flying

SAFETY

MAY 1982

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- Lightning Time Again
- A New View of Thunderstorms
- 1982 Mishap Forecast
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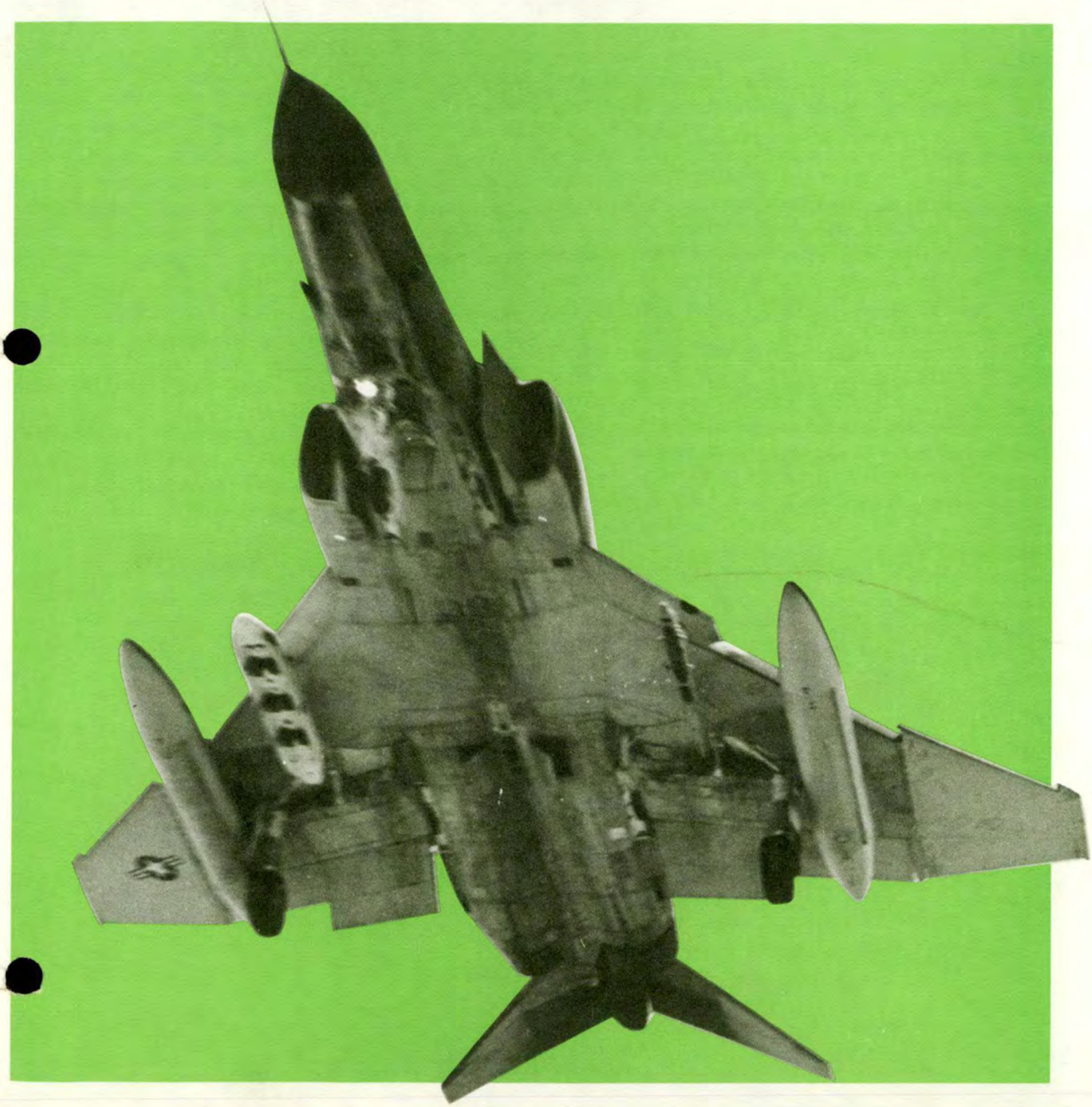


THERE I WAS

BRIG GEN LELAND K. LUKENS • DIRECTOR OF AEROSPACE SAFETY

■ In summer of 1980 we announced the start of a new program called "There I Was." The program was designed to cash in on the experiences of aircrews who were involved in a human factor mishap or "near-mishap."

The initial response was excellent, and the best stories have been published in *Flying Safety* magazine so everyone can learn from the storyteller's experience.

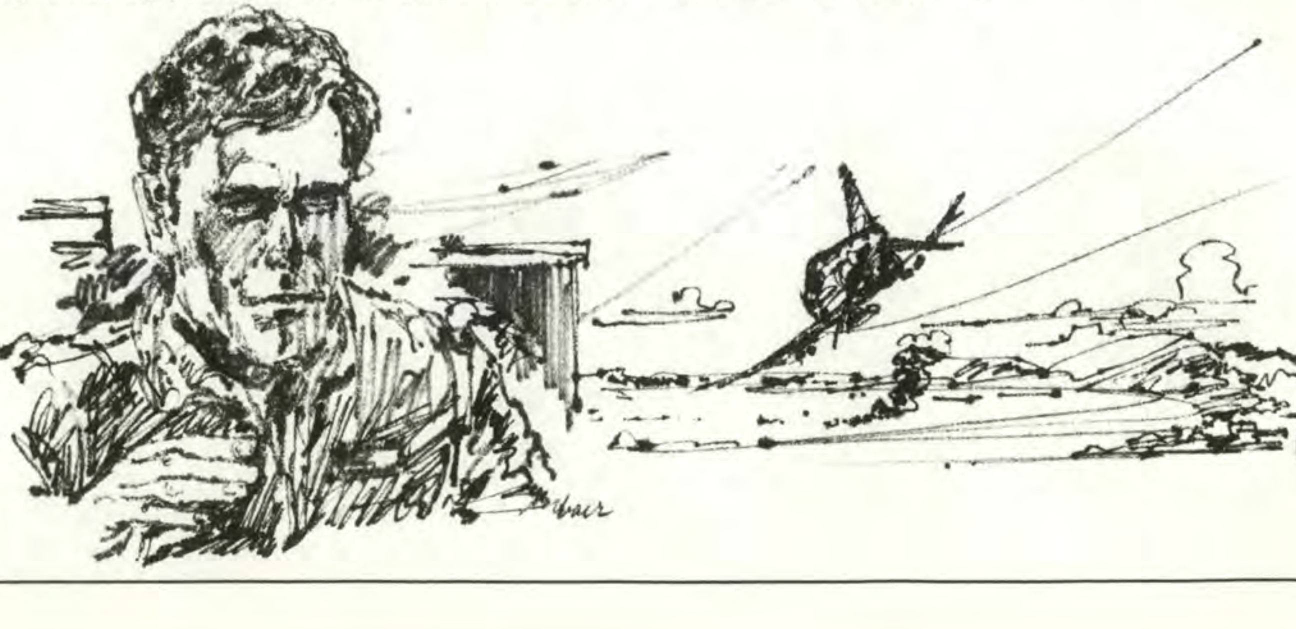
Lately, however, the flow of inputs has slowed down. While we would like to think that this is because everyone is flying safely and carefully, logic and experience tell us that this is not true. So we would like you to tell us your stories.

This program, as we said originally, is simple, with very few rules. Basically, we want anonymous accounts of personal errors or mistakes that we can publicize to warn others not to make the same mistakes. The end hoped-for result, of course, is a reduction of our operator factor losses. The form to fill out is the ultimate in simplicity — a nearly blank page on which we have begun the first sentence with "There I Was" — the rest is up to the writer. The reverse side of that page is preaddressed to the Director of Aerospace Safety so after the story is told, just fold, staple, and mail. Don't sign or identify yourself or unit — we want total anonymity. I will personally read each account. If considered appropriate, the lesson learned from the account and preventive measures, if any, will be publicized. In effect, save an airplane, save a life, tell your war story to the Air Force through the "There I Was" program.

In return for the trouble writers take in relating their stories, they can expect an inner sense that they may be contributing toward saving lives and airplanes and that they have our appreciation for their honest account of human error.

The program is not one to encourage reporting of other peoples' shortcomings — it is not a grievance system, and there will be no retribution or confidentiality breaches; the program is totally anonymous. It is not a program to be used in lieu of the USAF Hazard Reporting Program and the HATR Program — identified hazards should be reported through standard channels. The inputs will receive my immediate personal attention, and any items that may be useful to the operators and maintainers of our aircraft will be disseminated as rapidly as possible.

Sample forms were sent to safety offices in the April issue of the *USAF Safety Journal* for reproduction and dissemination locally. ■



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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

SUBSCRIPTION — FLYING SAFETY is published monthly to promote aircraft mishap prevention. It is available on subscription for $21.00 per year domestic; $26.25 foreign; $2.50 per copy, domestic; $3.15 per copy, foreign, through the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished. Use of funds for printing the publication has been approved by Headquarters, United States Air Force, Department of Defense, Washington, D.C. Facts, testimony and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payments can be made for manuscripts submitted for publication in the FLYING SAFETY Magazine. Contributions are welcome as are comments and criticism. Address all correspondence and, Postmaster: send address changes to Editor, FLYING SAFETY magazine, Air Force Inspection and Safety Center, Norton Air Force Base, California 92409. The Editor reserves the right to make any editorial change in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will ensure complete accuracy of material amended in light of most recent developments. The contents of this magazine are non-directive and should not be construed as regulations, technical orders or directives unless so stated. Authority to publish this periodical automatically expires on 30 Oct 1982, unless its continuance is authorized by the approving authority prior to that date. Distribution: 1 copy for every 3.0 aircrew and aircrew support personnel.

F-4 Single Engine Recoveries

WITH UTILITY HYDRAULIC FAILURE

MAJOR GARY L. STUDDARD
Directorate of Aerospace Safety

■ An F-4 was on a gunnery range mission, and everything was normal until the right generator tripped off on downwind leg. The crew felt a "thump" while they were trying, unsuccessfully, to reset the generator, and the pilot noticed he could only get 330 knots at 5,000 feet with military power on both engines. (Pretty doggy airplane, eh?) About two minutes later, the right fire warning light came on and, when it wouldn't go out with the throttle at idle, the jock stop-cocked the engine and headed for home.

Anticipating more trouble later, the pilot, wisely, decided to get the bird on the ground quickly and made a straight-in, downwind approach to the closest runway. He dropped the gear and one-half flaps, and about four miles from the runway, saw the utility hydraulic pressure starting to drop. At touchdown, utility pressure was down to 1,500 pounds, and it fell to zero as the bird rolled out. The crew stopped the Phantom with emergency brakes and exited, armed with a better-than-average war story for the next happy hour.

Maintenance men discovered that the aircraft had a bleed air duct failure and the leaking bleed air had damaged a bunch of equipment in the right engine bay.

The man who made the successful recovery had an interesting story to tell. It went something like this. "I knew I would have lateral control problems and kept that in mind during the entire approach. Control wasn't too difficult until the gear was down at 250 knots on final. It took a lot more rudder pressure to keep the dead wing up than I thought it would. I kept the airspeed above 230 knots until just before we touched down."

This mishap may sound familiar to you, but it shouldn't unless you have a super memory — it occurred in 1974. However, the circumstances involved and the lessons it portrays are still applicable today, eight years later. Utility failure with an engine out or PC failure is one of the stickiest compound emergencies a Phantom crew may have to contend with. There are a couple of important points in the mini-testimonial.

First, the pilot was expecting lateral control problems so when he encountered them, he was ready. Secondly, it took more rudder pressure than he thought it would to keep the dead wing up at low airspeeds. It does take a lot — like about 300 pounds of pedal pressure

at 200 knots! I think you can see that it might take both crewmembers and some super-smooth coordination to get that much push in at the right time.

The Navy and Air Force have done some testing with the utility system disabled, one throttle in idle and the other throttle as required to maintain flight. Both came to the same conclusion that the situation is very "dicey" at approach speed in a landing configuration. Specifically, the test showed that utility hydraulic failure will result in loss of directional stability if the rudder is allowed to float free. This will reduce the lateral control departure angle of attack. Yaw that cannot be controlled by rudder, creates a requirement for lateral control to counteract roll due to sideslip. Together, these conditions create a potential for a yaw departure at lower than normal angles of attack.

Under these circumstances, the Phantom displays a slight tendency to pitch up above 12 to 13 units AOA. This tendency gets stronger as the center of gravity moves aft and with wing tanks on. In summary, the F-4 is extremely difficult to control during this emergency and is very likely to encounter a yaw departure.

Some idea of just how hairy this emergency is are the words right out of the Dash one: "If the combination of weather, landing facilities and aircrew experience is less than ideal, consideration should be given to a controlled ejection." Additionally, down in the actual procedures section, right after the "when landing is assured" comment, there's the statement: "*Land or Eject!*" The point being that the most probable time for the approach to turn to worms is just before touchdown, as the airspeed bleeds off.

If you're going to try a double utility failure, engine out recovery, I think the first thing that should go through your mind is what you'll do if it turns sour before you're on the ground. Make a coordinated escape plan your first consideration. Like setting the command selector valve for a rear-seat initiated, dual ejection, and then briefing the WSO on the exact command you'll use for execution.

Remember, you must judiciously watch how you use the power. If you get slow, using the afterburner may only compound your problems because there may not be sufficient roll authority to compensate for the asymmetric thrust. The continued

F-4 Single Engine Recoveries

WITH UTILITY HYDRAULIC FAILURE continued

recommended procedure is to trade altitude for airspeed by lowering the nose. A steep, low power approach, with turns into the good engine is your best course of action.

All right, you've done a superb job, and you're on final at 230 knots with the airplane under control. Let's take a moment to talk about those few seconds — the time that starts when you decide the landing is assured and ends when the wheels are rolling on the runway. The book says when landing is assured to gradually reduce power to touchdown no slower than the airspeed provided in the gross weight chart. This chart says land with an airspeed range of 184 to 200 knots, F-4G/E, or 179 to 205 knots for other models, depending on fuel state. This is where your superior airmanship must come into play (as if you haven't already demonstrated it).

If you slow down, you lose some lateral control authority. If you lose enough, the plane could go out of control, and you won't be able to do anything about it. You don't really know how much you can slow down and still maintain control until you slow down too much, and then it may be too late. Kinda puts you between the rocks, doesn't it? So you say, "What the hey," I'll go ahead and land at 230 knots.

That's an intriguing idea that would minimize the chances of losing control on final, but you won't find anyone recommending it officially because it could prove disastrous. For openers, you'd be touching down well above the maximum main gear tire speed. The tires may be able to take it, and then again, maybe not. A blown main gear tire is exciting enough at 130 to 140 knots; at 230 knots, it would be a real thrill.

Then there's the problem of a successful arrestment. If you are taking a departure end cable, you'll most probably be slow enough by then, but if a mid-field arrestment is made, it's possible you may not be slow enough to prevent overspeeding the cable. If the cable breaks, it will undoubtedly throw you sideways with runway departure very likely to occur.

Okay, let's say you've reduced your speed on final and you touch down at the recommended speed. Don't relax just yet. Remember that you'll have nothing but manual rudder, emergency brakes, a little bit of aileron and will power for directional control. Differential emergency braking will provide the best means for maintaining directional control but without the antiskid protection, you are risking a blown tire or tires if you're not very prudent in applying braking pressures.

Another point to ponder upon landing is remembering since the airplane will be well above normal landing speed, it will have a tendency to fly back into the air. Keep the stick forward. If the hook should catch while the bird is nose high or lifting off the runway . . . well, it's been done before, and the results are kinda grim.

Last of all, as if enough hasn't occurred in the preceding few minutes, remember to get ready for a very uncomfortable slingshot ride. After the bird stops moving forward, the cable will snap you backwards. I've seen Phantoms flung clear off the runway doing this rollback trick. This is the time to really plant your feet on the brakes.

The intent of this article was n[illegible] to point the gloomiest of pictures, but mainly to provide thoughts on the subject. An occasional reading of the Dash One's discussion of this emergency may not be enough as you can probably tell by all the areas mentioned above. It's up to you to have a prior plan of attack that is clear and understandable by both crewmembers. Because of all the different systems which work off the utility hydraulic system, a fire which is sustained for even a short time or a malfunction in one area could rapidly result in total hydraulic loss. This is when you'll be grateful for those moments you contemplated: "What will I do if it happens to me?" Think about it. ■

Thanks to Tom Lockhart who provided much of this information in a PACAF safety article in July 1974 and to 9th AF Safety who recently brought it again to our attention. What was true then is still t[illegible] now. "It'll come back to haunt you as long as you fly Phantoms."

USAF FLYING SAFETY WEEK MAY 17-21

Last month Flying Safety provided analyses of many of the major weapons systems. This month we continue with articles on the B-52, A-10, E-3A, and E-4, as well as information on Air Traffic Control and Aero Clubs. Finally, on Page 22 the 1982 Mishap Forecast is expanded to give specifics on most aircraft.

These articles complete our magazine coverage for Flying Safety Week. The information has been presented to help you get the most out of Flying Safety Week and, more than that, to help you do your job — flying airplanes — better and safer.

AIR TRAFFIC CONTROL

LT COL
NICHOLAS O. GASPAR

■ Here at the Safety Center your safety is our concern as well as our job. To enhance your safety, we continually monitor the various reports for "cause" clues and trends. When an unfavorable trend in unauthorized runway intrusions was detected, we "got the word out" through an ALSAFECOM. We have also made several studies to see how flying safety was affected by Air Traffic Control matters.

A brief summary of reports for the period Aug-Nov 81 is: the majority of the NMAC encounters were detected by the military pilot. In 85 percent of the incidents, the second aircraft was a general aviation aircraft. In all but a few instances the civil pilot did not appear to see the military — no evasive action was observed either before or after the encounter. Location and altitude appear to be important factors. A majority of the near catastrophies reported were within 30 NM of the departure or arrival airport. The lower altitudes are more congested with civil traffic and, therefore, pose the greatest threat — the most vulnerable altitudes are below 8,000 feet, with 1,500 feet AGL and below the worst.

Failure to see-and-avoid was the predominant type of occurrence — accounting for 65 percent. The second most frequent incidents reported were caused by civil pilots violating airport traffic areas and restricted airspace. One NMAC is reported almost every other day in the CONUS. It seems safe to assume that many more go undetected and, therefore, unreported.

Keep these statistics in mind next time you are airborne. Practice proper scanning techniques, and when not fully IMC keep an eye out for the other guy. If you are unable to make visual contact with the traffic that radar has pointed out, ask for an "avoidance vector," but keep on the lookout for others who may not be detected by radar.

Since the PATCO strike the number of HATRs received from CONUS units has been lower than average. Whether this means there are fewer occurrences or just fewer reports is undetermined. But you can help.

When you encounter a situation that is reportable under AFR 127-3, don't hesitate to do your share — report it. We will, in turn, continue to work towards a safer environment for you. ■

A-10

MAJ JAMES H. GROUND

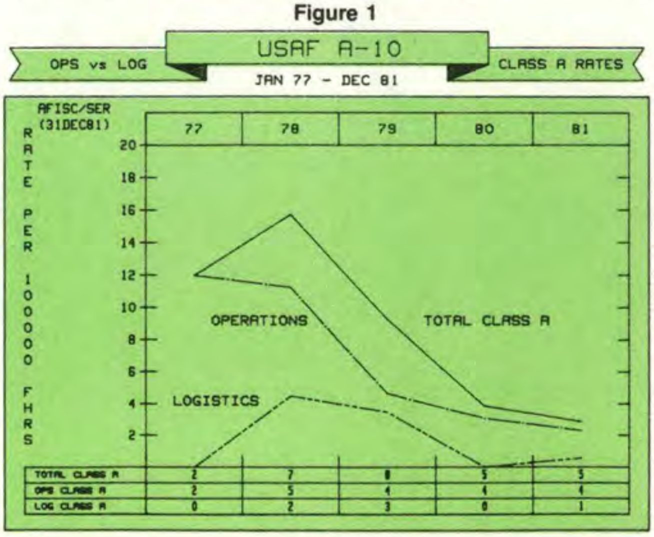
■ As of 31 December 1981, Fairchild-Republic Company had delivered 580 A-10s to the Air Force, Air Force Reserve, and Air National Guard. Twenty-six aircraft had been destroyed and 16 fatalities occurred in 27 Class A mishaps for an overall rate of 5.89. Five of these have been logistic causes and 19 operator-factor with three undetermined/other.

There were five Class A mishaps (aircraft destroyed, $200,000 minimum or a fatality) in 1981 for a rate of 2.86. One fatal mishap occurred for unknown reasons during the roll-in for a curvilinear (low angle bomb) attack. Another fatality resulted from a pop-up attack for low angle bomb. A roll restriction was thought to be the cause of another fatality, and the last fatality for 1981 occurred during hard maneuvering flight at low altitude. The final Class A resulted from a stall at low altitude during a reattack. The pilot ejected safely.

The only common thread among these mishaps is the arena in which they occurred — low altitude. Since the A-10 is flown about 80-90 percent of the time at 500 feet AGL or lower, chances are pretty darn good that an aircraft problem or our own mistake might occur demanding an immediate ejection decision. We should realize when we're in the envelope and when we're not and what actions we must take to have or regain the ability to safely eject. We should soon have enough information presented in the flight manual to be able to project our safe escape potential for any given situation. There is a good article in the March issue of *Flying Safety*, "Temporal Distortions and the Ejection Decision" which is recommended reading for A-10 drivers.

Let's now look at some of the fixes for these Class As. One of the mishaps was apparently a breach of flight discipline. A lot has been said recently on this subject, so we should all know the rules by now. The information on A-10 stall characteristics has been re-emphasized in formal training, PIFs, and briefings. If you're a bit hazy on the subject, it wouldn't hurt to get into the books and discuss the subject with the unit experts. It's a lot less embarrassing than explaining later why you were not up-to-speed.

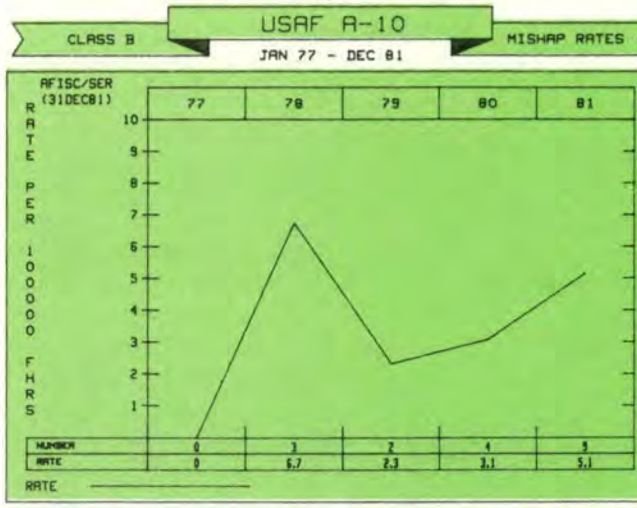
Figure 1



Other fixes center around flight controls. The generator fluctuation and Beta Dot SAS spurious inputs are being corrected by TCTOs. Both modifications are being accomplished by field teams and may already be complete at your unit. Another area is ballistic (rigid) foam. Loose or damaged ballistic foam has been removed. The A-10 System Program Office (SPO) at Aeronautical Systems Division (ASD) is looking at methods to preclude migration of foam near flight control bell cranks.

An improved adhesive technique is also being used for the future reinstallation of ballistic foam which plays a major part in the A-10's combat survivability design. Additionally, an A-10 Special Study Group has been convened by ASD to take a closer look at the accident potential of the weapon system. One area of concentration is the flight control system. The report of this group should be finalized soon.

Figure 2



One subgroup also looked at the human factors aspects, particularly those factors regarding pilot perceptions of aircraft attitude, altitude, and sink rate. Major Jay Stretch of the USAF School of Aerospace Medicine authored "Human Factors Aspects of Selected Class A Mishaps — A-10 Aircraft," and presented this information to the A-10 Tactical Training Squadron at Davis-Monthan.

Plans to incorporate his ideas into the formal training program are currently underway. This information will be distributed to other units as soon as possible. His bottom line is that: "Given aerodynamic and cockpit design characteristics of the aircraft, it is very probable that these situations (unanticipated loss of altitude and nose low attitude) are precipitated by the pilot being perceptually incapable of discriminating the attitude changes of the aircraft while at high bank angles, due to lack of effective orientation cues."

There were 10 Class Bs ($50,000 – $200,000) in 1981. Six were engine FOD mishaps, four from hardware and two from birds. An engine fan disk separated during one mishap when the bearing housing failed. An APU overload and an engine stall caused a fire/overtemp on two separate mishaps, and another was structural damage resulting from departing the runway after a formation landing.

The hardware FOD has been a four-fold problem for many months. Improvements have been made in fastener supply, design, training of technicians/technical order presentation, and availability of tools. The ongoing proposals to alleviate the early aircraft access door hardware problem (engine

FOD) are still in the evaluation stage. Being considered is the retrofit with the "chem-milled" doors, a door reinforcement technique, and a possibility of the use of a steel bushing design similar to the F-16 fastener system. The later is still in the experimental stage.

General Electric and the A-10 SPO have developed some new procedures for engine wash and maintenance affecting engine balance. This should help eliminate the possibility of another fan disk separation. The early aircraft APU problems appear to be eclipsed by the new APU hi pressure fuel control version. The continuous ignition modifications TCTO 966 and 986 will provide engine ignition during gun fire and aircraft stall. TCTO 966, almost fleet completed, activates the gun firing ignition for 30 seconds and provides provisions *only* for stall warning activation. TCTO 986, which must be accomplished subsequent to TCTO 966, will reduce this timing to one second or a slightly longer timing as determined by current flight testing. This will reduce the number of maneuver stalls, but the potential for overtemp will still exist.

Follow the Dash One single and double engine flameout procedures, flameouts, compressor stalls, roll backs and overtemps all require different actions. Remember, if your aircraft has the automatic start function, leaving the throttle at idle will cause "complications of major proportions" when the rpm drops down to the automatic start and ignition value.

The last category is Class C mishaps ($300-$50,000 or High Accident Potential (HAP). We experienced 314 Class C/HAPs in 1981. The top ten were engine, 73, flight controls, 57, engine FOD, 48, birdstrike (structural), 25, false fire warning (with engine shutdown), 23, starter fires, nine, fuel foam fires, eight, smoke/fumes or physiological incident, eight, wheel failures (two NLG), eight, and tire failures, seven.

The engine problems were broken down to flameouts, 23, high ITT/fire, 18, oil system, 16, stalls, 13, miscellaneous, three. In addition to the new relay for the ignition system already discussed, a new main fuel disconnect is being evaluated. Better quality in oil pressure transmitter units and gages is being sought along with an improved oil cap and "O" ring seal design.

We experienced a significant increase in flight control mishaps during 1981. The 57 mishaps were broken down as follows — maintenance, 23, maintenance/design 10, material failure, 10, depot maintenance, four, foreign object, three, manufacturing defect, two, TCTO instructions, one, and four undetermined (one could fall into flight dynamics and three may possibly be inexperience).

The maintenance causes were mostly in misrigging or maladjustments with maintenance/design primarily being improper servicing of the integrated drive generator (IDG). Several of the material failures were SAS computer malfunctions other than IDG associated. All four depot maintenance procedures or TCTO problems have been corrected. These corrections included improved quality on a disconnector and clearing the rudder pedal adjustment handle hang up problem. The foreign objects were one ballistic foam and two fasteners, all outside the white area.

Flight control fixes have been discussed in a limited manner earlier. Other improvements involve increased white area clearances (TCTO 841), seeking an improved generator (easier servicing), and more attention to quality assurance procedures. The greatest focus is being placed on the maintenance area. A proposal is being acted upon that would identify flight control specialists, give them more specialized training through an improved training system, form them in special teams, and give them greater longevity as an A-10 flight control expert.

If we're not doing these things fleet-wide, it might be a good idea to analyze current policies. Several units now have teams which are always called when any flight control malfunction is identified. These units are also using an impoundment checklist which requires telephonic notification of the A-10 SPO, Fairchild-Republic, and Sacramento ALC flight control Quick Reaction Team members if conditions permit. The important issue is that flight control systems and problems need extra vigilance in the coming year. It's incumbent upon everyone to contribute positively to this effort.

Engine FOD and birdstrikes were discussed with Class Bs. False fire warnings involving an engine shutdown have also increased dramatically. The chafing of the fire loop has often been attributed to misinstallation or tech order instructions. A new fire loop clamp is currently being considered. Starter fires were normally caused by pilot distraction during the start sequence.

Fuel foam fire evidence is sometimes difficult to analyze. Of the approximately 40 incidents reported, some were CAT I reports and some, particularly the red foam equipped aircraft, may have been foam discolorations. In any event, extensive testing has been conducted, and the main culprit was the refueling line purge system. This system is being modified so that the fuel/air flow from the purge system will not cause conditions that can produce ignition of fuel vapors. Current laboratory testing may produce other modifications that will combat the blue foam's ability to support static activity. The good part is that the foam did suppress the fires that occurred.

Smoke/fumes and physiological incidents were also on the increase. Many were caused by allowing engine wash liquids to enter the air conditioning system, resulting in contaminated coalescer bags, cooling turbine oil leakage, engine oil seal leakage and malfunctioning oxygen regulators.

New procedures and quality checks have improved the situation, but this subject is still a major concern and requires continued investigation.

Wheel failures rose in 1981 including the addition of two failed nose wheels. Aside from the danger of losing an aircraft due to a wheel failure during takeoff or landing roll, the hazard of a piece of shrapnel causing serious injury or death is ever-present. All wheels are now getting special nondestructive inspections (NDI) with eddy current and dye penetrant at each tire change and soon a shot peen process. New wheels could be in the field at the end of 1982. Tire failures were down but still noticeable. A new tire specification has been developed, and competitive bidding and testing is ongoing and could produce a new A-10 qualified tire within a few months.

Another year in a nutshell. While this synopsis, due to its brevity, may tend to cast unfair shadows on particular subjects, it is intended as a means of passing along some bits of safety information to the entire A-10 community. ■

B-52

MAJ TIMOTHY J. SHAW

■ This year marks the twentieth birthday of the youngest B-52 in the fleet. The B-52 is old, but continues to provide excellent service in a role for which it was not originally designed — the low level penetrator. As a B-52 crew member, you're probably already aware of the Buff's age, but it is not the only "senior citizen." Check out the age of some of the other heavies in the inventory. The C-135s average 20 years old, an average C-130 is 17 years old, and the youngster of the group is the C-141 with an average service age of 14 years. These advanced service lives equate to lots of system experience and flying time.

Past experience gives a pretty fair indication of what the future mishap

continued

rates and causes will be. The first indication is that aircraft age has not been a significant factor in the mishap rate of B-52s. In fact, logistics factors in destroyed or badly damaged B-52s has been dropping during the past ten years (Figure 1). The aircraft are getting older, but logistics has been responding. Modifications, parts replacements, and closely monitored time changes have helped the B-52 stay viable. In other words, "there is not much that can go wrong with a Buff that hasn't been seen and planned for by now."

Now we need to concentrate on operations problems. As we see in Figure 2, the ops-related Class A trend has been fairly constant.

Overall, the mishap record in 1981 was a good one for the Air Force. The experience for the B-52 is as shown in Figure 3.

It takes only a cursory glance to see where our problems were in 1981. Birds cost us 76 mishaps — all but one of the Class B's and almost one-half of the Class C mishaps were birdstrikes. As long as we fly down low where the birds are, the risk of birdstrikes is high.

The experts at Tyndall are working on a new computer model for predicting bird concentrations along low level routes. As this new model is refined, our ability to avoid bird hazard areas will improve greatly.

But there are still some things the aircrew can do. First and most important: if you perceive that the bird hazard is getting too high climb out of the hazard area or even abort the route, if necessary. Report bird concentrations so that those following you are warned.

Engine, hydraulic and flight control related mishaps were the other high categories of mishaps. While, there were no specially significant or unusual trends, there are some areas where crew preparation and attention can help.

■ There were eight pressurization system failures in 1981. This kind of malfunction is easy to cope with if you have reviewed your procedures. How about a crew study session on decompression sickness and pressurization systems?

■ The other area about which the crew is most concerned are those mishaps where inattention is the prime contributor. These mishaps cover everything from hitting a light-all during taxi to a short round on a bomb run. All were preventable!

Most of the B-52 problems in 1981 were "little" ones. We sometimes get complacent in the "heavies" because we do have a good safety record. But sometimes the difference between a HAP and a Class A is only a few seconds or feet.

That's how close one crew came this year to making our Class A total two instead of one. A crew, through a number of navigation errors, got several miles outside the low level corridor. Fortunately the pilots saw the

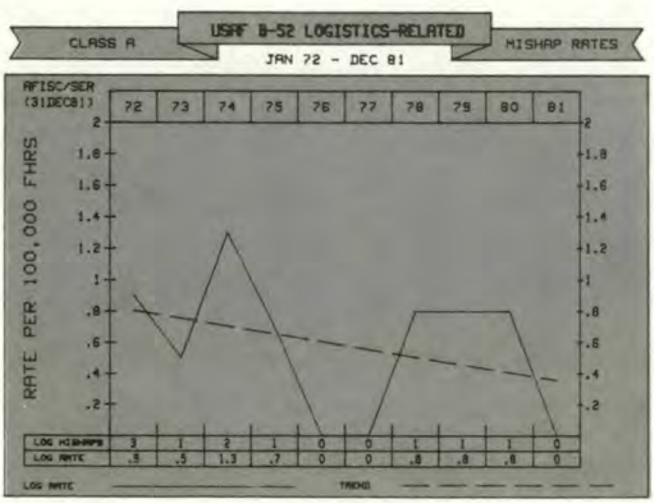


Figure 1

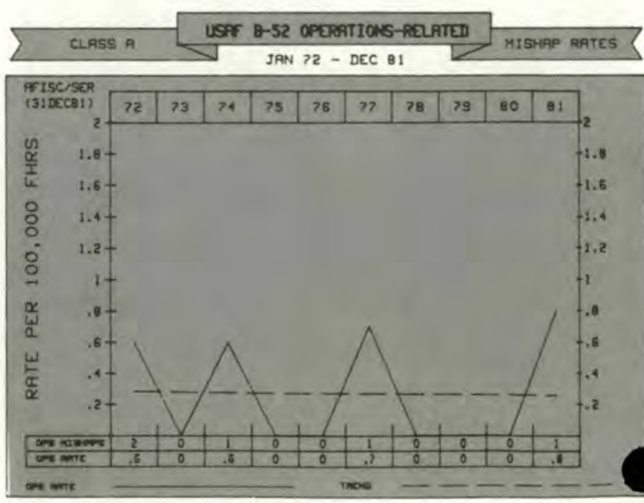


Figure 2

B-52 Mishaps 1981

Class A		Class B		Class C/HAP	
Coll w/ground	1	Engine	1	Birdstrike	70
		Birdstrike	6	Engine	28
Totals	1		7	Hyd/pneumatic	17
				Flight controls	11
				Miscellaneous	9
				Landing Gear	8
				Pressurization	8
				Dropped Objects	8
				Weather	6
				Other Categories (4 or less mishaps each)	20
				TOTAL	185

Figure 3

terrain rising through the haze and were able to make an emergency climb.

The 1982 Mishap Forecast predicts that one B-52 will be lost in a collision with the ground mishap. I suggest that the scenario I just described is a very likely candidate for such a mishap. A combination of "little" things: a missed IFR altitude change in FLIP; a small heading error not caught; a navigation error overlooked, all add up to a situation where the crew is no longer in control of the aircraft and mission.

There is an old saying that if you take care of the "little" things they'll never become "big" things. Let's do that in 1982 and not have any big mishaps. ■

E-3A

MAJ ARTHUR P. MEIKEL

■ TAC's E-3A fleet had a good safety record in 1981. There were no Class A or B flight mishaps. The aircraft has held up well as have the crews.

There were seven reportable Class C mishaps in 1981. Moisture in systems caused a jammed horizontal stabilizer and a rapid decompression in separate instances. In another case, a life raft door came off in flight damaging a wing. There was one heavyweight landing which resulted in overheated brakes and a brake fire. The emergency landing was caused by electrical fumes from the lower compartment. A fume detector modification contract for the compartment is projected for Oct. 82.

While the flight crews were logging up to 130 hours a month while TDY and building up a significant amount of days TDY, crew error in E-3A mishaps is minimal. One crewmember became ill in flight in one reportable mishap. In another, a crewmember was squirted with SF6 gas from a pressure relief valve while troubleshooting a system malfunction. SF6 is a coolant for the aircraft's radar system which replaces oxygen and could cause death. New in-flight procedures for working on radar equipment have been implemented.

There was one instance of a Navy aircraft flying in the E-3A radiation hazard area. Consequently, publication of radiation hazards has been increased. Theoretically, RF radiation can ignite fuel, interfere with avionics equipment or trigger electroexplosive devices within 1,300 feet.

Engine shutdowns due to oil starvation problems have resulted in changes to the TF33/P100 engine. A change in an oil filter and modifications to oil passages have been implemented to improve oil circulation.

The E-3A fleet is increasing and is more in demand as time passes. NATO received the first of a proposed 18 aircraft in 1981. The E-3A's safety record during its 24,000 plus hours in 1981 has been excellent. ■

E-4

MAJ ARTHUR P. MEIKEL

■ SAC's three E-4A and one E-4B aircraft flew approximately 2,100 hours in 1981 without a Class A or B mishap. There was one E-4 Class C flight mishap in 1981, resulting from a birdstrike on a flap panel.

In July 1981, air refueling flight tests were accomplished with the KC-10. The refueling was accomplished; however, KC-10 engine turbulence caused vibrations in the E-4 tail section and minor HF antenna damage. E-4/KC-10 refuelings are on hold until instrumented tests can be accomplished. SAC's E-4 Airborne Command Post Operation has maintained an effective safety program. Only four Class Cs have been reported in the aircraft's history. Keep up the good work! ■

AERO CLUBS

MAJ MICHAEL T. FAGAN

■ "All that goes up must come down," they said before the days of the deep space satellite programs. With Voyager 2 enroute to the outer fringe of our solar system and thence to parts unknown, that isn't true anymore.

But it still works for Aero Clubs! Maybe new equipment will some day drastically raise our service ceiling, but for now, all that goes up must come down. The questions are "how" and "where."

"Any landing you can walk away from is a good landing," someone used to say, in the fabric-and-wire airplane (or was it aeroplane) days. Frankly, there is some doubt that anybody ever meant it, but that isn't true anymore, either — not even in Aero Clubs. However, the record suggests that Air Force Aero Club pilots, well known to be the last true heirs of the Hat In The Ring squadron, may still believe that dubious adage, to this very day.

Not having a bombing, strafing, rocket-shooting, cargo hauling, or passenger moving mission, probably the most demanding tasks facing an Aero Club pilot are avoiding the fast movers and getting the airplane off and on the airdrome in a safe and expeditious manner. In other words, lacking a range, the Aero Clubber proves her or his proficiency in the traffic pattern.

Landing is the unavoidable end to flying activities. It is probably the most practiced maneuver except for straight-and level flight. No pilot has any doubt that landings require full attention lest one dash the empennage upon the ground.

Next, Aero Club pilots are good, safe pilots. Flying more than 160,000 hours a year, the clubs have a proven excellent safety record with an accident rate averaging about half that of general aviation at large. 1981 was a banner year with an accident rate probably around a quarter of that of the civilians. For the first time, we nearly beat the Air Force operational rate, which was also excellent this year! So, it is safe to assume that Air Force Aero Club pilots are safe, well-supervised pilots with a high level of proficiency in at least the basic maneuvers of flight. Landings are certainly a basic maneuver . . . every flight involves at least one.

Fifteen of the last 20 reportable mishaps have occurred on landing. There have been several gear-up landings, only one of which can be blamed on equipment failure. Our pilots have proved that they can not only fly like an Eagle, they can porpoise like a . . . well, like a Porpoise, except that the marine mammal rarely damages *his* nose in the process. Crosswind landings have dinged the gear more than once. (Was it the crosswind which got the gear, or the pilot?) A few Aero Club pilots have missed the runway. It's a big target, and usually longer than we need, but, whether the aircraft was stalled in short or hit a snowbank before touchdown, they missed. We even had one run off the end of a 5,000 foot runway.

The Aero Clubs deal with a lot of low-time pilots, and it would be convenient to say that therein lies the problem. However, a surprising number of the mishaps happened during dual flight with instructors or even flight examiners aboard! Pilots have ranged from new students to folks finishing up their commercial requirements.

Operator-caused landing mishaps are the single largest safety problem in Air Force Aero Clubs. If we remove solo students from the mishap figures landing mishaps still cause the majority of reportable damage. This sugests that the core of the problem lies not with the inexperienced student but with experienced pilots and, in the case of the dual mishaps, with in-cockpit supervision.

It should go without saying — but obviously it doesn't! — instructors and flight examiners must pay sufficient attention to prevent their students from landing in a manner which breaks the airplane. *All* pilots, not just you new folks, must put enough effort into your landings to: (a) make it to the runway, (b) touch down at an attitude and airspeed which is within safe limits, and (c) keep the airplane on the runway until you either stop or take off again.

A little preflight supervision and management may be of help. When there is enough runway available, as there usually is, why not shoot for a visible touchdown point which leaves some margin for error? The point is to teach precise aircraft control, not practice bleeding. "There is nothing more useless than runway behind you," it is true, unless the runway *ahead* of you doesn't start until after touchdown. With five or ten thousand feet ahead, most bugsmashers can afford fifty or a hundred feet behind them. And, if the student pilot is a little short, the instructor can chew him or her out while taxiing back rather than calling for a truck, crane, and new tires or gear.

Every flight ends with a landing. Make it a good one. ■

Hazards Of LOW LEVEL Flying

■ Earlier articles in this series discussed the hazards of low level flying in terms of four human factors, anomalies of which commonly operate in collision with the ground mishaps: perception, attention, knowledge, and judgment. This final article is devoted to that all important ingredient which cements the rest together — *discipline*.

A team of AFISC pilots recently analyzed all Class A mishaps occurring from January 1979 through October 1981. This project BROAD LOOK involved evaluation of 37 destroyed aircraft from collisions with the ground during that 24-month period and identified "discipline" as a factor in 19. That's slightly over one discipline-related collision with the ground mishap every two months; and that does not include mishaps occurring on the range.

There has been a great deal written about discipline in this magazine lately. Perhaps that's because of all the human factors affecting pilots, especially military pilots, you'd think discipline would be the one factor most amenable to control. Yet we continue to see discipline lapses, breakdowns and violations — some willful, some unintentional, some subtle, some not so subtle.

What is discipline, anyway? You might define it in several ways. You might say it's playing by the rules — even when your dad is watching, or your best girl, or even when no one is watching — in fact, especially when no one is watching.

Or you might define discipline as self-control — control of the alerting mechanism that maintains mental awareness appropriate to the situation, even when that mental mechanism verges on exhaustion from fatigue, distractions, irrelevant inputs, or boredom.

Or, again, you might define discipline as the purposeful programming of your subconscious "core" in your pre-mission planning, or as the rigorous mental rehearsal that must (or should) precede any complicated task, such as putting ordnance on the target, or flying an airshow. It has been said, in this context, that talent is not so rare — what is difficult to come by is discipline. Let's look at some of the dynamics of discipline breakdown.

Dazzling A powerful human motivator is the drive for recognition and approval. This normal drive gets out of hand in attempts to "dazzle" someone else — the IP, student, ground observers, etc. More than one guy has scraped a wingtip trying to dazzle the Army on a dry close air support pass. The urge to dazzle family and friends is almost irresistible and often leads to buzzing which can trap the uninitiated who are not familiar with the pitfalls of maneuvering at low altitude, or of target fixation, or of pull-off trajectories, etc.

Buzzing seriously reduces individual margin for error or time to cope with equipment failure. This form of discipline break recently claimed a couple of fine pilots. One was a young A-10 driver who had tried unsuccessfully for over six months to fly by his parent's home. During a deployment near their home, the opportunity for a fly-by finally presented itself, and the pilot phoned his parents to be waiting outside at a certain time. Now this pilot was considered a highly reliable, responsible, and

part V

COLONEL GRANT B. McNAUGHTON, MC
Directorate of Aerospace Safety

professional young officer. For him, intentional violations would have been totally out of character. He had not yet trained below 500' AGL, and on this particular flight was reminded by his lead not to descend below 1,000' AGL. Once over his parent's residential area, however, something happened. Ignoring the 1,000' restriction, he descended to an estimated 160' AGL, then, with his parents and girlfriend watching, he rolled into a right bank estimated to exceed 80 degrees, and held it there just long enough to commit the aircraft to hit the trees.

As you all know, a bank of 80 degrees requires nearly 6 G to maintain a level coordinated turn. An 80-degree bank drops the A-10s 28.5' wing about 28 feet below the cockpit. At high bank angles, the nose begins to drop as well. Unless a pilot anticipates and carefully looks for these changes in altitude and attitude, they can easily go undetected until too late.

Another fine pilot, a Vietnam veteran, known for his exceptional intelligence, became bored flying the C-130 on what he considered routine round robin training hops. To add a modicum of excitement, he'd taken to buzzing his buddy's nursery. During the pull off from one such low pass, 12 feet of leading edge departed the right wing. Studies later showed that a normally alert pilot could recover from the ensuing roll with an altitude loss of only about 250 feet. There was never any question about this pilot's alertness. He just didn't have the 250 feet.

Relaxation Another aspect of the discipline problem is an insidious relaxation of vigilance which tends to victimize more experienced pilots. Referring to the chart on page 16, when a pilot initially begins flying in the low level arena, his healthy awareness keeps him relatively high. With continued exposure, which usually covers a period of weeks (though it can shorten to a period of days, or even to one sortie), the pilot becomes increasingly comfortable and eventually plateaus at an altitude range where he can comfortably fly and accomplish all required tasks. This initial plateau is a relatively "safe" altitude range, safe in that it provides a reasonable margin for human errors (e.g., perception or attention anomalies), equipment failure (e.g., control jams or spurious electrons), and environmental hazards (e.g., wires or towers). He can aviate, navigate, communicate, check wingman's six and look out for threats comfortably and safely.

After continued training and flying in this regime, with increasing flying proficiency, he begins to fly lower and lower. This can happen subconsciously due to habituation of the peripheral visual fields to a given motion. As you all know, increasing speed registers in the peripheral vision as an increasing flow pattern. Early on, this sensation may be quite commanding, enough so as to raise the hair on the back of your neck. But the more you do it, the more you get used to it, the more comfortable you become with it. Now its formerly commanding, compelling quality has declined somewhat, conveying the false impression that you are either higher or slower than you intend to be. In order to recapture that speed sensation, you can push up the throttle; but more likely, you will simply descend, and you may descend without realizing it.

Having entered this phase, it may suddenly dawn on the pilot that he is now flying at some fraction, say half, of the original plateau altitude, or even lower, yet performing the same tasks. More importantly, he is devoting the same amount of time, if not more than he did up higher, to checking his buddy's six o'clock and looking around for threats. But for his speed and new altitude range, he is spending far too little time clearing 12.

He has become comfortable, all right; just a little too comfortable. Provided he doesn't inadvertently hit the ground during this period of

HAZARDS OF LOW LEVEL FLYING
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continued

unintentional low flying, he will (if he has good sense) abruptly jack his altitude back up to some level nearer the first plateau which provides a more reasonable margin.

Beating the System There's a little element in many of us that likes to get something for nothing. Getting away with something or "beating the system" can, in certain personalities, create a very gratifying psychic reward. The reward may be even greater if one is a "public conformer," as well as a private violator. This way, a person gets the best of both worlds — approval from peers and superiors, gratification from breaches.

Military flying can lend itself to private violation — especially solo flying, where there's no one checking up. It's a lot of fun to fly low level. It takes a great deal of personal discipline to stick to the altitude restrictions when no one is looking. But there's a good reason for those restrictions, as the following case illustrates.

A young 0-2 pilot departed his base on a morning solo navigation mission. Shortly thereafter and for the next hour or so he was seen flying quite low over the desert. He then flew along a road that paralleled some power lines, heading uphill toward a mountain. Had he looked at his map (found folded in his pocket) he might have noted the intersecting power lines clearly depicted. But due to the sun angle and high terrain, the intersecting lines blended perfectly into the background, decapitating him as he struck them at less than 40 feet AGL. An investigation revealed this not to be an isolated instance of unauthorized low flying by this pilot.

Planning Still another aspect of discipline is planning and personal preparation — to include whatever information is required to handle the mission, plus that required to handle contingencies. The more complex the mission, the more important is thoroughness — avoiding the temptation to cut corners. What's ideal is mental rehearsal — going over every detail in your head ahead of time. Equally important is playing the "what if" game to handle emergencies. Map discipline and route familiarity are critical in the low level arena. And, last, the personal physical preparation to handle your mission — staying in shape, getting enough rest, avoiding drugs, and watching the sauce.

Thorough mental rehearsal is the kind of discipline that is really difficult — just plain hard work for most of us. More so if we're tired, rushed, or a little too lazy. But the payoff is proportional to the investment: increased capability, excellence of performance, and the confidence that comes from knowing you can handle your assignment in a precise, professional, and safe manner.

We're all human. We have limitations, and weaknesses, and we're constantly exposed to temptations. Temptations to show off, to get a little too comfortable, to cheat a little on the altitude if we don't think we'll get caught, to slide a little on the planning and preparation routine, to party a little too late when we've got a complex mission to brief and fly at O-dark-thirty. How well we master these basic faults — how well we discipline ourselves — can easily make the difference in the low level arena. ■

RCR REQUIRES JUDGMENT

MAJOR ARTHUR P. MEIKEL
Directorate of Aerospace Safety

■ Is there a need to stress runway condition reading (RCR) concepts? Evidently.

▪ An E-3A landing at a northern base earlier this year received Mu meter readings for good braking action. Due to blowing rain and snow, the pilot exercised his judgment when he assumed a 10 RCR. Despite his conservative approach, his landing roll terminated off the runway among the approach lights. The next reported Mu meter reading converted to an RCR closer to a "0" than a 10.

▪ In one recent civil mishap, the pilot received less than optimum braking action reports prior to takeoff. Braking action reports at his destination airport ranged from "nil" through "fair to good." His landing roll ended in the water.

▪ In another recent civil mishap, the pilot's judgment concerning whether or not to abort on a runway with poor braking action could have been a factor.

▪ An EC-135A landed safely in freezing rain. The tower had warned the pilot of "possible reduced braking" due to precipitation. The aircraft departed a taxiway — RCR 01.

Pilots must thoroughly understand the principles involved in the determination of an RCR. It is not only a winter concern. Spring showers, summer thunderstorms, and northern landings present a year-round problem, and an RCR is never current for the pilot's landing. It was current when it was taken, and it was current until changed by blowing or falling rain or snow, a temperature change, or a taxiing aircraft.

It takes time for detection of an RCR change, a new reading to be taken and reported through ATIS, weather or tower, and it is not precise. An individual reading is as accurate (at that time) as the operator recording it and his equipment. Consider that, in addition to the military RCR concept, you have the civilian Equivalent Braking Action System (nil, poor, fair, good) and the Mu Meter System (40/40/40), and there are others. DOD has provided aircrews with the Flight Information Handbook to compare the various systems, but anyone comparing two or three systems will derive an approximate value only.

At what point on the runway is an RCR most accurate? It is an average of readings along the length of the runway. At the end of the runway, where the "pucker factor" is up, RCR is usually the worst due to accumulated rubber. Laterally, it is best at the middle of the runway, and if the aircraft lands or veers left or right of center, the RCR value is unknown. On taxiways RCR is a separate yet similar problem.

Ask yourself some questions about these mishaps. Can you safely operate from civil airfields? Do pilots equipped with thrust reversers depend too greatly on their reverser's capabilities? Do civilian airfields clear their runways as well or as often as the military? Do military pilots know their equipment better than civilian pilots? Are you alert to subtle weather changes?

Diverting, not landing long, waiting for the shower to pass, letting snow removal have the runway for 20 minutes, going around, braking early, using full reverse thrust, deploying speed brakes quickly, and braking techniques are all pilot judgment decisions.

The pilot who plans a landing based on a reported RCR is correct — it's the best information we have. The pilot who has 2,000 feet of runway to spare (according to the charts) and isn't concerned, is a potential time bomb. The bomb explodes when something goes wrong. Are you prepared? ■

Lightning Time Again

■ Various terms have been used to describe lightning, but few capture the awesomeness of this natural phenomena. Without a doubt, lightning is nature's most "flashy" show of force. It is hard to believe that several thousand of these shows are occurring at any one time somewhere in the world. Although they provide a spectacular show to those on the ground, they take on an entirely different light from inside the cockpit. Fortunately, lightning has caused very few serious mishaps. However, since April, May and June are the worst months for lightning strikes, it is appropriate to review what is known about lightning.

What Is Lightning?

Although current knowledge of lightning is far from complete, enough information is available to form a basic understanding of just what lightning is and how it originates. Without going into any great detail, lightning is a very long electrical spark between two oppositely charged areas.

The energy that produces lightning comes from warm air rising in a developing cloud cell. As the air becomes cooler, water droplets condense and form the cloud. When the air has risen to a point where the temperature reaches approximately minus 40°C, the water droplets freeze. Some of the ice crystals form hailstones which fall through the cloud. As they fall, small positively charged splinters separate, leaving the hailstone negatively charged. The vertical currents within the cloud cell carry the positively charged ice splinters upward, making the top of the cloud positively charged. When the potential near one of the charged areas exceeds the threshold for atmospheric breakdown, lightning results. It can occur within the cloud and/or between clouds. Cloud to ground lightning occurs when the potential between a positively charged spot on the ground and the negatively charged cloud base exceeds the threshold for atmospheric breakdown.

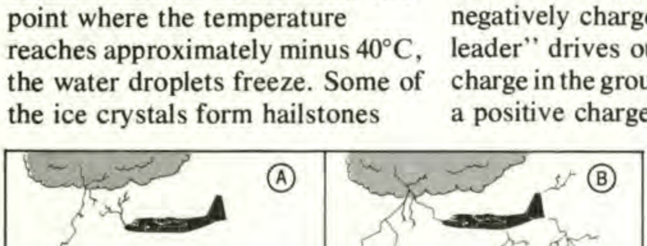
Although the lifetime of a typical cloud cell lasts about 30 minutes, a lightning "bolt" lives only for a few thousandths of a second. It starts with a relatively slow moving column of ionized air called the "pilot streamer," which moves 30-50 meters. This is followed by a more intense discharge called the "step-leader," which allows additional negative charge into the "pilot streamer," recharging it, and moving it another 30-50 meters. This cycle repeats itself and forms a zigzagging column of ionized air traveling at about 1,000 meters per second. The approaching negatively charged "stepped leader" drives out the negative charge in the ground, leaving it with a positive charge. At some point when the electrical field is strong enough, the ground sends up streamers toward the approaching leader.

When they meet, a path is established and the charge flows to the ground. As the charge is neutralized, the heavily conducting arc moves back up the path at a speed of 100 million meters per second until it reaches the cloud. This movement of the conducting region upward is called the "return stroke," and produces the intense flash and loud noise associated with lightning. This action can produce a current as high as 200,000 amperes. A "restrike" occurs when other charge centers discharge through the same path.

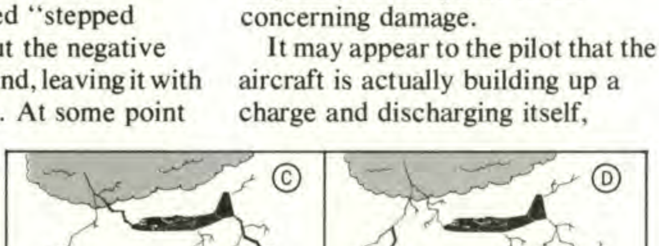
Why Is Your Aircraft Struck?

If your aircraft happens to be in the area of this activity, it may end up acting as a conductor for the lightning. When your aircraft approaches a charge center, the developing leader from the cloud may induce a streamer from your aircraft. As the streamer and leader connect, the charge passes through the aircraft. When the leader joins a streamer from the ground, a return stroke passes back up the path. The return stroke with its high, loud current (as high as 200,000 amperes), is the prime factor concerning damage.

It may appear to the pilot that the aircraft is actually building up a charge and discharging itself,



Stepped-leader attachment to an aircraft
(a) Stepped-leader approaching aircraft
(b) Stepped-leader attachment and continued propagation from an aircraft



Return stroke paths
(c) Return stroke through the aircraft
(d) No return stroke through the aircraft

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however, if you see a bright flash and hear a loud noise, you almost certainly have been "zapped" by lightning.

When Can You Expect a Strike?

Lightning can occur almost anytime, but statistics show that lightning occurs more often in clouds, between 10-15,000 feet, in light rain and light turbulence, and near an OAT of 0°C. From these statistics, it shouldn't come as any surprise that these same statistics are associated with thunderstorms and, therefore, you can expect lightning in or around thunderstorms.

What Are The Effects Of a Strike?

The effects of lightning run the full range from no damage at all to the loss of a crew and aircraft. (It should be noted that serious lightning mishaps are rare). The risk of a strike causing injury to personnel onboard the aircraft is relatively insignificant. The possibilities include a mild electric shock from the strike and temporary blindness from the flash. Although mild electrical shocks have been reported when a strike occurred, there is no danger of being electrocuted. A more likely occurrence would be temporary blindness if the bright flash was observed. The blindness usually occurs at night and only lasts for a short time (approximately 30 seconds). The effects of the bright flash can be reduced by turning up the cockpit lights, or selecting the "bright" feature in some aircraft.

In the past, physical damage at the points of attachment was the primary concern. The damage included holes burned in the metallic skin of the aircraft, shattered, non-metallic structures (radomes), and damage directly into the aircraft through electrical wiring (fuel tank explosions). These types of physical damage are called "direct effects." Aircraft designed to safely handle lightning strikes has significantly reduced the damage caused by "direct effects."

Today, other "indirect effects" of lightning are becoming known. The cause of these "indirect effects" are the electromagnetic field associated with lightning. Even though the aircraft skin provides a degree of shielding, some fields penetrate the aircraft and damage electrical and electronic equipment. The problems associated with "indirect effects" are further complicated by two developments in current aircraft design. First, designers are using more and more sophisticated electrical and electronic equipment that are more sensitive to these effects. Second, the use of nonconducting materials in aircraft skin cuts down the amount of shielding previously provided by aluminum skin. Since "indirect effects" originate in the aircraft's electrical wiring, the problem can show up anywhere in the aircraft.

USAF LIGHTNING STRIKE EXPERIENCE

(Reported 1976-1980 — Lightning Strike Mishaps)

	76	77	78	79	80	Tot.
C-130	12	13	14	16	16	71
F-4	16	6	13	5	4	44
C-135	5	8	5	7	7	32
F-111	3	5	6	11	7	32
B-52	2	9	3	6	9	29
C-141	4	2	2	1	4	13
F-106	3	2	3	1	0	9
F-15	1	0	1	3	3	8
T-39	2	1	2	0	2	7
T-38	2	0	0	1	2	5
A-7	0	0	3	0	1	4
F-16				1	2	3
A-10					2	2
Other						19
TOTAL						278

What Is the Air Force Strike Experience?

The table below details the number of reported lightning strikes between 1976 and 1980.

As you can see, certain aircraft experience more strikes than others. The most probable cause for this difference is that the mission of these aircraft require operation at lower altitudes where lightning strikes are more prevalent.

What's a Pilot to Do?

Since the best protection against a lightning strike is to avoid it altogether, start by knowing the seven warning signs of a lightning strike. Lightning is imminent when some or all of the following conditions are present.

- In clouds
- In precipitation (particularly icy types)
- Near OAT of 0°C
- Progressive build up of static or St. Elmo's fire (at night)
- In light turbulence
- At altitudes between 10-15,000 feet
- Climbing or descending

If avoidance of these conditions is out of the question, take as many of the following actions as you can.

- Avoid the areas of heaviest precipitation
- Reduce airspeed to slow static build up
- Avoid operation near an OAT of 0°C
- Turn up cockpit lighting

If a strike occurs, monitor equipment for malfunctions. In addition, if weather conditions were not as forecast, a PIREP may warn other aviators. ■

REFERENCE

Lightning Protection of Aircraft — Franklin A. Fisher and J. Anderson Plumer — Oct 77. *NASA Publication 1008.*

X-COUNTRY NOTES

AIRCREW QUESTIONNAIRES:
What's The Idea?

MAJOR WILLIAM R. REVELS
Directorate of Aerospace Safety

■ Aircrew questionnaires should provide transient services people with the positive and negative feedback which lubricates the services machine. Unfortunately, during the past six months Rex has received two strong indications that this is not always the case. In fact, at least two aircrews have received highly defensive and blistering replies to critiques left at stopover bases. This sort of response indicates a need to review the spirit and intent for aircrew questionnaires.

It's certainly true that aircrews often fill out questionnaires in moments of irritation and fatigue, often with inappropriate remarks. They may also make off-hand comments which are not in keeping with good professional conduct. Such abuse of services personnel is unwarranted and frequently very hard to take. But the fact remains that aircrews are the customers — the recipient of services rendered. In this case, the customer is not always right, but he or she deserves to be heard. Underneath those irritating manners may be that germ of truth which discloses a problem in need of a fix. Besides, the poorly mannered aircrew is in the minority, and does not provide a constant source of irritation. The Rex Riley approach to services is to listen to all the beefs, let the flack bounce off, and correct the problems.

When a base services organization adopts the defensive approach to criticism they rapidly lose concern for the offensive — an attack on the problems at hand. The practice of answering an aircrew critique with a "nastygram" accomplishes nothing and probably severely restricts any future feedback. Moreover, the time spent preparing such correspondence could be more productively spent by reviewing the critiqued area. A positive, mature approach to aircrew critiques generates a more productive attitude and will undoubtedly create more positive critiques.

On the other hand, aircrews should remember that abusive and unprofessional conduct is non-productive and will likely create escalating difficulties. Limit your critiques to the facts and skip the "baloney" which comes from frustration. Cut through the "bad stuff" and point out the specific problem at hand, with a recommendation that will lead to a solution.

The old spirit of cooperation is the key to good service. Cooperation between all parties will keep the standards up and the aircraft flying. Remember the main idea when writing or reading an aircrew critique. What's the idea? Good service through cooperative efforts.

Rex is interested in problems with aircrew critiques. If you feel the need to bend someone's ear, give us a call or write a note.

Rex recently completed a tour of Pacific area bases looking over the services organizations. It appears that facilities are generally good in the Pacific, with a lot of dedicated people working hard to make life better for transient aircrews. Here are some notes from the Pacific trip.

New Addition To List

CLARK AB, PHILIPPINES — Clark provides quality service — a direct result of the can-do spirit and hard work of services personnel. Aircrews can expect a fine reception and excellent support for a quick stop or an RON.

Reevaluations

ANDERSEN AFB, GUAM — An excellent stopping place for those of you traveling into the western Pacific region. The Andersen service indicates a base-wide effort toward supporting transient

REX RILEY
Transient Services Award

aircrews. They are oriented to handle the unexpected with minimum problems for the crews.

KADENA AB, OKINAWA — Kadena has a long history of fine service in the Far East. The transient service people are continually striving to improve capabilities to make your stay better than ever. Both officer and NCO clubs have recently been remodeled and relocated. Quarters are also being repainted. Have patience with the sandblasting noise while this job is in progress.

YOKOTA AB, JAPAN — An excellent RON location conveniently located near Tokyo. The transient services folks at Yokota handle huge numbers of people and are proud of their performance. Last year the billeting office received the PACAF Innkeepers Award for outstanding service. Base Ops, Transient Alert, ATC facilities, and Transportation also provide excellent services, making Yokota a fine stopover.

Letter to Rex

The following letter is from a long-time supporter of quality transient services. His last farewell was printed in the June '71 issue of *Aerospace Safety* magazine as he departed Perrin AFB, Texas. This time he is saying "so long" from Randolph AFB, Texas, and we hope this farewell will be no more permanent than the last. The quality service available at Randolph stands as a tribute to Earl G. Everhart, and we wish him well in the future.

"Well, Rex, I guess this time it is my final fond farewell to you and all my transient crews throughout all of the services. Randolph Transient Alert is going Civilian Contract 1 February 1982. Again, I thank all of you for allowing me the privilege of serving you on your cross country flights.

EARL G. EVERHART
Foreman, Transient Alert
Randolph AFB, TX

Outstanding Service Notes

MINOT AFB — A T-43 pilot recently called to tell Rex about some superb service at Minot. The Transient Alert troops were particularly helpful. When he asked for the aircraft to be repositioned for starting (bad tailwind), they did it quickly, safely, and without any quibbles about the cold weather. These same guys even managed to find a case of Cokes to restock the galley. Great attitude. Hats off to Minot!

K.I. SAWYER AFB — A fellow T-39 driver called to say that K.I. is a great place to RON. In addition to good quarters, transportation, and messing facilities, the response by Transient Alert is exceptional. They do everything before being asked. When the crew showed up for preflight, they even found the coffee pot was full. Sounds like super service at K.I.

There have been a few complaints recently about delays between Rex Riley evaluations. New bases wishing to be added to the list are particularly vulnerable to long delays before an evaluation can be carried out. The problem is one of transportation availability and

continued

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
MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
MARCH AFB	Riverside, CA
GRISSOM AFB	Peru, IN
CANNON AFB	Clovis, NM
RANDOLPH AFB	San Antonio, TX
ROBINS AFB	Warner Robins, GA
HILL AFB	Ogden, UT
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, NC
KADENA AB	Okinawa
ELMENDORF AFB	Anchorage, AK
SHAW AFB	Sumter, SC
LITTLE ROCK AFB	Jacksonville, AR
OFFUTT AFB	Omaha, NE
KIRTLAND AFB	Albuquerque, NM
BUCKLEY ANG BASE	Aurora, CO
RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
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
VANDENBERG AFB	Lompoc, CA
ANDREWS AFB	Camp Springs, MD
PLATTSBURGH AFB	Plattsburgh, NY
MACDILL AFB	Tampa, FL
COLUMBUS AFB	Columbus, MS
PATRICK AFB	Cocoa Beach, FL
ALTUS AFB	Altus, OK
WURTSMITH AFB	Oscoda, MI
WILLIAMS AFB	Chandler, AZ
WESTOVER AFB	Chicopee Falls, MA
McGUIRE AFB	Wrightstown, NJ
EGLIN AFB	Valpariso, FL
RAF BENTWATERS	UK
RAF UPPER HEYFORD	UK
ANDERSEN AFB	Guam
HOLLOMAN AFB	Alamogordo, NM
DYESS AFB	Abilene, TX
AVIANO AB	Italy
BITBURG AB	Germany
KEESLER AFB	Biloxi, MS
HOWARD AFB	Panama
GEORGE AFB	Victorville, CA
PETERSON AFB	Colorado Springs, CO
CLARK AB	Philippines

X-COUNTRY NOTES

continued

evaluator availability. The list of bases is long, the evaluator works on an additional duty basis, and transportation is sometimes limited. All requests for evaluations are taken seriously, and a Rex Riley visit will be scheduled at the earliest possible date. Rex will be on the road several times this year and hopefully will make a large dent in the list of future evaluations. Thanks for your patience.

For questions and comments on the Rex Riley program, contact AFISC/SEDJ, Norton AFB CA 92409, AUTOVON 876-2113. ■

1982 FORECAST

By Aircraft and Mishap Category

LT COL JOHN R. ALBERTS
Directorate of Aerospace Safety

■ The 1982 mishap forecast predicts 82 Class A mishaps, 76 aircraft destroyed, and 28 Class B mishaps. The forecast is a reflection of the collective mishap potential that currently exists in the way we support, maintain, and operate each and every one of our aircraft. Following is a detailed breakout by type aircraft and type mishap from which the forecast is derived. The Class A and B mishap potential identified for each is really the rate per 100,000 flying hours. History tells us what we can expect with no changes in the way we do business. To determine the number of mishaps your unit will experience based on the forecast, merely reverse the standard rate formula to calculate the number.

$$\text{Number} = \frac{\text{Class A Pot X Unit Hours}}{100{,}000}$$

For example, if your unit is programmed to fly 10,000 hours in the A-7 this year:

$$\text{Total Number} = \frac{5.62 \text{ X } 10{,}000}{100{,}000} = .562 \text{ mishaps}$$

That's a potential for a little over half a mishap for you in 1982. The potential by type mishap should give you a good idea where that "almost happening" may occur. As you see in this example, the finer you cut the forecast, the smaller the numbers. You know your unit best, can best evaluate your unit effectiveness in each area, and determine whether that potential belongs to your unit or some other unit. If you get a "twinge," then it's probably time to focus your prevention efforts toward that area of potential.

Please remember the following rules when forecasting.

- **It is very difficult to forecast, especially about the future.**
- **He who lives by the crystal ball soon learns to eat ground glass.**
- **The moment you forecast, you know you're going to be wrong—you don't know when and in which direction.**
- **If you're ever right, never let them forget it.** ■

AIRCRAFT		CONT LOSS	COLL GND	RNG	MID AIR	LDG (PLT)	T/O (PLT)	OPS OTH	FLT CONT	GEAR	FUEL	ENG	ENG FOD	HYD/ PNEU	ELEC	STR-UCT	BLD AIR	INST	LOG OTH	BIRD STRK	WX	UND MISC	TOTAL	FLYING HOURS
	A POT	.54	.40	.13	.11	.14	.05	.13	.17	.08	.11	.31	.01	.06	.06	.01	.01	0.0	.06	.02	0.0	.10	2.53	3,377,020
U	DEST	15	15	5	4	1	1	4	6	2	2	11		1	4		1		2			2	76	
S	CL A	15	15	5	3	5	1	4	6	3	2	13		1	4		1		2			2	82	
A	CL B					4	1	1		6		10	1		1				2	2			28	
F	B POT		.03		.03	.12	.04	.07		.11		.28	.02	.01	.01				.05	.04		.03	.85	
A-7																								
	A POT	2.23	1.12	.73		.80						.73											5.62	83,789
	DEST	1	2	1								1											5	
	CL A	1	2	1								1											5	
																							.40	
	B POT		.40																					
A-10																							5.04	209,513
	A POT	.56	1.32	.79	.28			.24	.51			.36		.37					.61					
	DEST	1	2	2					1														6	
	CL A	1	2	2					1			1							1				8	
	CL B											2	1										3	
	B POT											1.04	.24										1.28	
A-37										NO MISHAPS FORECAST														24,065
	A POT											1.05											1.05	
B-52										NO MISHAPS FORECAST														128,171
	A POT		.24																	.22			.24	
	B POT											.51											.73	
FB-111																								18,319
	A POT	2.00	3.00									1.70										1.5	8.20	
	DEST		1																				1	
	CL A		1									1											2	
	CL B											1											1	
	B POT											2.60											2.60	
C-5																								53,091
	A POT											.70											.70	
	CL B									1				.68						.67			1	
	B POT									.73													2.08	
C-9										NO MISHAPS FORECAST														30,006
	A POT					1.23																1.26	1.23	
	B POT																						1.26	
C-12										NO MISHAPS FORECAST														5,220
	A POT		9.68																				9.68	
C-123										NO MISHAPS FORECAST														7,651
	A POT	2.38						1.69															4.07	
C-130																								384,461
	A POT		.10			.09									.10				.09			.18	.56	
	DEST		1																				1	
	CL A		1			1																	2	
	B POT					.09				.10													.19	
C-135																								257,259
	A POT					.12	.26		.13														.51	
	DEST						1																1	
	CL A					1	1																2	
	CL B											1											1	
	B POT						.11	.25				.35											.70	
C-141																								294,667
	A POT		.11				.12			.12													.34	
	CL A									1													1	
	CL B					1				1													2	
	B POT		.11			.12				.34													.57	
F-RF-4																								329,902
	A POT	1.25	.86	.27	.16			.18	.27	.08	.40	.57	.08	.30	.20	.08	.30		.27	.11			5.15	
	DEST	4	3	1	1			1	1		1	2		1	1		1		1				.18	
	CL A	4	3	1	2			1	1		1	2		1	1		1		1				.19	
	CL B					1				1		2							1				5	
	B POT		.09			.25		.09		.38		.63	.08						18			.19	1.89	
F-5																								30,082
	A POT	2.11	1.04		1.16	.98																	5.29	
	DEST	1			1																		2	
	CL A	1			1																		2	
	B POT							1.07				1.14											2.21	
F-15																								147,435
	A POT	1.09	.90		.54	.62			.59	.32												.28	4.34	
	DEST	2	1		1				1														5	
	CL A	2	1		1	1			1														6	
	CL B					1				1		1							1	1			5	
	B POT				.30	.68				.29		.53							1.01	.44			3.25	

1982 FORECAST

continued

AIRCRAFT	CONT LOSS	COLL GND	RNG	MID AIR	LDG (PLT)	T/O (PLT)	OPS OTH	FLT CONT	GEAR	FUEL	ENG	ENG FOD	HYD/ PNEU	ELEC	STR- UCT	BLD AIR	INST	LOG OTH	BIRD STRK	WX	UND MISC	TOTAL	FLYING HOURS
F-16																							103,979
A POT	3.38				.84	.64	5.28		.49		4.75			2.68							.56	18.6	
DEST	2				1		1		1		2			3							2	12	
CL A	2				1		1		1		2			3							2	12	
CL B									2													2	
F-101										NO MISHAPS FORECAST													5,659
A POT	5.27					1.86				2.59	1.95											11.67	
B POT					2.46																	2.46	
F-104																							9,338
A POT							4.05				10.43											14.48	
DEST											1											1	
CL A											1											1	
F-105										NO MISHAPS FORECAST													8,718
A POT	.78	3.94						1.87			2.44							1.32			2.04	12.39	
F-106																							56,372
A POT	.48	1.0					.53	1.04		1.08	.56		.52									5.21	
DEST		1						1		1												3	
CL A		1						1		1												3	
B POT				.52																		.52	
F-111																							79,987
A POT	.86	1.45	1.31	.90				.94	.54		1.50			.40								7.89	
DEST		2	1					1			2											6	
CL A		2	1					1			2											6	
CL B					1						2			1								4	
B POT					1.25	.36					2.38			.51								4.51	
H-1										NO MISHAPS FORECAST													48,928
A POT					.75																	.75	
H-3										NO MISHAPS FORECAST													27,788
A POT												1.71										1.71	
B POT					1.42						1.41											2.83	
H-53																							15,632
A POT		2.07					3.15			2.40												7.61	
DEST							1															1	
CL A							1															1	
CL B							1															1	
B POT							4.75															4.75	
O-2																							38,386
A POT		.84	.57				1.11	.53														3.04	
DEST							1															1	
CL A							1															1	
OV-10																							19,140
A POT	2.39	1.13		1.08																		4.59	
DEST	1	1																				2	
CL A	1	1																				2	
T-33																							44,576
A POT	1.24	.62								.62	.70											3.18	
DEST											1											1	
CL A											1											1	
T-37																							313,777
A POT	.49				.05		.11				.14											.79	
DEST	2										1											3	
CL A	2										1											3	
B POT																						0.0	
T-38																							369,433
A POT	.17	.14			.13		.04	.17	.23	.10	.21		.10						.09			1.4	
DEST	1	1						1	1		1											5	
CL A	1	1			1			1	1		1											6	
CL B						1																1	
B POT				.13		.19	.09				.12											.53	
T-39										NO MISHAPS FORECAST													86,285
A POT																					.30	.30	
T-41										NO MISHAPS FORECAST													19,046
A POT					1.83						2.0											3.83	
T-43										NO MISHAPS FORECAST													19,140
A POT																						0.0	
B POT																			1.65			1.65	

A New View of Thunderstorms

Here's some new information on that old nemesis of flying

MSGT JAMES A. HOY
Air Weather Service
Scott AFB, IL

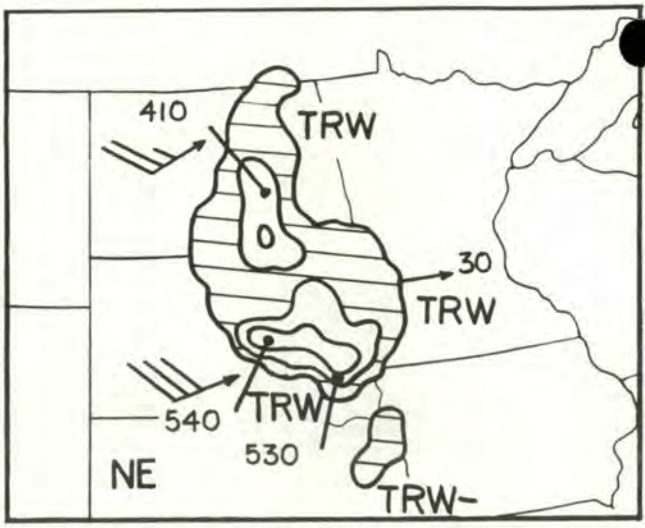
■ Thunderstorms pose a significant problem for the military crewmember. The associated weather — the high winds, shear, turbulence, lightning, downbursts, and hail — make severe demands of even the most experienced aviator. Recent statistics indicate that weather is a factor in approximately 40 percent of the fatal aviation accidents. According to the Air Force Inspection and Safety Center, since 1975, weather-related mishaps have caused aircraft damage in excess of $44 million and resulted in over 60 deaths.

You are probably familiar with two basic types of thunderstorms — frontal and airmass. The frontal, or prefrontal squall line, consists typically of a narrow line of individual storms. Your alternatives are (1) to fly over, or (2) perhaps "sit it out" until the squall line passes by you. Probably the most often used approach, but by far the most dangerous, is to attempt to fly through a break in the line. Lack of adequate "elbow room" between you and the individual thunderstorm cells can be very hazardous.

The airmass thunderstorm occurs randomly over much of the United States, especially during warm summer afternoons. Again avoidance — picking your way around and giving a wide berth to the individual cells — is the "normal" procedure.

Research meteorologists have recently described a third type of thunderstorm system of which you should be aware, the Mesoscale Convective Complex (MCC). By definition, these systems develop rapidly, become very large, move slowly, persist for long periods, and are usually circular or elliptical in shape. The MCC produces typical summer thunderstorm weather, but because of its size, persistence, and slow movement, it can have more dramatic effects on the area. Unlike the airmass or frontal thunderstorm, the MCC's hazards which range from lightning and hail to IFR or marginal VFR conditions may persist over a terminal for hours. For example, the weather at Jackson, Mississippi during an MCC included thunder, lightning,

Enhanced infrared satellite image of a large MCC over the eastern Dakotas. Note the wide area covered.



A radar summary of the MCC shown in Figure 1. The radar depiction is shaped much like the satellite picture, and the area of precipitation is nearly as large as the satellite observation.

and light to moderate rain that persisted *continuously* for more than nine hours.

Figure 1 shows a large MCC over the eastern Dakotas while Figure 2 presents the nearly concurrent radar summary chart. The radar depiction is shaped much like the MCC and the area experiencing precipitation appears nearly as large as the satellite observed system. The surface reports indicated thunderstorms, steady rain and rainshowers affecting a large area, and six-hour rainfall amounts over one inch in the area of the system.

MCCs pose particularly tough problems for pilots for several reasons. The MCC appears to grow within areas of favorable flying conditions (weak pressure gradients and light winds). The upper air charts may even indicate the MCC has developed within a ridge of high pressure. However, upon detailed analysis, meteorologists find the areas were usually very unstable, with an upper level disturbance embedded in the winds at higher altitudes. Within two and one-half hours, scattered airmass thunderstorms can develop into an MCC covering an area the size of the Dakotas.

The typical MCC covers several states and has a life cycle which spans over 12 hours. The pilot whose destination is in or near an MCC must be aware that conditions are slow to improve as contrasted to rapidly improving conditions when a squall line passes. Also, the MCC may be too large to permit you to circumnavigate the system.

The MCC generates enough energy to modify typical cruise level winds. Winds between 35,000 and 40,000 feet are substantially altered by the MCC outflow; southwest of the MCC's center, wind speeds are significantly reduced; while northwest of the MCC's center speeds dramatically increase. As the system grows, a pronounced high speed jet outflow forms along and downwind of northern portions of the MCC cloud shield. Actual pilot reports northeast of the center of an MCC indicated winds 50 to 60 knots in excess of the forecast winds with moderate to severe CAT to the north of the outflow jet.

Since this process occurs at cruise levels of jet traffic, the potential impact on flight plan winds and enroute fuel burn are substantial. This is especially true since we've shown deviations in the wind flow are *not* adequately predicted in upper level wind forecasts and computer flight plans.

MCC's are thunderstorm systems that threaten or substantially impact all of the aviation community; yet, MCC's are not routinely considered in most flight decisions. The aviation community needs to be wary of them since they usually develop rapidly, cover several states, blanketing 100 times the area of an airmass thunderstorm, last a minimum of six hours, and move very slowly. Since these systems have not been previously well recognized and documented, the first effort is to improve the way in which the aviation weather system copes with them. This must involve education to develop a general recognition of the significance and effects of MCCs. ■

This article has been compiled from "Mesoscale Convective Weather Systems and Aviation Observations," R.A. Maddox and J.M. Fritsch, and "Forecasting Mesoscale Convective Complexes Over the United States," R.A. Maddox; NOAA, Environmental Research Laboratories, Office of Weather Research and Modification, Boulder, Colorado 80303.

Landing From Non-Precision Approaches

■ Pilots attempting to land without being fully aware of where they are in relation to the runway continues to be a problem during non-precision straight-in approaches. Some reasons for this are:

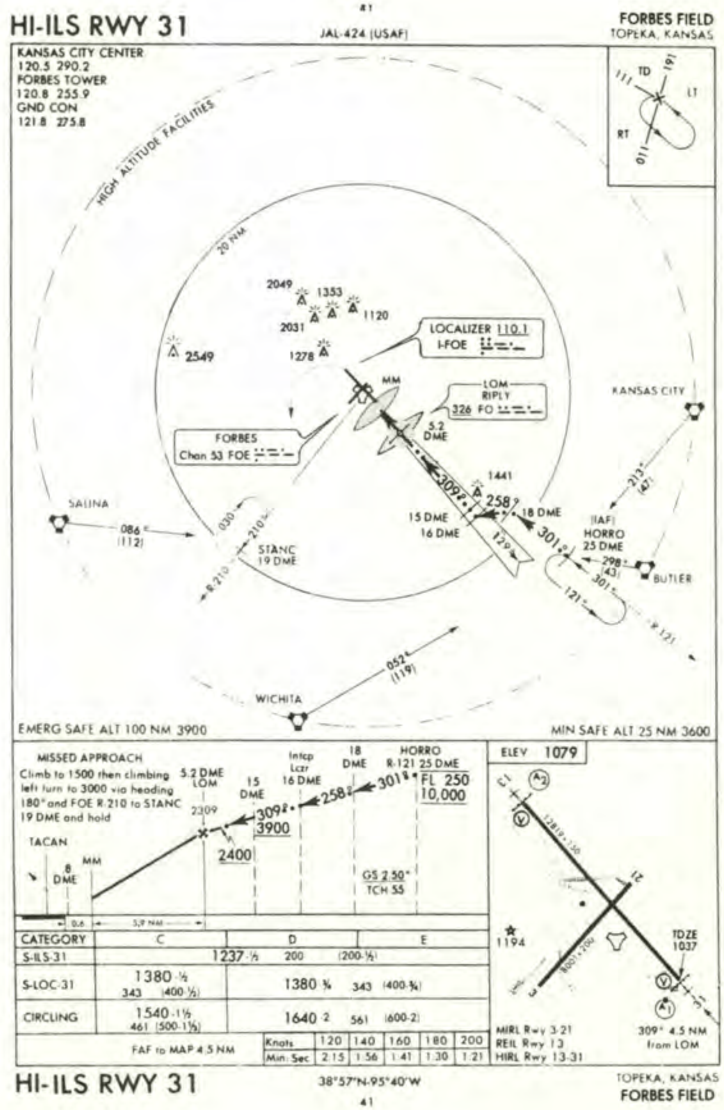
▪ The misconception that approach design guidance is formulated to provide a normal descent at the Missed Approach Point (MAP) for all aircraft from Minimum Descent Altitude (MDA) to the runway.

▪ Lack of planning for a normal visual glide path to the runway from MDA.

The MAP is just what the name implies. It is the point from which the missed approach commences. It is not, nor was it ever intended to be, the point from which to maneuver to land. Approach design does not attempt to provide normal descent to the runway for all aircraft from the MAP. The MAP's position in the approach is primarily dependent on missed approach criteria. It is seldom dependent on final approach criteria.

As an example, the approach depicted in Figure 1 may lead you to believe that at the MAP you will be in a position for a normal descent to

Figure 1



ON COURSE

continued

the threshold. ILS approaches with associated localizer minima depict the ILS MAP from decision height alone. The instructions adjacent to the timing block, for the non-precision portion indicate "FAF to MAP 4.5 NM" which places the MAP over the threshold. Most high performance aircraft would require an extremely long runway to safely land if they started descent from the MDA at the threshold.

Let's look at a less extreme example. The MAP in Figure 2 is placed .7 NM from the runway on this TACAN RWY 25, Langley AFB, VA. If you depart the MDA when at the MAP for the threshold, you will need to descend at approximately 5° or 500 feet per nautical mile descent gradient, which will be too steep for some aircraft. For an aircraft on final at 150 KTAS, this would require a vertical velocity of 1325 feet per minute. You should plan the non-precision approach so that you arrive at the MDA in a position to make a normal descent. VDPs are published on many approaches but when no VDP is published, you should use whatever is available to define a VDP, such as timing or DME. If this point is computed and overflown while looking for the runway or while descending to MDA, you will at least be aware that if you elect to land you may be descending at a greater-than-optimum rate.

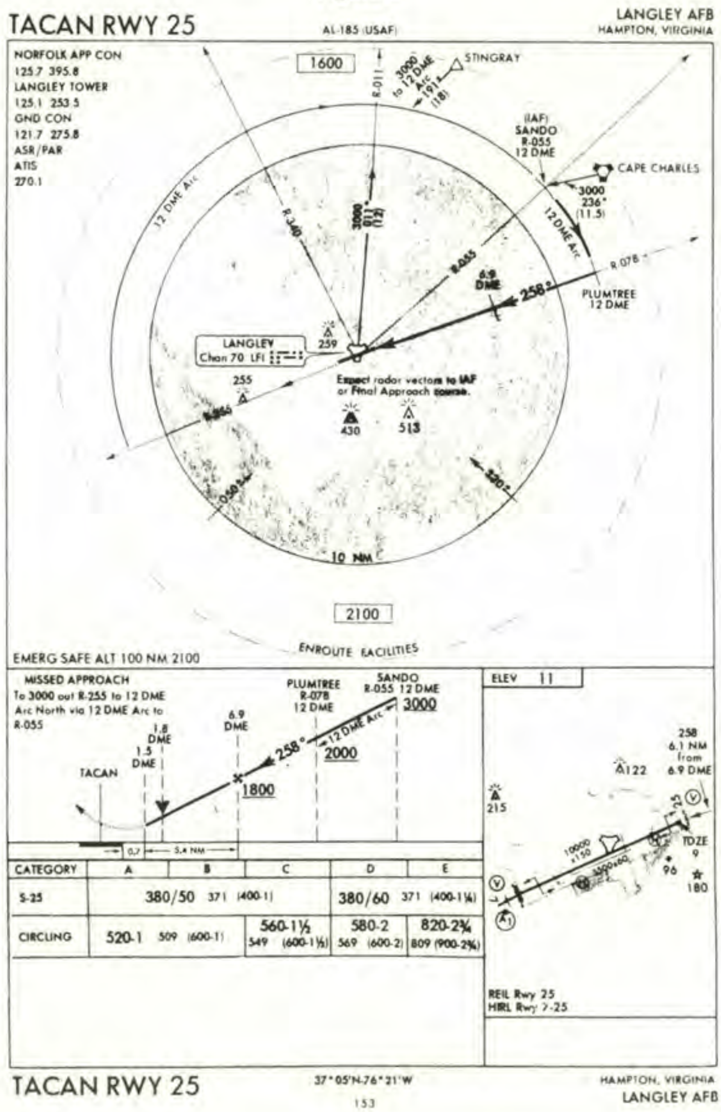
A VDP will normally provide a three-degree descent gradient to the threshold, but the VDP is not necessarily the last practical point from which to land. For each particular approach, each aircraft has a last practical point from which a safe landing can be made. Several variables, such as runway length and aircraft maneuverability, make it impossible to designate such a point on each approach plate. This last practical point, beyond which you are committed to a missed approach, must be determined for each particular situation.

If you have no way of determining a VDP or last practical point from which to land, visibility must be such that there is absolutely no question about where the aircraft is in relation to the runway.

Although our flying directives define approach lights as part of the runway environment, you may want to remain at MDA if approach lights are all that can be seen. By departing MDA with only the approach lights in sight, you may be flying a dangerously dragged-in final approach or land short due to an illusion of being high. You should be totally aware of your position in relation to the runway and initiate an optimum descent at a pre-computed or published VDP.

Our next "On Course" article will discuss the "new" Pilot's Annual Instrument Exam. In the meantime, if you have questions relating to instrument flying in general or AFM 51-37 in particular call Lt Col Jim Curran or Maj Bill Gibbons at AUTOVON 487-5834. Keep it "On Course." ■

Figure 2



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UNITED STATES AIR FORCE

Well Done Award

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

LIEUTENANT COLONEL
William M. Douglass
311th Tactical Fighter Training Squadron

MAJOR
James F. Boggan
58th Tactical Training Squadron

LUKE AIR FORCE BASE, ARIZONA

■ On 28 May 1981 Colonel Douglass and Major Boggan were flying a DACT sortie in an F-4C aircraft. During the rejoin after takeoff, the right engine fire light illuminated. Chase called smoke trailing from the right engine, and Colonel Douglass shut down the right engine while Major Boggan confirmed all checklist procedures were complete. With the fire light now off, fuel dumping was initiated, and the crew planned a single engine landing. Shortly after the approach was initiated, aircraft utility pressure dropped to zero, and the aircraft became extremely difficult to control. At the same time, landing gear indications went from the "down and locked" to the "unsafe" position. Altitude and airspeed could not be maintained and full afterburner was selected for go around. Level flight was achieved at 500' AGL and airspeed bleed off was stopped at 195 knots. The utility hydraulic pressure began to recover approximately 30 seconds to one minute later. The aircraft was too slow for the aircrew to safely raise the flaps, and Colonel Douglass elected to maintain landing configuration rather than risk possible complications if additional demands were placed on the utility system. In full afterburner, the airspeed gradually increased to 210 knots, and a shallow left turn back to the field was begun. Altitude and airspeed could not be maintained with more than approximately 15 degrees of bank. As the aircraft approached a position 10 miles out on final, the utility pressure again dropped to zero, and the flaps individually went to a trail position. Aircraft control was maintained with difficulty by Colonel Douglass during the ensuing pitch and rolling maneuver. When the flaps reached the trail position, airspeed increased to 230 knots. A steep, low power, straight-in approach was flown at 230-250 knots as the utility pressure continued to cycle from 3,000 psi to zero. The prompt, decisive actions and superior airmanship of Colonel Douglass and Major Boggan probably prevented the loss of a valuable aircraft and averted possible loss of life. WELL DONE! ■

KNOW YOUR ENEMY From Afar