

Our sister services, having different requirements, found they could maintain a specialized training concept on a broader scale than that of the USAF. The Navy, for instance, specializes within the undergraduate pilot training framework. When a naval aviator receives his or her wings, two-thirds of the training has been related to the type aircraft and missions to which the pilot will be assigned.

Specialization in the present USAF system starts when the pilot receives the aeronautical rating. USAF pilot training develops a pilot who is more qualified to fly a single-seat aircraft than a multicrew manned system.

This lack of specialization has, in the past, been a frustrating experience for UPT graduates assigned to either type of aircraft. The fighter pilot is not exposed to tactical specialization prior to his rating. The transport pilot is similarly not exposed to multi-crew coordination duties and cannot be rapidly phased into this system without additional training.

In the fighter-attack business, the fix is a lead-in course which has recently been expanded to 49 sorties. This course exposes the UPT graduate to the tactical scenario in an aircraft he is familiar with.

The transport pilot would achieve the required level of proficiency by flying as copilot or third pilot.

The deficiency common to both situations has been slower integration into the end assignment weapons system. Now we are being driven to specialization by increased operational costs and lack of fuel.

An aircrew repeatedly flying the same type of mission such as air combat, close air support or tactical troop drop will become more effective at the specific mission. This gives the aircrew the ability to "fine tune" their procedures and techniques. On the other hand, a broad exposure to several types of missions will serve to bring the aircrew to the midpoint on the learning curve which does not enhance their effectiveness or significantly reduce the crew's accident potential.

In the final analysis, emphasis on specialization could prove to be the breakthrough in the reduction of operator factor mishap causes.

The article that follows describes the fighter lead-in mission. ★

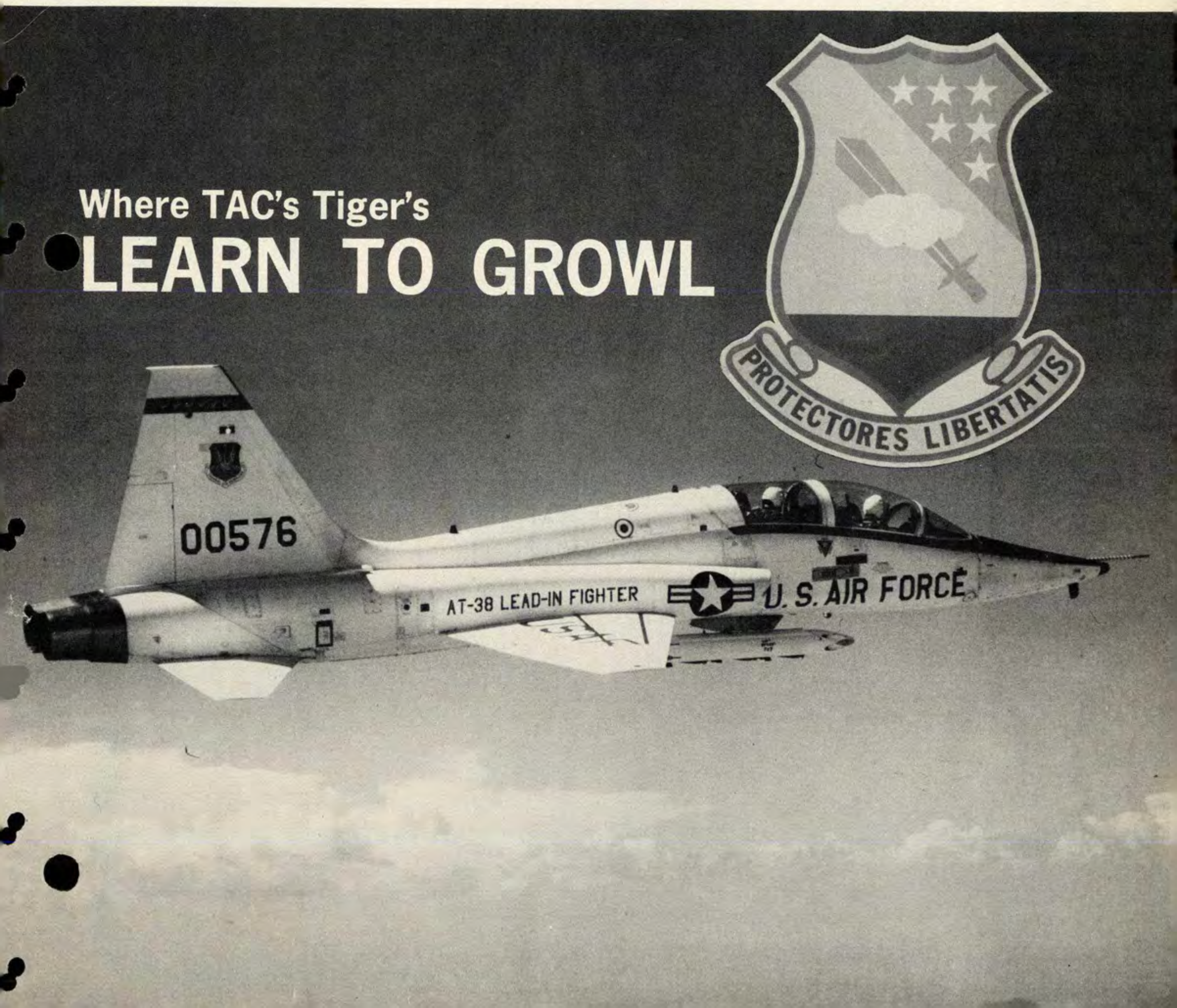
MAJOR JOHN E. RICHARDSON
Directorate
of Aerospace Safety

The morning sun starts to warm the white sands of the New Mexico desert; a Roadrunner stalks a particularly succulent lizard among the sparse vegetation at the edge of the dunes. Suddenly, the early morning calm is shattered by the roar of jet engines. Two sleek, blue-gray shapes flash overhead. The Roadrunner unconcernedly looks up and sees a second pair of T-38's lifting from the runway at Holloman AFB. The bird watches as the four aircraft join up and streak out toward *El Capitan*.

So starts another mission for one of TAC's newest and most important wings. The 479th Tactical Training Wing has the responsibility for training new pilots and navigators before they report to an RTU. The 479th's history makes it well suited to training new fighter aircrews. First activated in October 1943, the 479th Fighter Group distinguished itself throughout Europe in both P-38's and P-51's. The Group was deactivated from 1945 to 1952 when it was designated the 479th Fighter Bomber Wing at George AFB, California. From then until 1971 the wing flew many of TAC's first line fighters: F-86's, F-100's, F-104's, and F-4's.

The heart of the 479th's mission is fighter lead-in training. The

Where TAC's Tiger's LEARN TO GROWL



course is designed to train recent UPT and UNT graduates and other aircrew resources without a TAC background in fighter tactics and procedures. The course concentrates on basic fighter maneuvers and ground attack using T-38 and AT-38 aircraft. There is also a comprehensive and demanding academic program. The academics are designed to compliment each phase of the flying training.

Why have a special fighter lead-in program before RTU? The answer is economics and safety. Colonel William Crum, the commander of the 479th, emphasizes that the mission of the wing is to give TAC the best possible aircrews at minimum cost. This means the least costly aircraft that can provide the required training objectives. The T-38 is remarkably suited to accomplish this; its cost per flying hour is only about 20 percent of that for an F-4 or F-15. The training currently being given in the

The fledgling fighter crews learn the basics of fighter tactics and aircraft operation from highly qualified instructors.

Simulator training in both T-38 and F-4 simulators is an important part of the training program.

Detailed briefings are a prelude to every flight. All crewmembers must be very familiar with every aspect of the flight.

Capt Jim Slaton of the 435th TFTS explains an important point about tactical formation during a flight briefing. Careful and explicit instruction keynotes each 479th flight.

fighter lead-in syllabus has enabled the F-4 advanced fighter training to be reduced by four sorties. The savings from this reduction is more than $5,000 per student.

But aircraft cost per flying hour is only part of the story. The real savings is in training effectiveness. The UPT/UNT graduate reporting to an F-4, F-15 or A-7 RTU is faced with an awesome learning task. First the trainee must learn the highly specialized and extremely demanding skills of a tactical fighter crew member. But this is not enough —at the same time he must master the complexities of a new first-line combat aircraft.

The logical solution is to reduce the learning work load. This is most easily accomplished by eliminating one of the variables. Since all UPT graduates are already familiar with and qualified in the T-38, this is the most feasible solution. Now a trainee can concentrate on learning the basic maneuvers and tactics he

"Pegtop Flight Check In." A precise professional check in sets the tone for every 479th flight.

Flight taxies out for a basic fighter maneuver mission, one of the important phases of the course.

Last chance inspection—that final assurance that everything is ready to go.

On the runway—the flight lines up and takes off in two-ship elements.

will employ in a fighter without being overloaded. This concentration also allows for much better retention of the material and then, when the trainee goes to advanced training, he already knows the language and basic maneuvers. The advanced training can, therefore, be just that —a polishing of the skills of a fighter aircrew.

We mentioned safety. This is a cornerstone of the fighter lead-in course. The fighter mission is demanding. There is little margin for error in tactical flying; consequently, the new fighter crew must have safety ingrained as part of their training. This does not mean using the old "fly safely" bromides. Rather, the approach is one of discipline and expertise in mission accomplishment. It is a realization that true flying is nothing more or less than doing the job correctly, efficiently,

Now we get to practice what we briefed on the ground. Tactical flying is a demanding but very rewarding mission. The satisfaction of flying a well executed tactical maneuver is about the best you can get.

professionally. This point is continually emphasized by the instruc[illegible]r. An accident means loss of com[illegible]at capability, thus safety is important.

Combat is something the 479th instructors know about. Most are long time fighter types, some with 500 combat hours and even one with more than 1000. Their creditability in teaching the business of fighters is excellent for they've been there. Now they are passing on that hard won knowledge to a new generation.

The New Mexico sun climbs higher in the sky. The desert begins to shimmer reflected heat as midmorning approaches. The Roadrunner, remembering his earlier repast, is looking for another lizard. Across the dunes comes the increasing rumble of jet engines. Two pairs of T-38's flash over the desert in fingertip formation. Each one, in turn, arcs into a tight pattern over the runway and descends gracefully to touchdown.

The Roadrunner watches as the T-38's taxi back to parking. This is the last flight for these students. They have completed the lead-in course and now go on to advanced fighter courses in A-7's, F-4's or F-15's. Four new TAC Tigers have learned to growl. ★

[illegible]rning to land a high speed fighter is a difficult task. By [illegible]ng an aircraft already familiar (T-38), this stumbling block is avoided, and the trainee can concentrate on tactics.

Mission accomplished. Another crew has learned the skills necessary to prepare them for their future roles as first-line members of TAC.

THE SECOND FIRE WARNING LIGHT or, WHAT DO I DO NOW?

This article is reproduced courtesy of McDonnell Aircraft Co Product Support Digest
By BOB JENSEN/*Senior Engineer, Flight Safety Department*

In twin-engine fighters like the Phantom, a single fire warning light isn't the heart thumper that it is in a single engine machine. Not that it doesn't attract a lot of attention and demand rapid action, but there are ways to cope with the problem and bring the airplane home. Phantom Phlyers have seen their share of fire warning lights, both false warnings and the real thing. They . . .

"Idle the affected engine, then proceed to cut-off if the light continues or a fire is confirmed."

This should take care of the problem, requiring only a no-sweat single engine landing if there are no additional complications. However, one of the rarer added thrills for the pilot is a *second* fire warning light from the other engine bay. Here we have a hopeless situation - fire in both engines and nothing to do but eject, right? Perhaps, but not necessarily, and certainly not before you know for sure what is really going on down there in the engine room.

FIRE WARNING INDICATIONS

First, let's consider what the fire warning light is saying. The detection element is designed to pass enough current through an electrolytic salt to start the fire light glowing when a temperature of 766°F is attained on any segment of the fire detection elements. This temperature is high enough that normal engine heat will not cause a warning light, and low enough that a warning comes before major fire damage has occurred. A temperature of 800°F will not cause immediate serious structural damage in the engine cavities. Like the pain in your hand when you touch a hot stove, the fire warning usually comes before serious damage is sustained. So the second fire warning light is not a cause for instant despair.

FIRE WARNING IMPLICATIONS

Second, let's examine the history of F-4 accidents where a second fire warning has occurred. (In this part of the discussion, only *fire* warning lights, as distinguished from *overheat* warning lights, are considered. There is a very good reason for this distinction, because a fire warning light reports a 766°F temperature condition *inside the forward and mid-engine cavity,* while an overheat warning light reports a 1050°F condition *outside the engine bay* at the "turkey feathers.")

There are some variations in the double fire light accident patterns, mostly in the time interval between the first and second fire lights. The cases on record where nearly simultaneous fire lights occurred immediately after takeoff almost invariably involved F-4's with *centerline external fuel tanks* installed. Although investigators did not always agree that a leaking centerline tank connection was the cause, the circumstantial evidence is overwhelming.

The few exceptions that involved near simultaneous dual fire lights had entirely different characteristics. Most importantly, they did not occur just after takeoff. Each of the exceptions also had clear-cut catastrophic failures indicated. In one case, an early configuration titanium first stage engine compressor disc failed, causing major shrapnel type damage and a series of explosions. Another case occurred on centerline rack cartridge firing, when a poorly secured jettison cart housing punched a hole in an engine fuel line in the keel. Another similar case was a result of jettisoning external stores.

But on liftoff, or initial climb after takeoff, a double fire warning with a full centerline tank installed calls for C/L tank jettison, or depressurization by extending the IFR receptacle door/probe. If accomplished promptly, centerline tank depressurization/jettison may eliminate the fire.

SEQUENTIAL WARNING LIGHTS

A different situation exists where first one engine fire light comes on, and *following throttle reduction* to idle or cut-off, the other light then comes on. Here we have a definite fire origin within one engine cavity that is transmitting enough heat to the other engine bay to trigger that fire light as well. Does this mean that the fire has spread so that both engine bays are involved in the fire? Not always; perhaps we can even say not usually.

If we consider only fire warning lights again, with no overheat lights illuminated, F-4 history says that only the one engine bay is really involved. Post-accident examination of the engine bays with this condition normally shows little or no evidence of fire in the engine bay that had the second light. The reason for the second light is that sufficient heat from the primary fire was transmitted through the center keel web to heat the fire detection element in the other cavity to 766°F.

In one or two cases, it has been theorized that because right engine bay fire elements are mounted directly to the single titanium keel web above the 83R door, a fire properly positioned in the left engine bay could direct enough heat on the web to cause a right engine fire warning as well. In other accidents with these symptoms, it has been found that hot gas and flame found a path through web openings, such as the centerline bomb rack (AERO-27) access doors, into the other engine bay. Though the damage in the second cavity was normally limited, i.e., scorched paint, the temperature was high enough to cause a fire warning.

The J-79 engine installation uses a large-volume, high-velocity flow of secondary cooling air outside the engine and inside the engine bay. This is provided by the jet pump action of the engine exhaust nozzle during engine operation. Inside the engine bay of an operating engine, and especially during engine acceleration, air pressure is less than in the air outside the cavity. This is how a leaking external centerline tank can trigger one or both engine bay fire warning lights. The leaking fuel is drawn into engine bays, ignited in the A/B flame at the nozzle, and fire flashes back into the engine bay.

If, however, the pumping action of the engine exhaust nozzle is stopped in flight by engine cut-off, the normally negative relative pressure inside that engine bay becomes positive. Ram air, entering the engine intake, spills through the opened bellmouth into the engine bay. Due to the termination of nozzle pumping and a restricted exit area, a pressure increase occurs in the engine bay. If one engine is idled, a similar but lesser pressure rise occurs in the engine bay of the idled engine. Thus, when one engine is idled or shut down in response to a fire warning light, any opening between the engine bays becomes a "pneumatic tube" to draw the fire into the other side. As engine shutdown cuts off all but residual JP fuel and a few gallons of hydraulic fluid and engine oil, the fire has little chance to seriously involve the second engine bay. However, it will cause the second fire warning.

OVERHEAT WARNINGS

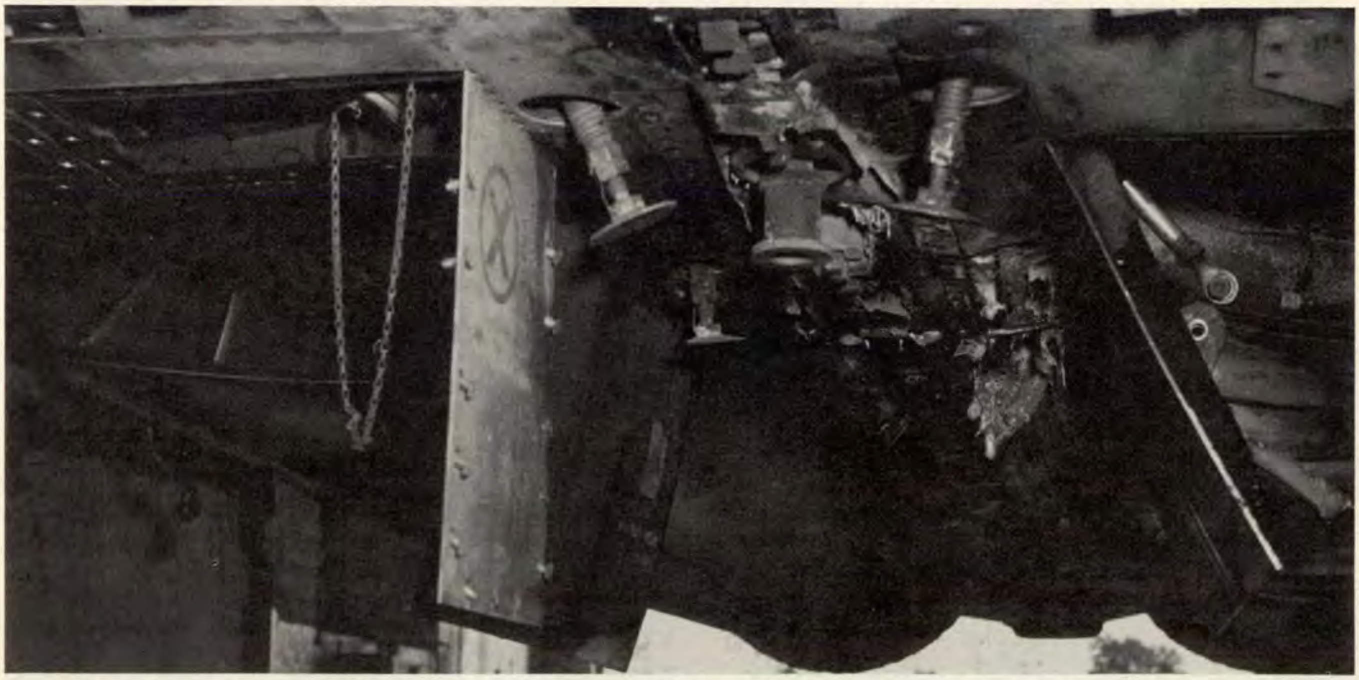
To complete the picture, let's examine the accidents where overheat lights were involved. These are indications of high temperature outside the engine exhaust nozzle, where sensors were added to the F-4 to warn of a nozzle flap failure. A single overheat light, with no other fire indication, is usually just that, a nozzle flap failure.

Two overheat lights alone (no fire warning) are a different story - that usually means fuel is burning at the tail in such quantity as to light both lights. An upper fuselage fuel system leak, as from a fuselage fuel transfer line failure or a fuel cell rupture, normally does not enter the engine bays. Fuel streaming aft, from an airframe fuel system leak outside the engine cavity, will not ignite until an ignition source is encountered. Historically, engagement of afterburner has been the most frequent and most positive method of igniting leaking fuel. So, if two overheat lights come on shortly after A/B selection, probably a major fuel leak exists.

If one fire light follows (or precedes) the two overheat lights, there is a likelihood that the fuel is originating in the engine bay that has the fire warning, and immediate shut-down of that engine may control the fire. Some types of catastrophic engine failures, however, can rupture a fuselage fuel cell from below causing an uncontrollable fuel leak/fire from the engine bay. In any fire in which both overheat lights are on, there is a possibility of loss of stabilator control due to fire progression inside the aft fuselage. •

USING WHAT WE NOW KNOW

The history of F-4 fire accidents is well worth examining for the purpose of learning whether cockpit indica-



A centerline tank leak on takeoff gave the crew two fire warning lights and an overheat light to analyze. After alternate throttle reduction did not help, tank jettison solved the problem. (All photos are of same aircraft)

This right engine bay center keel web was bright blue, showing 1100°F+ flame temperature. Note fire warning loop mounted to titanium web skin.

tions can be used to discriminate between types of fires. This summary is an effort to pass on the knowledge available; however, none of these typical indications can be considered absolute indicators of the fire source.

Even though analysis of fire and overheat warning light sequencing is not an exact science, the record shows that a particular warning light sequence can be meaningful. So, how can a pilot, maintenance supervisor, or mechanic use this information? As a pilot, I would make a mental note that with a centerline tank installed, a double fire light just after breaking ground might be cured by tank jettison, or even by nothing more than extension of the IFR receptacle/probe. Even a single fire light at that point would make me think — centerline tank? I would also make certain that, on preflight, the AERO-27 (centerline) rack access doors are installed and secure. Without becoming complacent about engine bay fires, I might also remember that, statistically, the record shows a single fire light followed by a second fire light after cutting the throttle on the first engine, probably means heat transfer from the initial warning area. Completion of engine shutdown as dictated by the first fire light might eliminate both problems. If both lights persist, or the second one goes out and the first remains on after engine cut-off, the odds are good that a Utility hydraulic line is the fire source. In several accidents of this type, the fire ran out of hydraulic fluid and went out at about the same time the crew ejected.

In the aircraft maintenance group, the knowledge that keeping the keel web airtight can save an airplane and crew may improve the incentive to watch AERO-27 access doors more carefully. Other keel openings may also be detected that require resealing. Meticulous leak-checking of centerline fuel tanks after installation can also save a crew and airplane. The fact that these tanks only pressurize for transfer after takeoff is the reason a careful leak-check is required *with the tank pressurized.*

Engine bay fires are serious problems in the F-4, and our twin-engine redundancy needs to be protected so that a fire in one engine can be contained and possibly eliminated. Better understanding of the causes and progression of fires may result in saving some aircrews and aircraft.

Jettison of three external tanks to reduce landing weight also got rid of the source of the fire. The crew brought this one back after an adrenalin-filled eight minutes. Photo on right shows centerline bomb rack from below.

Caffeine Comments

Air Command Headquarters
Canadian Forces
Westwin, Man

Caffeine is a common drug found in a variety of plants, most notably coffee beans, tea leaves, cocoa seeds and cola nuts. It is closely related to a variety of chemicals, including uric acid (the causative agent of gout), purines (a major constituent of DNA in cell nuclei), theophylline and aminophylline (for treatment of asthma) and theobromine (the major stimulant in cocoa). Of all the chemicals of this family, caffeine has the greatest stimulant effect on the central nervous system, especially the cerebral cortex. It also causes the kidneys to increase fluid output, stimulates the heart to beat faster and relaxes smooth muscle (e.g., the bronchi or respiratory tubes).

Of all these effects, we drink coffee for its stimulating effect on the central nervous system. Caffeine, through the central nervous system, does a variety of "good things": It allays fatigue and drowsiness, allows sustained mental effort, gives a keener appreciation of sensory stimuli, decreases reaction time, enables a clear flow of thought, increases motor activity and enables greater association of ideas. Through other avenues it also increases the muscular capacity for work, increases secretion by the stomach and increases respiratory rate, among others. Although tolerance to all these effects does develop, the stimulant effects seem least affected.

Since a variety of food products are made from the plants that contain caffeine, many commonly consumed beverages and snacks have fairly high levels of this drug. Also, since caffeine does have the physiological effects referred to above, it appears in a host of commonly-prescribed and proprietary medicines. Following is a list of the commonest sources of caffeine on the market today, with approximate contents of caffeine:

1. Beverages	**Caffeine Content**
Brewed Coffee	90-150 mg/6 oz cups
Instant Coffee	80- 90 mg/6 oz cups
Tea	70- 80 mg/6 oz cups
Hot Chocolate*	20- 50 mg/6 oz cups
Colas	35- 55 mg/12 oz btl

*Certain types do not have any (e.g., Ovaltine R)

2. Medications	
Frosst Pain Killers (e.g., 222, 292, etc.)	30 mg/tablet
AC &C (Ayerst)	15 mg/tablet
Anacin R	32.5 mg/tablet
Coricidin Cold Tablets R	30 mg/tablet
Sinarest R	30 mg/tablet
Bromo Seltzer R	32.5 mg/tablet
Excedrin R	60 mg/tablet

In addition, certain chocolate preparations and Dristan R also contain significant amounts of caffeine.

Although caffeine has many good side effects, too much of the proverbial "good thing" has undesired, adverse, and often deleterious effects. When one consumes enough caffeine to get side effects, the condition becomes known as caffeinism, and most of us have probably had this entity on occasion. The symptoms of caffeinism are legion, and include the following: irritability, shakiness, muscle twitching, inability to sleep, nervousness, rapid breathing, flushing, rapid heart rate, irregular heart beats and palpitations, frequent urination, abdominal cramps, diarrhea, and acidy stomach with heart burn. Most of these effects are due to the stimulant properties of caffeine, again the reason we drink coffee or tea in the first place.

The development of these symptoms and the dose of caffeine required to produce them depends on the individual. On the average, however, 50-200 mg of caffeine is usually enough; therefore, two cups of coffee or tea could produce unwanted effects, and so could the drinking of several colas.

To avoid the adverse side effects alluded to above, a lot of people are switching to decaffeinated coffee. However, there is evidence that caffeine is not the only offending constituent in coffee, albeit the principal one. Thus, people who switch to decaffeinated coffee may still witness some, or all, of the unwanted side effects. Morever, other heavy caffeine consumers, alarmed by articles such as this have ceased their intake abruptly. This has resulted in a physical withdrawal with such symptoms as irritability, headaches, shakiness and a variety of others. So, if you decide to break the caffeine habit—let's call it what it often is, a caffeine addiction—let yourself down slowly, or stop under the care of your Flight Surgeon. Although we often don't take caffeine seriously, we should!

To stop drinking coffee would be extreme, and probably not warranted. However, to be aware of what one is consuming, and to practice moderation, seems to make sense no matter what we are doing, especially flying. And this is especially so if the results of immoderation adversely affect performance—indeed be downright incapacitating — as they can be in the case of caffeine. ★

LIGHTNING AND AIRCRAFT

continued from page 4

CAN YOUR AIRCRAFT TRIGGER A STRIKE?

A question often asked is, "If an aircraft cannot produce its own lightning flash, can it trigger a natural one?" Stated another way the question might be, "Would the lightning flash have occurred if the aircraft were not present?"

While there is still much we don't understand about lightning formation process, most researchers conclude: (1) that aircraft are usually struck by flashes that would have occurred anyway, but (2) the aircraft, being conductive, is attractive to a nearby leader and causes it to divert towards the aircraft rather than continue on in some other direction. There is some evidence that jumbo-jets sufficiently "squeeze" and intensify the electric field around a nearby charge center to cause a stepped leader to form before it otherwise would have, thus triggering a strike; but this seems improbable for smaller aircraft.

WHEN IS A STRIKE MOST LIKELY?

Erratic as they are, it is impossible to predict just when or where a lightning strike will occur, but some idea of when to be on the alert for one can be obtained from study of past experience.

Figure 5 shows flight and weather conditions summarized in a recent survey of 200 commercial airline strike reports, and Figure 6 shows the flight altitudes at which most of these aircraft were struck. The outside air temperature reported in most instances was within a few degrees of the freezing point (0°C). From this data one might draw the conclusion that a strike is most probable to an aircraft flying at an altitude between 10,000 and 15,000 feet, within a cloud, experiencing rain and light turbulence and with the outside air temperature near 0°C. Strikes have been reported under many other combinations of circumstances, however.

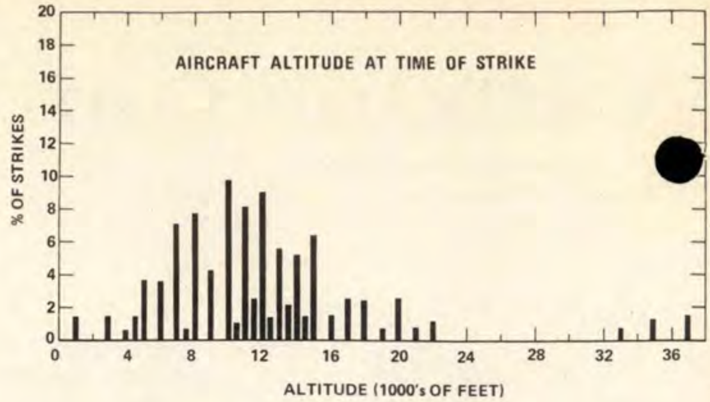


FIG. 6 Altitude Where Most Strikes Occur

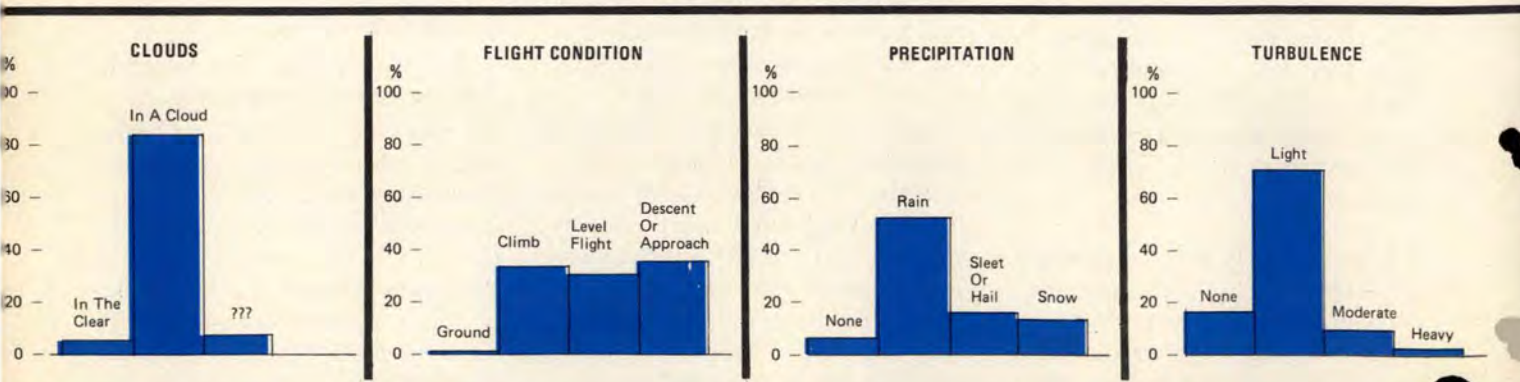
WHAT ABOUT AVOIDANCE?

Good flying practice and USAF flight manuals call for avoiding thunderstorms at all cost—not only to avoid lightning strikes but also to avoid the other manifestations of a good thunderstorm: turbulence, hail and rain. Careful study of weather reports and use of radar can help you avoid areas of precipitation, but unless you can circumnavigate these by well over 25 miles, an occasional strike may still reach out to greet you. There are many reports of strikes occurring to aircraft operating between clouds or in other areas where no thunderstorms were forecast, and a few pilots have even reported "bolts from the blue." Thus, even if you fly diligently by the book, you can probably expect to be "zapped" sometime during your flying career.

WHAT EFFECTS CAN YOU EXPECT?

As we said before, electric currents of up to 200,000 amperes will flow through your aircraft between lightning entry and exit points when you are struck. Owing to its short duration, most of this current will remain in the skins, with relatively little of it diffusing into interior spars and ribs. Fortunately, aluminum is a very good electrical conductor and there is enough of it in most aircraft to conduct this current.

FIG. 5 Commercial Aircraft Lightning Strike Experience



In most cases the only noticeable effect of this current having passed through your aircraft will be small pit marks where the lightning flash momentarily attached, as shown in Figure 7. At trailing edges or other places where the flash can hang on longer, a hole might be melted. Holes can be prevented by making the skin thick enough (0.080 inches will usually suffice) but skins that thick are heavy and are usually used only over fuel tanks or other critical places where penetration of the hot arc cannot be permitted.

Lightning may do a lot more damage to nonmetallic structures such as the fiberglass radome shown in Figure 8. In this case, a streamer induced from the radar dish probably punctured the radome wall and reached the approaching leader. Then when the return stroke followed this path, its explosive blast pressure shattered the radome. The radome contained the blast until its pressure had built to a very high level, resulting in a "violent explosion," forcing the crew to eject.

If there is a pitot probe on the radome, as is the case on most fighters, the probe forms a good lightning rod. Usually the pitot probe is grounded to the airframe by a wire inside the radome. Sometimes these ground wires are too thin to carry severe lightning currents and have exploded on several occasions, with damage similar to that of Figure 8. Sometimes the aluminum tubes which bring pitot static pressure back to the instruments have acted as the ground conductor, but the intense magnetic fields surrounding lightning currents often crimp such tubes, cutting off instrument air. To make matters even worse, the cord which brings electric power out to the probe heater is also susceptible to the lightning magnetic fields. These fields may induce severe surge voltages in the heater power circuit. Since the heater is usually powered from the essential bus, other equipment powered from this source is exposed to the same surge. The immediate result has been damage to a variety of other electronic equipment, and has led, in a few cases, to loss of the entire aircraft. Figure 9 shows typical lightning damage to pitot static lines and a heater power cord. Much more is known today about how to protect against these effects, so that radomes and pitot systems in the aircraft now being built are not likely to be as vulnerable.

Because they are usually located on wing tips or other extremities, navigation lights are frequently struck. Normally, the flash attaches to the metal lamp housing and does little damage, but once in awhile it will break the globe and light bulb, as happened to the

FIG. 7
Pit marks where flash attached

FIG. 8
Radome shattered by glass effect

Typical lightning damage to pitot static lines and heater power cord

FIG. 10 NAV light globe broken by lightning, leaving a path for lightning current to enter aircraft's electric system.

lamp in Figure 10. If this occurs, a portion of the lightning current may get into your aircraft's electric power distribution system and damage electronic equipment powered from the same bus. This, like the pitot heater situation above, is another of the more hazardous lightning effects for it may cause loss of instruments or communication equipment you rely on in bad weather. The circuit breakers for this equipment will usually pop, but not before the lightning surge has already passed through and done whatever damage it can. Surge arrestors are available to suppress these surges before they get this far, but they are not found on all aircraft. If this happens to you and some circuit breakers pop, try to reset them, but be aware that some equipment may be permanently damaged.

FUEL SYSTEMS

The vapor over a partially filled tank of JP-4 can be explosive at the flight altitudes and temperatures where lightning strikes most frequently occur, as indicated by the flammability limits of a JP-4/air mixture shown in Figure 11. The overpressure which such a mixture can produce when ignited is shown in Figure 12, and these figures show that the maximum degrees of flammability and overpressure occur near the flight altitudes and temperatures at which most lightning strikes to aircraft are reported to occur.

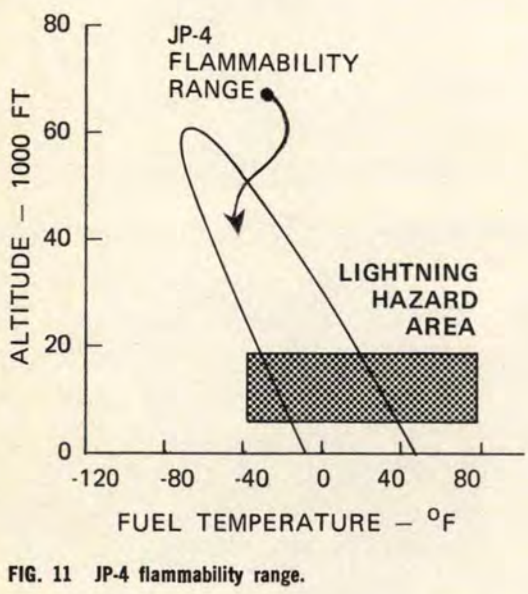


FIG. 11 JP-4 flammability range.

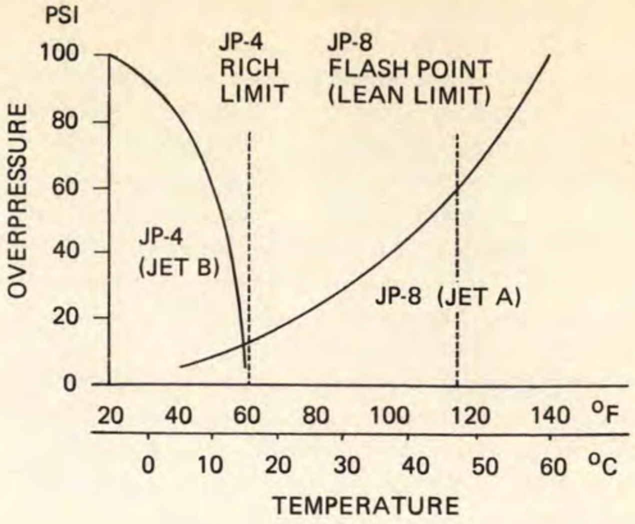


FIG. 12 Pressures generated on ignition of partially fitted fuel tanks under sloshing conditions.

There have been many laboratory studies made of the ways a lightning flash might produce a source of ignition within an aircraft fuel tank. Flashes attaching to access doors and filler caps have been found to cause sparking across inadequate joints or bonds; and flashes attaching to the surface of an integral tank skin have been shown capable of burning a hole if permitted to dwell long enough at one place or if the skin is too thin. Also, simulated lightning flashes have been shown to be capable of igniting vapors at fuel vent outlets under certain airflow conditions—conditions that almost certainly would not exist in flight. Protective measures for each of these situations have been developed, however, and incorporated into today's aircraft, so that the probability of fuel ignition from a lightning strike is remote.

Since the causes of some in-flight fuel tank explosions have never been found, there may still be lightning-related ignition mechanisms which are not fully understood. This is another reason why thunderstorm areas should be avoided, and why operations involving the fuel system, such as in-flight refueling or dumping of fuel, should be avoided while flying in conditions where lightning strikes may occur.

INDIRECT EFFECTS

The lightning effects discussed thus far are frequently termed the *direct effects* because they involve some sort of physical damage. In recent years it has become apparent that there are other *indirect effects* produced by lightning strikes. Flight and engine instruments and other electronics have occasionally malfunctioned even though no direct connection with any part of the lightning flash existed. Because electronic systems are being increasingly depended on to perform critical functions in military and commercial aircraft, the Air Force Flight Dynamics Laboratory (AFFDL), National Aeronautics and Space Administration (NASA), and some of the manufacturers have initiated research programs to find out more about these indirect effects. Thus far, it has been learned that the electromagnetic fields which accompany lightning stroke currents may find their way inside an aircraft, where they induce transient voltages and currents in the aircraft's electrical wiring. This occurs even if the aircraft is all metallic, because there are still a lot of nonmetallic windows through which these fields may enter, and the fields themselves can be very intense. This summer, AFFDL, working in conjunction with NASA, will fly an instrumented Lear Jet aircraft near thunderclouds in Florida, in an attempt to record and measure the electrical transients which nearby lightning flashes induce on several electrical circuits in the aircraft.

These data will further our understanding of indirect effects and help validate test techniques that are presently in use to study induced voltages in aircraft in the laboratory.

WHAT ABOUT YOU?

The most hazardous effect you are likely to receive from a lightning strike to your aircraft is temporary blindness from the bright flash, if the strike occurs near the cockpit. This blindness usually (but not always) occurs at night and may persist for up to 30 seconds, during which time you may not be able to read your instruments. If you have a copilot, one of you may minimize this problem by keeping your eyes lowered when you think a lightning strike is imminent. Turning up your instrument lights may help by reducing your eye sensitivity before the flash occurs and making the instruments easier to regain afterwards. Keeping one eye closed is another technique.

Some pilots also report receiving a mild electric shock when lightning strikes occur. Since you are inside a conducting enclosure, the electric potentials of everything around you remain very nearly the same with respect to one another—even during the lightning strike—and you are not in danger of being electrocuted. The strong electric fields which can pass through the windows as the leader approaches, however, may give rise to streamers from your head or shoulders, causing a slight shock as the minute currents which feed these streamers pass through your body. Just as often though, the shock is simply your startled reaction to the loud bang accompanying the strike.

The effects on you may be much more serious, however, if you are flying in a nonmetallic airplane, such as a glider. In such a craft, the control cables may be the only electric conductors and place you in a direct path between attachment points, with fatal consequences.

PRECIPITATION STATIC

Our discussion thus far has dealt with lightning strikes. Another electrical phenomenon which may be even more annoying is precipitation static, more commonly called "P-static." When an aircraft is flying through rain, sleet, hail, or snow, the impact of these particles on the aircraft will cause a charge to separate from the particle and join the aircraft, leaving the aircraft with a preponderance of positive or negative charge (depending on the form of precipitation) and thereby elevating its potential with respect to its surroundings. Since the aircraft has room for only a small amount of this charge, some of it will begin to leak off in the form of ionization at sharp extremities. This ionization continues as long as the aircraft is flying in P-static charging conditions (precipitation) and is visible as a bluish corona (St. Elmo's fire) at night. Unfortunately, this ionization radiates broadband electromagnetic radiation (EMR) throughout the low and high frequency radio bands. This EMR is often received as interference, or "static" by the aircraft communications or low-frequency automatic direction finding (LF-ADF) or communication receivers, and may render this equipment temporarily unusable. The static dischargers usually found on tips and trailing edges reduce this interference by making it easier for the charge

LIGHTNING AND AIRCRAFT

continued

to leave the aircraft, but they are not always 100 percent effective, especially in heavy precipitation. Since the conditions that produce P-static may also produce lightning, a strike should be considered possible when P-static appears, but except for providing an easily replaceable attachment point, the static dischargers provide little protection against lightning strikes.

We have reviewed the conditions where lightning is most prevalent and discussed some of the more common things to expect when you are struck. There are new structural materials and electronic devices becoming available whose susceptibility to lightning effects is not known, and there are still aspects of lightning itself which we do not fully understand. Therefore, a considerable amount of research is under way at present to learn more about lightning and its effects, and how to design even better protection into new aircraft.

To date relatively few serious incidents or accidents can be attributed to lightning, but there are two trends in aircraft design which promise to aggravate the problem unless positive protective measures are utilized. The first of these is the increasing use of miniaturized, solid-state components in aircraft electronics and electric power control systems. These devices are more efficient, lighter in weight and far more functionally powerful than their vacuum tube or electromechanical predecessors, but they operate at much lower voltage levels and thus are inherently more sensitive to overvoltage transients such as those induced by lightning.

The other trend is toward the use of nonmetallic materials in place of aluminum in skins and structures. This reduces the amount of electromagnetic shielding which the airframe provides and increases the exposure of wiring to electromagnetic fields. Nonmetallic materials may also aggravate some of the other effects noted earlier. Streamers may be drawn from conducting objects inside plastic wing tips or radomes, for example, puncturing them on their way out to meet an oncoming leader. The stroke current may then do extensive damage to the plastic sections. Fortunately, most manufacturers recognize this problem and provide *diverter* strips to minimize punctures of plastic extremities which enclose vulnerable items such as fuel cells or electrical wiring. Together, these two trends present a challenge to the designer of lightning protection for aircraft of the future, but the challenge can be successfully met if it is recognized early in design.

FIG. 13 Simulated lightning tests on wing-tip fuel tank at the GE High Voltage Laboratory, Pittsfield, Massachusetts.

Usually, the vulnerability of new materials or devices to lightning, and the adequacy of protection systems, is determined by subjecting them to simulated lightning strikes in a laboratory. The Air Force Flight Dynamics Laboratory has recently installed a lightning simulation facility for this purpose, as have some of the aircraft manufacturers. Others utilize facilities such as the GE High Voltage Laboratory pictured in Figure 13. The GE Lab was originally built to help design lightning protection for electric power systems, but much of its equipment is applicable to aircraft testing as well.

Much is being learned in the laboratory, but our progress there is only as good as our ability to simulate the real-life environment. Thus, we continually seek reports from you who experience the real thing in flight—reports especially of incidents that seem unusual for some reason, or ones that cause a malfunction of some piece of equipment. You can help by providing complete information on these incidents to the Air Force Inspection and Safety Center. Those of most importance are the ones involving electrical or electronic equipment malfunctions. Describe the malfunction as you experienced it and try to follow up with maintenance and repair personnel to see if you can find out what exactly burned out or malfunctioned. Photographs of unusual damage will also be helpful as will retention of damaged parts for further inspection. Of course, many lightning strikes are "routine" events and need not be elaborated upon except as requested in AFR 127-4. But the extra time you take to report the unusual ones will help designers provide better lightning protection in the future. ★

OPS TOPICS

WIND SHEAR TEST

The FAA will begin tests early this summer of a new surface wind monitoring system (SWIMS) to detect low level wind shear caused by thunderstorms and fast moving weather fronts. The tests will be conducted at six airports: Tampa International; Oklahoma City's Will Rogers; Houston Intercontinental; Denver Stapleton; the W. B. Hartsfield Atlanta International and New York's J. F. Kennedy.

Using a mini-computer, the SWIMS will compare measurements of wind speed and direction obtained by sensors located in the runway approach corridors with wind data obtained near the airport center. When a significant difference in wind velocity—approximately 15 knots—is detected, an aural and visual alarm is triggered in the control tower cab, alerting controllers to potential wind shear conditions.

The SWIMS unit will give air traffic controllers better wind information from as many of six points on and around the airport. As a result, they will have additional time to alert pilots and possibly time to rearrange traffic flows to avoid possible wind shear situations.

ARE YOU PREPARED?

During an FCF in an RF-4C, the WSO heard a loud thump and saw sparks and smoke coming from under the aft part of the right rear console. This continued for about 15 seconds, with sparks shooting into the WSO's face and lap and burning holes in his jacket. He turned off everything in the rear cockpit except the INS and the crew went to 100 percent oxygen.

After recovery and maintenance having a look, the AC cannon plug that attaches to the AC control box was found burned through on one side. Specialists feel the cannon plug failed internally, although they don't know why.

The point for aircrews, of course, is that you must be prepared for the unexpected—like the airplane spitting sparks at you.

CHECKLIST DEVIATED?

After about 2½ hours of flight, the crew of a UH-1N heard a pop and discovered that the nr 1 engine had failed. They made an uneventful landing at their destination and started to investigate. Before takeoff from the previous landing site, the copilot placed his checklist binder on the forward left pedestal console. During the takeoff the binder slid down the console and came to rest against the nr 1 engine console. About two minutes after takeoff, the copilot lifted the binder so he could see the aux fuel switch position. The checklist binder spiral wire caught on the nr 1 engine governor switch, moving the switch from auto to manual and back. This is when the crew heard the pop and found the engine failed. The movement of the governor switch from auto to manual with the throttle above flight idle may cause an engine overspeed or overtemp and possible engine failure (as in this case).

The lesson to be learned applies to all who fly. Unsecured checklists, aircraft forms, flashlights, etc., can cause unwanted problems in aircraft cockpits and flight decks. Good housekeeping procedures are a must for aircrew members. ★

MAIL & MISC.

Send your thoughts, ideas, comments, and questions to:
Editor, Aerospace Safety Magazine — AFISC/SEDA — Norton AFB, CA 92409

CRASH SURVIVAL

Lt Col Charles Pocock
AFISC/SE

1. In response to your article in **Aerospace Safety** (July 1976, "Escape"—Ed) concerning crash survival, I reviewed procedures currently in use on the C-9 for crash landing/ditching. As a result, I recommended some changes in the crash position described in the Dash 1. Based on this recommendation, AF Forms 847 were developed to modify both the C-9 and C-141 Dash 1s. The change to the C-9 Dash 1 has been approved. . . .

2. My rationale for requesting the change is based on the need to protect the hands and arms during a rapid deceleration. In an aft-facing seat, grasping the seat arms has three disadvantages: (1) The armrests are not secured to the seat, (2) The passenger in the center seat must share/fight for the armrests with passengers on either side, and (3) Extending the mass of the arms away from the body will create high G-loading on the arm and could easily result in flailing and injury. On the other hand, keeping the hands under the armpits protects them and concentrates the mass to minimize flailing. . . .

RICHARD E. SIMMONS, Capt, USAF
Flying Safety Officer
HQ 375 AAW
Scott AFB IL

Thank you for your letter. . . . On a high G impact (9 Gs), there is no question that the flailing injuries will occur if the arms are not folded across the torso. If the arms were to go up overhead, shoulder dislocation would be very possible.

The need to protect the hands and feet for successful escape is highlighted in Brig Gen William W. Spruance's (USAF Retired) presentation "Crash Survival." This presentation was recently put on 16mm film (AF #AVR 133). AAVS indicates this film is now available, however, is probably not yet listed in the film catalogue. Gen Spruance is available as a speaker and I am sure would welcome any telephone discussion on this subject. He can be reached through the Delaware National Guard. The safety office at Dover should know how to get in touch with him. Another excellent reference on this subject is Mr. Harry Robertson. Mr. Robertson is on the staff of the Crash Survival Investigator's School, Arizona State University, Tempe, AZ.

Again, thank you for your letter. If I can be of any further assistance please contact me at AUTOVON 876-2226. Unless I hear otherwise, I intend to pass this letter on to the Editor of Aerospace Safety *as an example of positive response to his publication.*

CHARLES L. POCOCK,
Lt Col, USAF
Action Officer,
Flight Safety Division
Directorate of Aerospace Safety

OLD OR UNUSUAL AIRCRAFT?

Do you have any pictures of old or unusual aircraft?

Would you share them with the readers of **Aerospace Safety?** If so, please write to the editor, **Aerospace Safety** magazine, AFISC/SEDA, Norton AFB CA 92409. We advise not to send irreplaceable or very rare photographs.

NEW BASE HOUSING OCCUPANCY RULES FOR TDY ENROUTE

Going TDY enroute to a new assignment? A new change to the housing regulation may help reduce some of the trauma. Now an Air Force member going TDY enroute is specifically allowed to have his dependents continue to occupy base housing. The only requirement is that the member must be able to return to the station after TDY to clear the family from housing. AFM 30-6, "Assignment of Family Housing", is the governing regulation. If you are living in base housing and anticipating a PCS, TDY enroute, check this out with your housing office. It may make your planning easier.

THE OTHER COMMAND

It has been brought to our attention that the biography for Major Thomas C. Skanchy, author of "Flying The Eagle" in the February 1977 **Aerospace Safety,** was unclear. Major Skanchy instructed in ATC for three years after completing pilot training.

NAME THAT PLANE

Can you name this variation of the DC-3 produced for the General Staff in the 1930's? For answer see inside front cover.

☆U.S. GOVERNMENT PRINTING OFFICE 1977 789/855/46

UNITED STATES AIR FORCE

Well Done Award

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

Pictured left to right above are SSgt Beltz, MSgt Johnson, Mr. Raccasi, TSgt Scrivani, 1Lt Mole, Capt Stokes and Capt Stroup.

CAPT George N. Stokes
CAPT Robert J. Stroup
1LT Richard E. Mole
MSGT Gerald Johnson
TSGT William Scrivani
SSGT Thomas R. Beltz
MR. John Raccasi

Air Force Flight Test Center
Edwards Air Force Base, California

Captain Stokes, pilot, and crew were flying in an HH-53 helicopter for midair retrieval of a remotely piloted vehicle (RPV). The helicopter had been modified and equipped with a midair retrieval system and other special test equipment. The load line between the RPV main parachute and the engagement parachute prematurely broke the breakaway tie at the skirt of the main chute canopy and shifted its position 180° around the canopy until it was over a white aiming panel. Because the load line was white, it was not visible to the pilots during the approach. All main parachute breakaway straps and release mechanisms worked normally. However, the main parachute was draped over and became entangled with the load line. At the time, the main parachute looked like a streamer that could have re-inflated at any moment. The re-inflation of the 100-foot main parachute would be the same as a main parachute hang up, a very hazardous condition. Because of the probability of main parachute re-inflation whipping all the cable off the winch drum on the helicopter, with the added possibility of injury to crew members working near it, no winch cable was reeled in as is normally done. The RPV's jettisonable chaff pods were retained to help cushion the coming touchdown. However, with 390 feet of the RPV's load line and 100 feet of the helicopter's cable, there was insufficient power to hover at 500 feet and gently set down the RPV. Helicopter airspeed was decreased and a minimum rate of descent established. But when the firing buttons for the explosive cable cutter were depressed, the cutter jammed and the RPV was dragging on the ground. Captain Stokes increased airspeed to maintain altitude and Staff Seargeant Beltz, winch operator, reeled the cable in. Captain Stokes was able to make a max power, slow rate descent to place the RPV on the ground where it was cut free. Damage was minimal. Captain Stokes and crew exhibited outstanding ability in handling an extremely difficult and dangerous situation. WELL DONE! ★

USAF SAFETY AWARDS

CHIEF OF STAFF

INDIVIDUAL SAFETY AWARD

Presented to Air Force personnel who made exceptional contributions to safety during the previous calendar year.

MAJOR EDWARD R. MARSEY
89th Military Airlift Wing (MAC)

SSGT PATRICK J. CONROY
5071st Air Base Squadron (AAC)

SSGT JOHN P. LEIBIN, JR.
90th Security Police Group (SAC)

SSGT DAVID A. TREZISE
823rd Civil Engineering Squadron (TAC)

THE KOREN KOLLIGIAN, JR., TROPHY

Awarded to the USAF aircrew member who most sucessfully coped with an in-flight emergency.

CAPTAIN ROBERT G. DOWNS TAC

THE COLOMBIAN TROPHY

Recognizes outstanding achievement in military aviation safety by an Air Force unit involved in tactical air operations.

36TH TACTICAL FIGHTER WING USAFE