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SAFETY SEPTEMBER 1976

THE APPROACH

The Critical 11 Minutes

Danger Area

Low Altitude Wind Shear

IFC Approach

Cover photo by
SSgt Steven Spoors
Det 5, 1369 PS (AAVS)
Elmendorf AFB AK

UNITED STATES AIR FORCE SEPTEMBER 1976

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

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THE MISSION - - - - - - SAFELY!

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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SEPTEMBER 1976 AFPR 127-2 VOLUME 32 NUMBER 9

Thunderstorm? Cumulonimbus?

MAJOR HERBERT WEIGL, JR.
All Weather Service • Scott AFB IL

Circle the correct answer.

- F Flight hazards associated with thunderstorms aren't associated with cumulonimbus.
- T F Cumulonimbus (CB) are less intense than thunderstorms.
- T F Some MAJCOM supplements to AFR 60-16, General Flight Rules, specify in-flight thunderstorm avoidance criteria. These criteria apply equally to cumulonimbus.

Finished the quiz? The answers are: false, false, and true. At least I hope the third answer is true because thunderstorms and cumulonimbus ARE THE SAME THING.

The **Glossary of Meteorology** defines thunderstorm as, ". . . a local storm invariably produced by cumulonimbus cloud, and always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail." The same source defines cumulonimbus as, "A principle cloud type (cloud genus), exceptionally dense and vertically developed, occurring either as isolated clouds or as a line or wall of clouds with separated upper portions. . . . The usual occurrence of lightning and thunder within or from this cloud leads to its popular appellations: thundercloud, thunderhead, . . . , and thunderstorm."

Simply put, weather observers report thunderstorms when they hear thunder, whether or not they can actually see the associated cumulonimbus cloud(s). They report cumulonimbus, e.g., CB W - N (cumulonimbus west through north), when they see cumulonimbus clouds, but cannot hear thunder.

Aircrews should take the same precautions when briefed about thunderstorms. The hazards are the same: lightning, turbulence, wind shear, heavy rain, hail, etc. ★

See correction inside front cover

THE

REX RILEY
Transient Services Award

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SCOTT AFB	Belleville, IL
McCHORD AFB	Tacoma, WA
MYRTLE BEACH AFB	Myrtle Beach, SC
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MATHER AFB	Sacramento, CA
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, TX
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GRISSOM AFB	Peru, IN
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RAF MILDENHALL	UK
WRIGHT-PATTERSON AFB	Fairborn, OH
CARSWELL AFB	Ft. Worth, TX
HOMESTEAD AFB	Homestead, FL
POPE AFB	Fayetteville, NC
TINKER AFB	Oklahoma City, OK
DOVER AFB	Dover, DE
GRIFFIS AFB	Rome, NY
KI SAWYER AFB	Gwinn, MI
REESE AFB	Lubbock, TX
VANCE AFB	Enid, OK

CRITICAL 11 MINUT

First published in SAC's **Combat Crew,** this article takes on the subject of pilot workload during the most critical period of flight. While the B-52 crew is featured, the problems presented apply in some degree to all crews—from the single seater to the many member crews, so we're reprinting it for all to ponder. Ed

A B-52 is approaching home base after a long mission practicing low level, bombing, refueling, and navigation. The crew is tired but satisfied with their performance today. They now start the series of tasks required to get the big hummer on the ground. The AC flies the airplane and calls for the descent checklist. They review the approach and the copilot calls metro for the latest weather. The AC monitors center, who turns them over to approach control, and he retunes the radio. The copilot finishes copying the weather and changes No. 2 UHF to command post where he confirms their intention to land and relays a list of maintenance writeups. The AC then calls for the continuation of the descent checklist (19 items) and they start the penetration. The most critical minutes of the mission have begun.

From penetration to after landing the pilots will read and accomplish 54 checklist items, numerous radio calls to approach, GCA, tower, possibly to their command post again, several crew coordination interphone calls, and fly the airplane. In a few words, they are busy as H--- and must fight to prevent additional distractions such as weather or possible emergency procedures from overloading the system and interfering with the primary task of safely flying the airplane. We all know flying the beast is number one but

MAJOR JOHN R. DOCKENDORFF • HQ SAC Offutt AFB NE

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other things can get nearly out of control more often than we like to admit.

Contrast this with the airline crew who is making an enroute descent to the civilian airport on the other side of town. Wait a minute! Read just a little more before you turn the page.

I know the missions of these two crews are vastly different and that the Buf is more complicated, but I submit that all aircrews face very similar problems in those few minutes just after takeoff and just before landing.

Back to the airliner—the cockpit crew (normally three pilots) comes out ahead in this comparison with a SAC crew for several reasons. Some are logical, some are controversial, but since the airline safety record is better than ours, maybe we can learn something from them. After all, we in Safety believe there is no plagiarism in our business, so if somebody has a good idea we feel free to borrow it.

The first advantage the civilians have we can't do much about, most domestic crews get 30-50 takeoffs and landings per month. On the one hand this amount of practice is beneficial, but statistics can penalize airline crews by the sheer magnitude of their increased exposure to the critical minutes of takeoff and landing. To reduce the hazard of this exposure, one airline has a program we can learn a lot from. It is called "The Critical Eleven Minutes" of a flight.

The critical eleven minutes are defined as takeoff plus three and landing minus eight. The program stresses two concepts. One is individual crewmember awareness and readiness, to insure that they are prepared to take timely and appropriate action if an emergency occurs. This is stressed to the flight attendants in the form of a suggested "30 Second Review" of emergency procedures (evacuation, door and slide operation, etc.) to be done everytime they strap in for takeoff or landing.

The second concept is the development of procedures to minimize cockpit distraction and workload, especially during the critical eleven minutes. For example, the NO SMOKING sign is usually on during these eleven minutes and is designated as a signal to remind non-cockpit crewmembers not to knock, enter, or even call the cockpit on interphone while this sign is illuminated, except in serious emergency. Other cockpit procedures are also designed to minimize distractions.

Some airlines require that neither captain nor first officer read any normal checklists when the plane is moving. The second officer reads which allows minimum "head in cockpit" time for the front seaters.

The checklists themselves are designed around a different philosophy from most USAF checklists. Airlines require qualified crewmembers to know the systems and procedures well enough to accomplish them at the proper time, then read a brief list as a true doublecheck. This contrasts with USAF's "read and do" philosophy. Disregarding philosophy, one result is an airline checklist consisting of 15-25 items which accomplish the same basic functions as the aforementioned fifty-four B-52 items.

Checklists were further modified as a result of the critical eleven minutes program. The reading of After Takeoff Checklist is delayed until 10 to 12,000 feet is reached. Power and flap adjustments are made at the appropriate time, but delaying the reading maximizes the time available for all three pilots to watch for traffic and cross-check instruments. In the landing phase the preliminary checklists are done early (usually above 10,000 feet) such that only three to four items remain to be read when final approach is started and a three-item final check is made when the gear comes down for final descent. Anything that reduces distractive elements such as checklist reading, making flight log entries, and radio calls during the time the airplane is in the busiest part of the environment—the airport area—is worthy of attention.

Another airline uses a procedure that is controversial even among other airlines. On every approach they obtain the airport altimeter

The Air Force checklist is an important and time consuming task on each approach. The current B-52 checklists for the descent and landing contain 54 items.

correction factor from their company dispatch office. After careful cross-check by all three pilots, they then reset two of the three altimeters in the cockpit to read altitude above the runway. In effect, this means that every approach at every airport looks the same on the instruments—the two altimeters always read zero on the ground. This means that for a 100-foot decision height (DH) approach, the pilots can always count on seeing 100 feet on the altimeter when the decision must be made.

Sounds wild doesn't it? But consider this. That airline has not had a fatal accident in several years and probably has the world's best safety rate as of this time.

Airline crew coordination and training philosophy is similar to the Air Force's in that Air Force manuals contain words similar to the following airline manual excerpt.

"The emergency procedures in this handbook represent the best available facts about these subjects. Flight crews should follow these procedures as long as they fit the emergency. At any time they are not adequate or do not apply, the flight crew's best judgment should prevail. Safe altitude and airspeed should always be of primary concern."

Have we been emphasizing this enough? What about this excerpt from an airline normal procedures section?

"All cockpit crewmembers shall assist the captain in monitoring and cross-checking instruments, speeds, assigned altitudes and headings, control positions, including flaps, spoilers, landing gear, stabilizer position, etc. A crewmember shall immediately call to the captain's attention any discrepancy noted."

Do AF pilots properly and readily solicit this type of cross-checking by other crew members? We have the procedures but some crews appear to ignore them.

Why talk about the critical eleven minutes when we have always said safety must be "paramount" and be constantly stressed throughout the mission? Indeed, safety must be held constantly in highest priority, but history, luck, fate, complacency, pilot proficiency, crew discipline, or some as yet unnamed factor has so far proven that safety is like a blanket slightly too small to cover the bed. (We have not yet achieved a zero accident rate.) We must, therefore, cover those parts which are most vulnerable.

The world air carriers suffer about 85 percent of their airplane losses in the critical eleven minutes of flight. An analysis of SAC accidents since 1957 shows about 70 percent of the SAC major accidents also occurred in this time span. These numbers indicate the need to stretch a large portion of our blanket in this direction. Experience has shown that when we try to stre[illegible] the blanket in all directions at once —a' la "paramount"—thin spots and tears can occur. We must cover the most vulnerable areas pending the development of a better blanket.

What can you and I do? A good salesman would produce his order book at this point and ask for your order. The nebulous and intangible qualities of safety make this difficult but we must start somewhere. SAC Safety has asked the "schoolhouse" experts (CCTS, CEVG, CFIC) to evaluate the following questions for possible use by SAC crews and make any other ideas known. These same questions can be evaluated by other commands for their own use.

- Could some items on aircrew checklists normally accomplished during the critical eleven minutes be eliminated or relocated to less critical times such as above 10,000 feet?
- Could pilots delegate mo[illegible] checklist reading to other crewmembers during critical phases of flight?

In contrast to the B-52 crew on page 4, an airline crew normally has only 15-25 checklist items to do in the same descent and landing period.

• Should checklist philosophy and construction be revised such that amplification is contained only in the flight manual and a simplified list used as a true doublecheck on items accomplished as opposed to the "read and do" list?

• Can other pilot duties, such as flight log entries, fuel panel changes and radio calls be accomplished during less critical times?

• What can be done to bring other crewmembers "into the loop" to improve crew discipline and provide a true cross-check to reduce the risk to the aircraft?

Many of these questions are based on nonspecific and time honored concepts but any area is fair game for safety if accidents can be prevented. Talk it over at hangar flying sessions. Talk to your IPs and supervisors. At the very least, think about these concepts and develop an automatic reaction of increased vigilance and your own "30 Second Review" of the critical eleven minutes of a flight.

* * *

Since Major Dockendorff wrote his article, there have been some developments. He summarizes these very well in a letter to *Aerospace Safety* quoted below:

"SAC Combat Evaluation Group (CEVG) is actively involved in redesigning the checklists for SAC aircraft. The subject study has resulted in many inputs and suggestions from crews in the field. All inputs are forwarded to CEVG for their consideration. As of this date they are staffing a much simplified B-52 checklist through the laborious steps required for checklist revision. SAC Safety and CEVG are currently establishing suspense dates for inputs for flight manual reviews for the other SAC airplanes. We are hopeful that improved checklists which reduce the hazards of cockpit distraction will result.

"Another facet of this study addresses the distractions of air traffic radio calls, frequency changes, and transponder code changes. SAC Safety has opened communications with FAA in order to explore ways to minimize this type of distraction. The FAA is very interested in investigating these areas as evidenced by their work with the Special Air Safety Advisory Group (SASAG) and their recently published study. As further evidence of their interest, they are reprinting the 'Critical Eleven Minutes' article in their Air Traffic Controller's Journal.

"The problems addressed in the SAC article and study are applicable to and could improve safety for everyone who flies airplanes. We hope that USAF will take the lead and sponsor a study or a continuing working group at USAF or even DOD level. At the cost of aircraft accidents these days, the savings could be spectacular.

J. R. DOCKENDORFF, Major, USAF
Air National Guard Advisor
Directorate of Safety,
DCS/Operations"

ABOUT THE AUTHOR

Major John R. "Doc" Dockendorff is currently on a 4-year military leave of absence from Trans World Airlines. Assigned to HQ SAC as the Air National Guard Advisor to the Director of Safety, he is a liaison officer for the transfer of KC-135 aircraft to the Air Reserve Forces. In addition to being a pilot for TWA, Doc served as an instructor flight engineer and taught flight attendant (hostess) safety. He has accumulated over 5,000 hours of flying time and has been an aircraft commander in the B-52D and (ANG) KC-97L. He holds a B.S. in mechanical engineering from Iowa University and an M.B.A. from Auburn. ★

TRUST

CAPTAIN PHILIP M. McATEE
Directorate of Aerospace Safety

As a maintenance officer who is also a civilian pilot, I have always tried to view the operation from the point of view of both the operator and the maintainer. I'd like to pass on some things that I have observed which may cause trouble.

The first things that come to mind are the aircraft forms and the exceptional release (ER). Most commands have a requirement that the ER be signed by the maintenance officer or 9-level maintenance supervisor, at least for the first flight of the day. This assures that the maintenance supervisors are aware of all discrepancies in the forms and consider the aircraft safe for flight. Here is where the first problem comes in.

I used to go out to the aircraft and review the forms while the crew chief was pulling his preflight. Now, most crew chiefs like to have as few write-ups as possible in the 781A, so they transcribe as many delayed or deferred write-ups as they can to the 781K. The block on the 781K isn't very big, and these days there are usually quite a few discrepancies being delayed. So, in order not to have too many 781K's, the discrepancy write-up is shortened as much as possible. Now that's OK to a point, as long as it has been shortened in a way that leaves the nature of the problem still clear. But that assumes that the crew chief understood the write-up in the first place.

Remember, aircraft are getting more complex all the time and the average crew chief knows very little about systems used in an operational environment. This is particularly true in fighter aircraft in which the crew chief never flies. Also, this lack of understanding of the need for, or use of, many systems is not limited to the crew chief, but often includes others in the maintenance complex, including debriefing personnel who assign the symbols. They may not be aware of the importance or dangers connected with a problem in a system.

So now we have the potential to put a serious, not understood write-up on a red diagonal and then have a well meaning crew chief transcribe and shorten the write-up down to an insignificant few words. I have frequently seen write-ups that should ground the aircraft be shown as red diagonals because the person assigning the symbol didn't understand the significance of the discrepancy or the importance of the system. Because of my flying background I would often catch these and upgrade them *before* they got in the forms, but frequently these were not discovered until exceptional release time.

Now to be ready to sign the release, it usually took me about 10 minutes of reading and asking questions about the write-ups so I knew what was wrong and where it was located. Sometimes I had to make a phone call to find out what a unit did and how important the system or part was for a certain mission.

Yet, amazing as it seems to me, I have seen aircraft commanders come out, look quickly through the forms searching mainly for red X's, ask not one question, and go fly. Remember, like everyone else, maintenance officers or supervisors all have different backgrounds and levels of knowledge about any aircraft. Most are not experts by any means. Maintenance may have signed the ER, but *you* are the one who is going to fly the aircraft. Trust is most definitely needed between aircrew and ground crew. But trust is a two-way street. You, the aircrew, are the important link. Remember, that crew chief expects that you will look at the forms and know and catch anything that is wrong, especially things he doesn't understand. ★

water/glycol FIRE HAZARD

MR. DONALD GWYNNE
General Dynamics
Fort Worth Division

An aircraft electrical fire is just about guaranteed to get everyone's attention. One such fire led to rediscovery by the USAF and the aerospace industry of a weird chemical process first reported by NASA in 1968.

A loose F-111 water tank cap allowed several gallons of water/5% propylene glycol mixture to spill into the main gear well area. Several days later, during a ground check of avionic systems, fire broke out in the gear well. Electrical power was cut off, and the fire self-extinguished.

This was no ordinary "short." The circuit breaker of the affected armament system black box had not popped. The wires around the burned cannon plug showed signs of overheating only within a few inches of the fire area. When high current is the cause of overheating, wire insulation is typically damaged the entire affected length.

It was learned after intensive investigation that a water/glycol electrochemical reaction fire had occurred as a direct result of water/glycol contamination from the loose ECS cap. Note that such a solution is very slow to evaporate and the hazard is present days or even weeks after contamination occurs.

This is a typical example of the wiring damage resulting from a water/glycol fire.

The passage of direct current (DC) through a water/glycol solution from a positive (anode) terminal of silver, gold, or rhodium can lead to an intensely hot flame, liberating considerably more energy than supplied by the DC current source (current values of less than one ampere are typical).

Since many aerospace electrical connectors, switches, relays, and wires use silver or gold plating, the USAF is a prime candidate for repeats of such fires.

Water/glycol solutions in common USAF usage include MIL-A-8243B Deicing Fluid, boiler water/5% propylene glycol solutions, ethylene glycol coolants, propylene glycol in air pressurization systems anti-icing, etc. Such solutions are also found in missile/space systems such as Apollo.

After the previously mentioned mishap, another F-111 mishap pointed out a different danger. Fire occurred underneath the wing of an aircraft which had been recently deiced using MIL-A-8243. An underwing pylon disconnected socket was found burned. Normal ground service deicing operations expose electrical wiring, connectors and equipment to ethylene/propylene glycol solutions on a recurring basis.

Another loose F-111 water tank cap resulted in wetting of the circuit cards of an avionics black box, which subsequently led to fire within the unit.

Although no water/glycol fires have been reported from contamination of avionics via water in cooling air ducts, the possibility exists in some types of aircraft. Several cases of leaking gaskets have resulted in water/glycol solutions being introduced into the environmental cooling air ducts of F-111s, with resultant flooding of some avionic systems. In such instances, prompt decontamination action is required to prevent avionic equipment damage from corrosion and/or the water/glycol fire phenomenon. ★

MAJOR JACK SPEY
475 ABW

Most midair collisions occur below 5000 feet in VMC, and near the airport traffic area at maneuvering airspeeds. Few occur on airways at cruising speeds and altitudes. This is true, in part, because much of the traffic at cruise altitude is under air traffic control. Also, traffic becomes diffused at altitude and the probability of a midair collision decreases.

The *danger area* is that area between our cruising altitudes and the immediate airport traffic area: below 5000 feet, while maneuvering to and from the airport and while clear of clouds. It is in this "funnel" around an airport that traffic is most dense.

Before the gyro, the aviator was limited to flying by visual reference to the ground and sky. Aviation's capability took a quantum jump when the gyro was adapted to a reference instrument, and subsequent improvements now permit the aircraft to be flown during almost any weather. Along with the gyro instrument came the requirement for the pilot to be proficient in instrument flying. As with visual skills, this requires practice. Today we find ourselves practicing our instrument skills while both VMC and IMC. This has become necessary, in part, due to the tolerances required during evaluation flights; however, it has contributed to a condition where pilots, even when clear of clouds are devoting the majority of their cross-checks to *inside* the cockpit where danger cannot be seen.

Today as more pilots are placing heavier reliance on aircraft control by *instrument* reference, our ability to control the aircraft by *visual* reference is deteriorating. Given the condition of an increasingly crowded "danger area" and a reduction in outside cross-check by all pilots, the potential for a midair escalates. As the potential increases, our eyes remain the only reliable system for detection. It is, therefore, imperative that our outside cross-check be increased and our ability to fly our aircraft by natural reference be improved or maintained, while clear of clouds, particularly when maneuvering in the area of greatest danger.

Some may argue that you cannot fly a modern aircraft under visual conditions without heavy reliance on flight instruments. This is simply not true. A pilot who learned to rely on flight instruments, even in VMC, may experience more difficulty, but with practice he finds that flying an aircraft by reference to the "World's largest Attitude Indicator", the natural horizon and ground reference, actually works and works well.

The next time you are flying a transition mission in the VFR traffic pattern, cover the attitude indicator with a piece of cardboard and make a few trips around the flagpole by visual reference aided by altimeter and airspeed only. *This technique should only be tried in aircraft with more than one qualified pilot and then only if not prohibited by command regulation.* On base leg, improper pitch attitude may result in a higher speed and larger descent rate than desired, but following a few pitch changes relative to the "World's Largest Attitude Indicator", we will soon recognize the proper attitude to produce the desired speed. Altitude control on downwind leg may be a little erratic until we recognize the level flight attitude of our aircraft. During the experiment, there may be an enormous feeling of insecurity, but the IP or copilot can provide reassurances that all is not as bad as we might think. Following a few circuits, we soon realize that our aircraft can be flown with less reliance on flight instruments while in VMC conditions. In fact, with more practice she could be flown almost entirely by outside reference and flown well.

During an instrument arrival within the danger area, the pilot has two primary objectives: maintaining a heading assigned or predetermined by instrument reference, and maintaining a pitch/power relationship necessary to obtain the desired climb or descent rate and speed. Both these conditions can be maintained visually with a little practice. Five degree heading tolerance can be maintained by keeping the bird pointing toward a cloud or object on the ground, and pitch attitude necessary for desired speed can also be maintained by reference to the horizon or ground/sky juncture. Altitude reference, as always, requires occasional reference to the altimeter. Heading and airspeed maintained this way may not satisfy an evaluator's $\pm 2^\circ$ or ± 5kts criteria, but during the initial stages of an arrival, when VMC, these tolerances are not critical.

It is only during the *final* portion of an instrument approach that heading, altitude, and airspeed control become more critical, thus forcing the pilot to rely more heavily, if not entirely, on instrument reference in order to get "in the groove" and stay there. However, the transition to primary instrument reference should be gradual as the distance to the airport diminishes and the groove gets smaller.

During a departure from a busy airport under ATC control, modern instrumentation, the autopilot, and present day ATC radar actually make the pilot's job simpler. Today the pilot of modern equipment has more opportunity to concentrate his attention "outside the aircraft" when VMC, if he so chooses. Two degree heading variations are even less important when going out the funnel, but often will not be present thanks to heading select/nav auto pilots.

Make no mistake, we must continue to be the best possible pilots "on the gauges" when IMC or when it's 200 and ½, but we must also avoid the worst kind of failure—a midair!

Improvement of flying skills by visual reference to ground and horizon when in visual flight conditions is mandatory, if we are to safely transit the danger area and "see and avoid." Our eyes can detect the potential midair, which may not be seen if we are guiding our aircraft primarily by instrument reference. If we are to master the art of flying, we must strive to be an artist in both instrument and visual skills. Failure to master both is like the aspiring artist who is proficient in the use of one brush, and may invite the worst kind of failure. ★

Low Altitude Wind Shear

The effects of wind shear have been consistently identified by aircraft accident boards, civilian and military, as major factors contributing to accidents. The problem of wind shear is particularly serious because:

1. The pilot does not have reliable information as to its existence.

2. The effects are variable and unpredictable for any particular set of circumstances.

3. The pilot may not recognize the existence of wind shear until too late to take corrective action.

Wind shear is defined by the FAA/NWS publication *Aviation Weather* as "a change in wind speed and/or direction over a short distance." The most common example is the temperature inversion shear. This occurs when a warm mass of air moves over a cooler mass closer to the ground. This type of shear is especially dangerous because it often occurs at night when many visual flight references for landing are missing. Shear can also be caused by friction. That is, when there is a strong surface wind, the wind closest to the ground is moving slower than that at 25 or 50 feet because of friction. The other dangerous type of wind shear is that associated with thunderstorms.

How does shear affect an aircraft? An abrupt change in the relative wind causes an immediate change in indicated airspeed (IAS). However, the inertia of the aircraft prevents the ground speed (GS) from changing as rapidly. Thus, the change in IAS destabilizes the aircraft flight path and causes the pilot to make some adjustments in attitude or power. However, the aircraft inertia is soon overcome and GS moves to match IAS. This now requires pilot correction *opposite* the one just made. As an example, let's consider the situation in a recent accident. During an ILS approach, the wind shifted abruptly almost 180° at about 200 feet AGL. In addition, the speed changed from a 13-knot tail wind to a 5-knot head wind in 100 feet. This rapid increase in head wind component caused the IAS to increase and the aircraft's rate of descent to shallow. To correct to glide path, the pilot reduced thrust and increased the nose down attitude.

Then, as mentioned earlier, the ground speed reduced to match IAS. This meant that the power and pitch attitude were insufficient to maintain proper glide path. Thus, either the IAS must decrease, or the sink rate increase. In both cases, the result is a landing short of the ILS touchdown point. The aircraft contacted the approach lights 500 feet short of the runway threshold.

Shear was not the sole factor leading to the accident mentioned above. Several other factors all conspired to cause the short landing. However, a different type of shear has been directly responsible for two recent accidents, one Air Force and one air carrier. This is the violent, unpredictable and extremely dangerous shear associated with a thunderstorm.

The wind shear in a thunderstorm is usually related to the "gust front." There are several characteristics which mark this gust front.

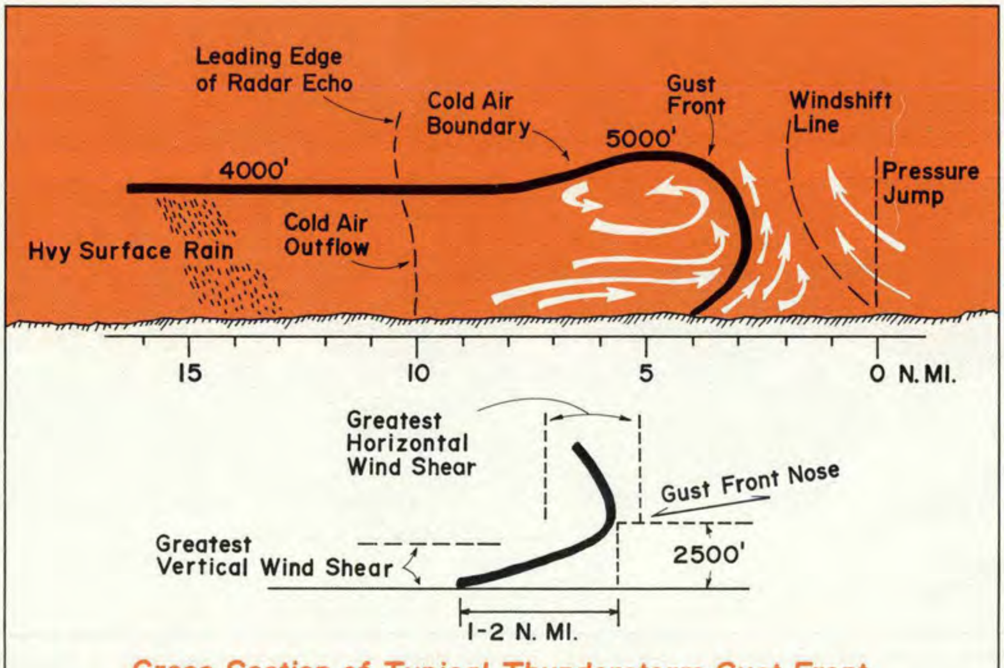
- It has high winds and gusts at the ground usually in the range of 40 to 50 knots.
- It moves faster than the thunderstorm which generates it. (It often precedes the leading edge of the thunderstorm radar echo by 5-10 miles.)
- The gust front above the surface may lead the surface position by a mile or two.

There have been horizontal wind shear speeds in excess of 40 knots measured across a gust front. Vertical shear has been reported in excess of 1800 feet per minute at 200 feet AGL in one storm. These violent downdrafts have been called "downbursts" by Dr. T. Theodore Fujita, Professor of Meteorology, at the University of Chicago in his research project into the meteorological phenomena associated with a civilian air crash at J. F. Kennedy Airport. This study contracted by Eastern Airlines led to the following conclusion: The sudden downdraft exceeding 1800 fpm was directly responsible for the high descent rate of the aircraft and subsequent crash. It is very possible that even if the flight crew had immediately recognized the high descent and made a correction, the winds may have been too severe for the correction to take effect before impact. This finding is also supported by the formal NTSB accident report.

Granted that wind shear is dangerous; what can an aircrew do to protect themselves? The problem is recognition. There is no really reliable way to predict shear, however, there are a few basic guidelines.

- The meteorological conditions which will usually generate wind shear can be forecast. Check your DD 175-1 and weather briefer for the details.
- Be alert for PIREPS. In the accident cited above, a preceding aircraft encountered strong downdrafts and reported it on missed approach.
- Be careful around thunderstorms, coastal airports or airports near mountain ranges. These are especially favorable spots for wind shear.
- The presence of surface fronts and inversions produce shear. The stronger the temperature contrast, the stronger the shear.

In essence, the best preparation an aircrew can make is to know that the possibility of a shear exists and if one is encountered, to act at once. ★



Cross Section of Typical Thunderstorm Gust Front

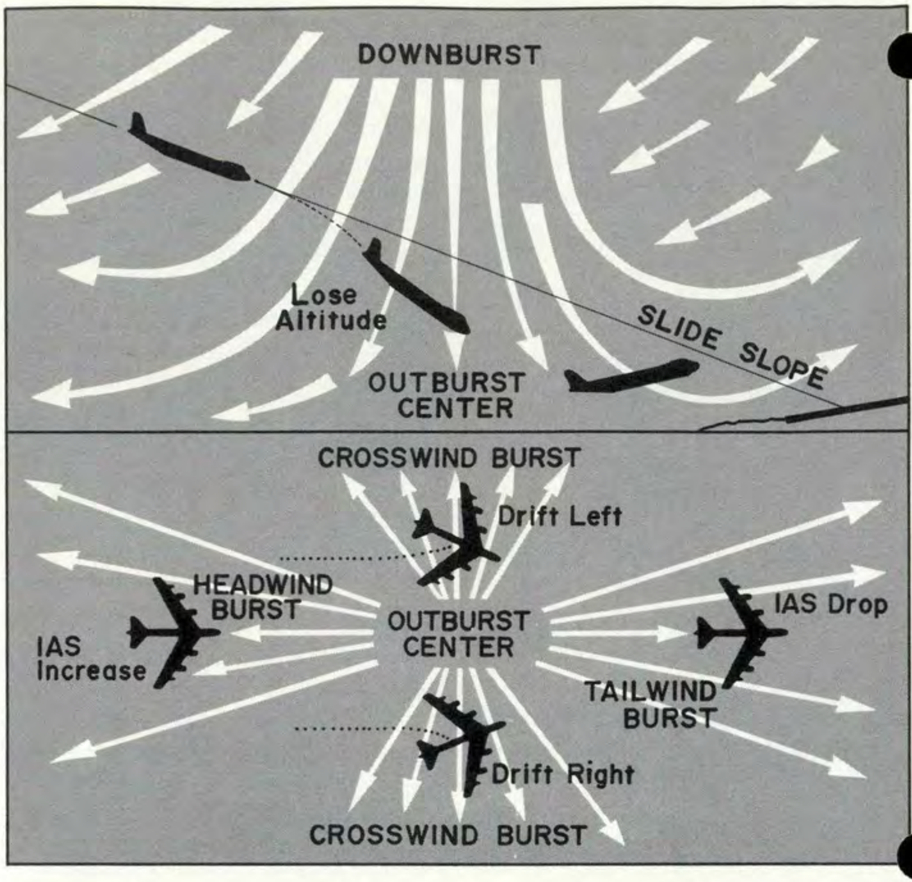
(Adapted from NOAA Tech Memo NSSL-61)

The approach of a thunderstorm gust front to an airport complex cannot usually be specifically detected until it has reached the weather instruments. At large airports the gust front may be affecting some approach corridors several minutes before the tower is aware of the condition.

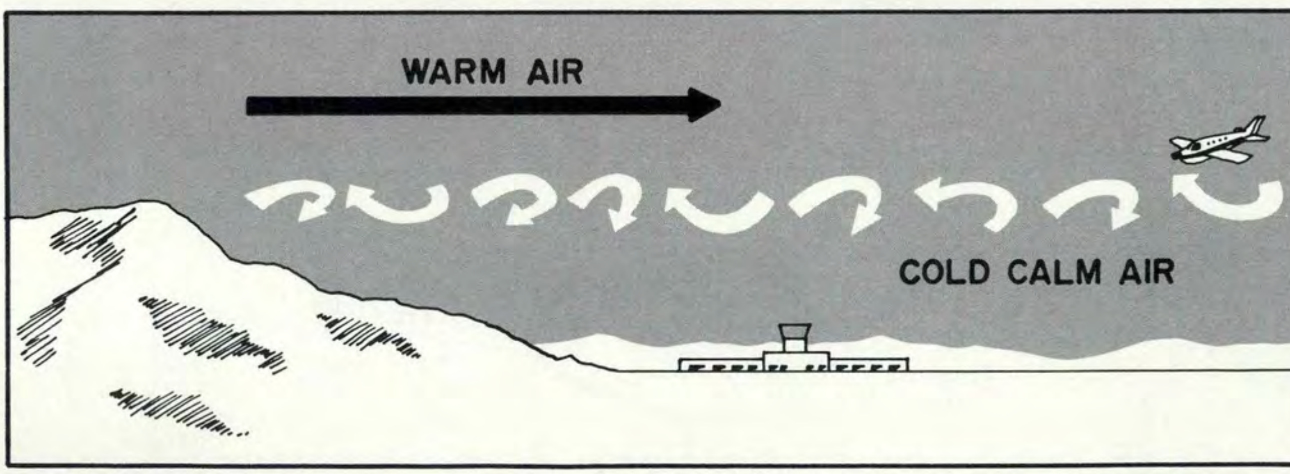
Turn the page . . .

Low Altitude Wind Shear

continued

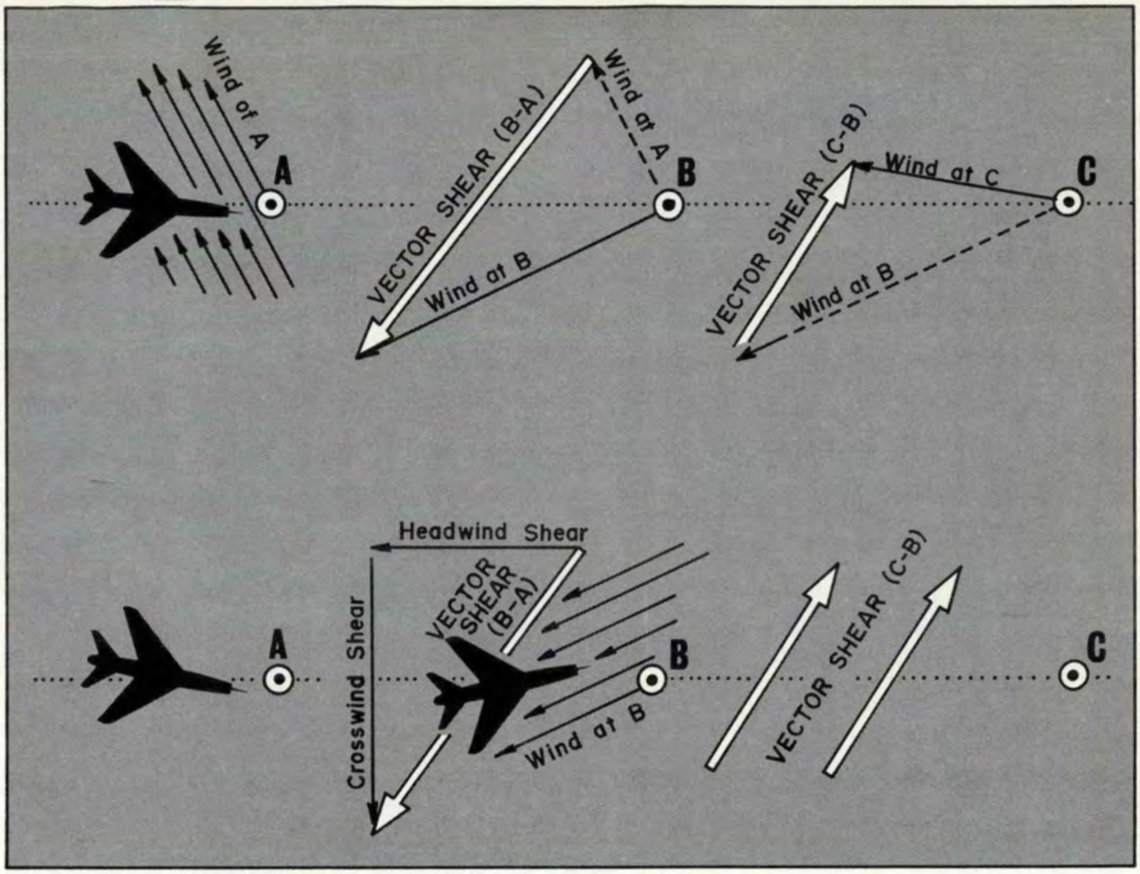


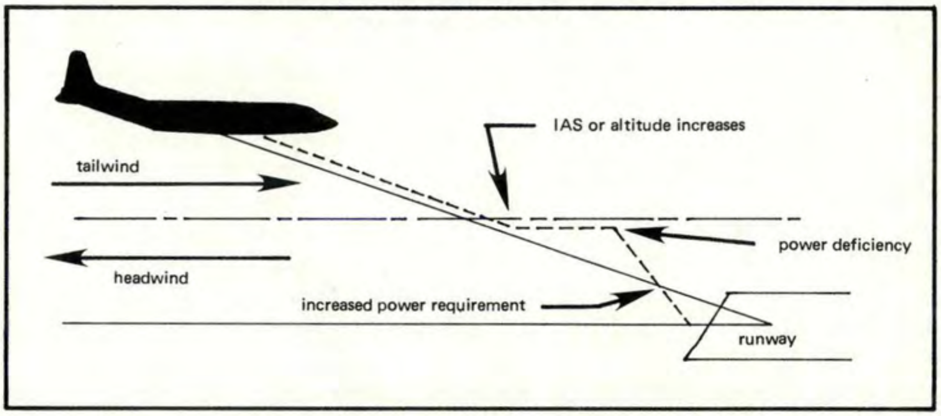
The effects of downburst and outburst gusts upon aircraft during a final approach. Of these the most dangerous are downburst and tailwind burst encountered near the ground. Outburst is defined as the strong outflow created when a downburst hits the ground and spreads out.



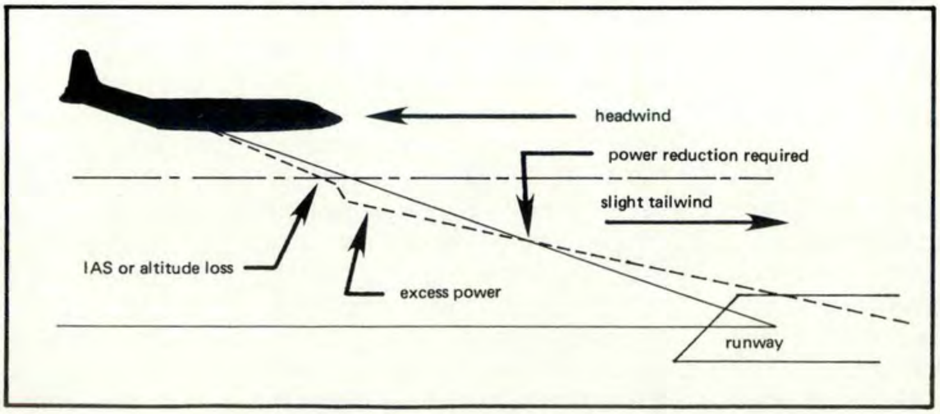
One of the most common and dangerous types of wind shear. Warm air moving above a pocket of cool, calm air may produce a shear a short distance above the airport.

A graphic depiction of vector shear, headwind shear, and crosswind shear likely to be encountered by an aircraft flying in or near a downburst cell.





An approach profile with a tailwind to headwind shear.



An approach profile with a headwind changing to a slight tailwind.

FOOD PREPARATION

SSGT CHARLES R. TEAGARDEN
Programs and Current Operations
3636 Combat Crew Training Wing
Fairchild AFB WA

"Waste not, want not." Though this old adage is not in line with today's fast moving plastic society, it is a must in any survival or PW situation where you, the aircrew member, must use all that is available to you.

People have died because they failed or refused to fully exploit their food resources. How would eating the eye or brain of an animal, to replace the loss of body salt, sit with you? Could you cut into an animal's stomach and eat half digested food? Now, we're not trying to turn your stomach or put the fear of survival into you, but that *is* food utilization!

How does this relate to food preparation? Preparation is more than tossing a piece of meat into a skillet, frying to taste, and gulping it down. Food preparation, by definition, is the act or process of making ready, or in our case, using your resources to the maximum. Food preparation begins with the kill and ends with the meat cooked.

Prior to the preparation of the food, you should first consider the type of game vs the means of transportation. If you cave in a bunny's head, no sweat. You can gut and skin it on the spot; then quarter and cook it back at your camp. However, if you tackle (not a recommended technique) a large animal that can't be moved easily, you might opt to bring your camp to the kill. A large animal requires some time in preparation, so the less effort you expend, the better off you'll be.

The steps in food preparation are not complicated nor do they follow a precise order. In fact, some steps may be left out completely. It depends on the type and size of animal. The steps generally are as follows: bleed, cut, skin, quarter and cook.

Is bleeding, throat cutting, really necessary? For the most part, no. Small animals contain so little blood that it would not be worth your while. A large animal should be bled, providing it has not been shot. The shot animal should be gutted as soon as possible and the blood in the cavities retrieved. Note: Blood in the abdominal cavity will most likely be contaminated—avoid it. Blood can be used in making sausage and can serve as a salt substitute. Remember, blood is not a substitute for drinking water.

Gutting is one of the most critical steps and should be accomplished as soon after the kill as possible. After a period of time, the ungutted animal will start to decay and spoil. Care should be exercised in the removal of the internal organs, especially the sex organs and intestines. The contents will quickly ruin the best of meats. Save all the internal organs because most are edible. The heart, lungs, liver, stomach and kidneys as well as the tongue, eyes and the brain, can be well utilized. Note: In the arctic the livers of all animals should be avoided because of high Vitamin A content. Some may be all right, but it's best not to take the chance.

Skinning, a step you will want to accomplish as soon as reasonably practical, will aid in the cooling of the animal. A large animal left unskinned is an ideal place for bacterial growth. A small animal's hide will normally pull off easily, but you're probably going to have to cut the hide off of large animals. Any hides are useful and their use is limited by your imagination only.

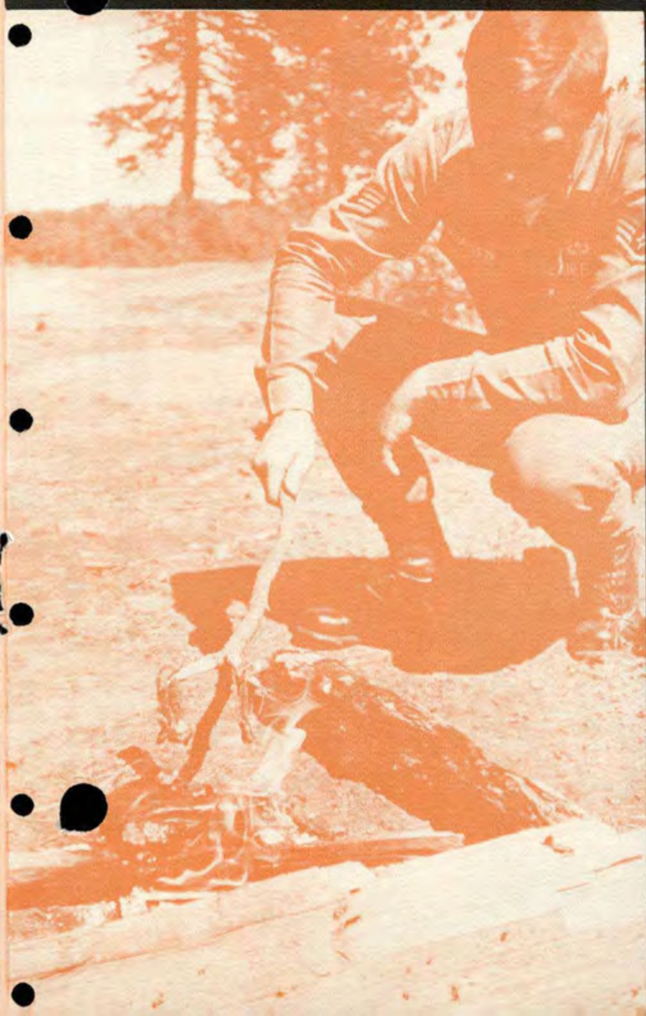
The primary purpose of quartering is to permit easier handling of the meat. Cut the animal into major parts or sections. Then wrap and store in a cool place away from insects and other animals. In the winter, cut the meat into meal size chunks and allow it to freeze. If you don't, you'll need a chain saw to cut a steak from a frozen carcass.

Cooking of most foods, including meat, is not necessary. Not having to cook meat has two advantages: It precludes making a fire in an E&E situation and the maximum number of nutrients can be consumed. Of course, there are some disadvantages. Eating raw meat exposes you to diseases in the meat, and the psychological repugnance has to be combated.

Then why do we cook our foods? Cooking makes foods more appealing, both in appearance and smell, more palatable and safer. To a large degree, though, most of these factors are purely psychological.

Though you may have a favorite cooking method, in a survival situation you must consider the nutritional aspect and the availability of cooking utensils. Boiling is the most efficient cooking method because you can eat the meat and drink the broth to get the maximum number of nutrients. But to boil your food you need a pot or similar container (don't forget the ration tin). Roasting is the next best method of cooking. You may roast your game in the coals or flames of a fire. By coating your game with mud and placing it in the coals, the meat will cook and reduce the loss of the food by burning. Fish and birds may also be cooked in this manner and won't need to be scaled or plucked. To spit cook, a form of roasting, impale your game on a stick and cook to taste over the flames or coals.

Baking, next in cooking preference, is a method used virtually worldwide. By wrapping your game in moist parachute material, certain palm leaves or the like, and burying it in the earth below the fire, the heat will bake your game. Frying your game is the least desirable way of cooking but the fastest. Some of the nutrients are destroyed by frying.



FOOD PREPARATION

continued

Getting the most food from your kill is important in any survival situation. Before you discard any portion of the animal, think first and decide if you really could live without it.

You may suddenly find yourself dependent upon your own resources for survival. Preparing yourself for an emergency costs very little in terms of time, money and effort and, considering the stakes, can be a very wise investment. Each year more and more people become lost or stranded in the wilderness. Some will succumb needlessly because they lack the knowledge or ability to make it.

In the last three articles we have tried to give you a brief glimpse into the importance of food, food procurement and food preparation. You can't fight the wilderness—you must make it work for you.

Questions or comments concerning the survival articles may be referred to the 3636 CCTW/DOO, Fairchild AFB WA 99011 or AUTOVON 352-5470. ★

Photographs by A1C Mike McCowen, 3636 CCTW

F-4 BLC--Blessing or Burden?

LT COL J. P. CLINE
Directorate of Aerospace Safety

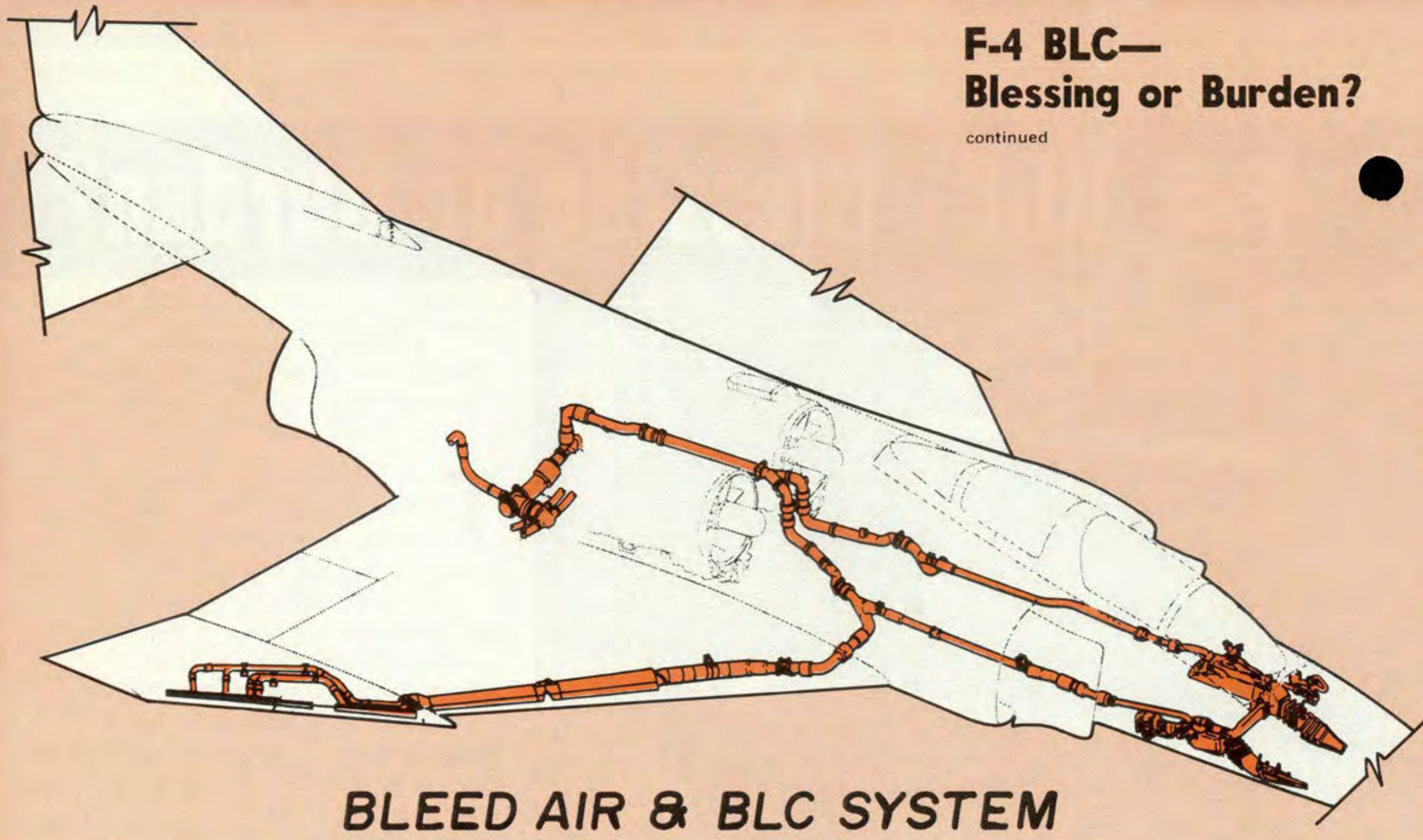
There has been much heated debate in recent years over the fate of the F-4 boundary layer control (BLC). For those of you who fly and maintain the slat birds, this is simply an academic discussion. But, the people involved with the Cs, Ds and RFs will be personally affected by the operational and maintenance ramifications of the decisions. You may be interested in a summary of how we ended up with BLC in the first place, the problems with the system, and possible causes of action from here. You may want to have a voice in the outcome.

A little discussion of aerodynamic evolution helps us partially understand the compromises and gadgets we live with today. In trying to meet operational needs, we have expanded aircraft airspeed envelopes from 100 knots to 2,000 knots. The design problem remains rather simple when an aircraft has a top end of 150 knots and lands at 50 knots. But when the bird is to go Mach 2+, and still land at some reasonable speed, the designer has to pull some tricks out of the bag.

We first saw the addition of flaps to the trailing edge of the wing to increase the wing camber,

F-4 BLC— Blessing or Burden?

continued



BLEED AIR & BLC SYSTEM

allow a slower stall speed and provide drag. As we moved into higher performance aircraft, we saw leading edge flaps and slats to further increase the wing camber as well as to energize the boundary layer over the wing. When the F-4 was coming into the picture, the contemporary supersonic fighters were scooting down final approach at 175 knots and up. Since the F-4 was being built for the Navy to land on carriers, these high landing speeds were unacceptable. Therefore, we saw the addition of BLC.

This system directs engine bleed air through slots along the leading and trailing edge of the wing over the upper wing surface and trailing edge flaps. The bleed air delays flow separation over the air foil. The result is lower stall speed thus lower allowable landing speed as well as improved low speed stability. As we have seen on some recent aircraft, other ways to change the aerodynamic characteristics of a wing are to vary the angles of incidence or sweep. The whole idea is to design a wing that can move through the air at high speed and still support the aircraft at slow speeds.

In many cases, we have seen a great number of trade offs and problems. The F-4 BLC system has been a source of many maintenance headaches and the cause for loss of operational missions. When the leading edge slat (LES) modification was installed on the F-4E, the entire BLC system was removed. The leading edge slat replaced the function of the leading edge BLC and the 12 to 14-knot increase in landing speed was determined to be an acceptable trade off for the elimination of the trailing edge BLC problems. The BLC problems fall into three categories: duct rupture, valve malfunction and inadequacies of warning devices.

Engine bleed air from the 17th stage of the compressor is used for BLC as well as for air conditioning, pressurization and equipment cooling. The bleed air is about 900 degrees F when it leaves the engine and any rupture in the system produces a significant fire potential.

The feed duct that carries the bleed air to the wing trailing edge has been particularly vulnerable to failure and passes through an area of the engine bay which lacks any fire or heat detection. These ducts are now being made of an improved material (Inconel 625) and a retrofit program is in progress. This will reduce the probability of failure but the fire potential, in case of failure, remains unchanged.

The bleed air is directed into the wing ducts through valves located at the leading and trailing edge wing root. Herein lies the major source of BLC failures. The valves are linked mechanically to the leading and trailing edge flaps in each wing so as to allow an air flow only when the flaps are down (full down in the case of trailing edge flaps). Associated warning devices are designed to alert the pilot when any of the valves are open but flaps are up. This undesired configuration allows the hot bleed air to flow out of the BLC ports but traps it in an area not designed to withstand the high temperature bleed air. Unfortunately, the valves can fail in such a way that the warning system thinks all is well.

Redesign of the valves is not feasible but improved care and inspection of the valves can reduce (not eliminate) failures. A redundant warning system which would sense abnormally high pressure in the ducts was proposed but rejected due to cost.

So, where are we now? We want to retain the BLC system because of the reduced landing speeds. We want to improve the BLC system to eliminate the costly failures. We have severe budgetary constraints that limit desirable modifications. It boils down to the fact that we will just have to live with a continuation of most BLC failures. A few figures will illustrate the scope of the problem. The trailing edge BLC accounts for over 25 reportable mishaps, nearly 100 aborts, and over 1,000 failures of some kind annually.

An alternative, that has been proposed, is to cap off the trailing edge BLC at the engine. This would eliminate the potential feed duct failures as well as the numerous trailing edge valve failures. The dollar cost would be quite small but the operational cost would be an additional 12-14 knots on final or in other words, an approach like the slat model. And, like the slat model, the approach configuration would be one-half trailing edge flaps due to excessive buffet with full flaps and no BLC. Without BLC, the trailing edge flaps only add drag and very little lift going from one-half to full. The leading edge BLC cannot be capped off due to unacceptable stability trade offs. In the slat model, it was traded for the leading edge slats.

This is typical damage caused by a BLC duct failure (top). The actual failed duct is shown in the bottom photograph.

If nothing is done, we will continue seeing aborts, incidents and occasional accidents as well as an exorbitant consumption of maintenance man-hours all caused by failures and malfunctions of the BLC system. A total fix would be cost prohibitive and still may not eliminate all failures. To go the other direction and cap off the trailing edge would eliminate many failures but would degrade landing performance. Mark III antiskid, which is now being installed, will mitigate the landing distance part of this problem.

The final answer is compromise. Within the constraints of cost and technology, we must decide on a course of action that will optimize the F-4 capability. Can we live with the BLC hazards so as to retain the slower landing speeds? Can we live with a higher landing speed so as to eliminate BLC hazards? From our vantage point, it appears that the best course of action would be to cap off the trailing edge BLC. Everyone involved with the F-4Cs, Ds and RFs should be knowledgeable, concerned, and anxious to see a solution. ★

THE IFC APPROACH

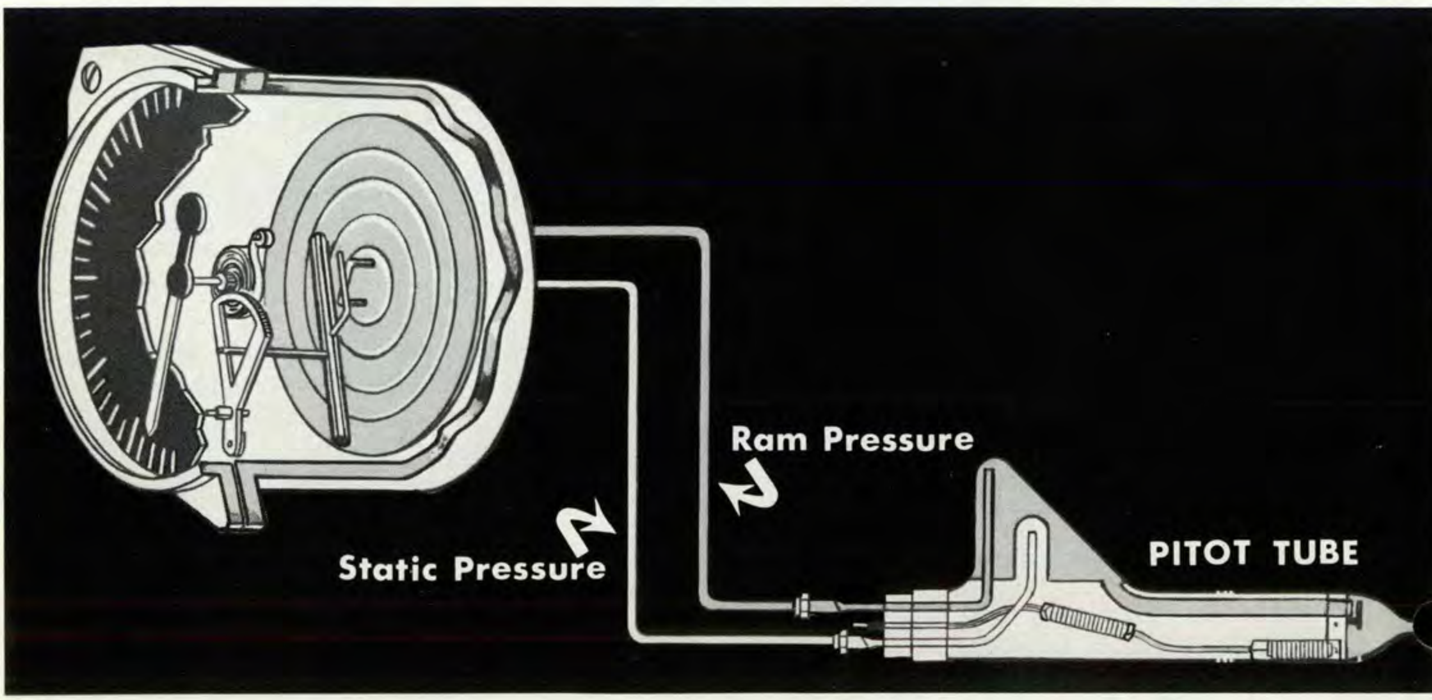
How long would it take you to notice an airspeed indicator malfunction? If something didn't look right in your cross-check, how quickly would you suspect an error in the airspeed indicating system?

Aircrew instinct to rely heavily on airspeed is brought to light by a Boeing 727 accident. On this flight the pitot heat was inadvertently left off prior to departure. The cockpit voice recordings indicate that during the climb the crew noticed the airspeed increasing. As they climbed, the airspeed continued to increase. From 16,000 feet to 24,800 feet the airspeed increased from 305 knots to 420 knots. They continued to increase pitch attitude (up to 30°) and reduce power to keep the airspeed below the critical mach for the aircraft. Indicated vertical velocity was more than 6,500 feet per minute rate of climb. When the stick shaker indicated a stall warning, the crew believed it to be a high mach buffet. The aircraft stalled, went out of control and crashed, killing the three crewmembers. The gross weight of the aircraft was less than the crew was accustomed to. Did that lead them into believing their aircraft's climbing performance?

You may be thinking to yourself, "How could the crew of that 727 not have noticed and realized the problem was an erroneous airspeed indication?" MSgt Roy Jones, a simulator instructor at Williams AFB, says that he can put unsuspecting pilots in the same situation that the 727 crew encountered, and nine times out of 10 they will react in the same way. This reaction to airspeed errors is not limited to the inexperienced pilot, but to the "old head" as well.

A review of pitot and static systems and how the blockage of either or both systems will affect the cockpit indications is important to understanding how to recognize erroneous indications.

Operating Principle of the Airspeed Indicator



By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

Airspeed measurements are a comparison of pitot (ram) pressure to static (ambient) pressure. The difference between these two pressures is differential (dynamic) pressure. The airspeed indicator measures this dynamic pressure by supplying pitot pressure to the airtight chamber which surrounds the diaphragm.

When the pitot system is blocked by something, such as ice, the ram pressure is trapped and the static pressure is not; thus, the airspeed indicator acts as an altimeter. When the aircraft climbs, airspeed indication increases as the static pressure decreases.

Some aircraft have the static source located on the pitot boom. If the boom ices over, both systems will most likely be blocked. In this case the airspeed will remain constant, indicating the airspeed at which the blockage occurred.

On subsonic aircraft the static ports are located at a position on the aircraft not significantly influenced by the airstream. If the static source is blocked and the pitot boom is not, the airspeed will decrease as the aircraft climbs. This situation is possible even with the pitot heat operating, since most aircraft do not have static port heaters.

The most important action you should take if you suspect an airspeed error is establish a known pitch attitude and power setting; then, check the pitot heat on and the circuit breakers in. Next, check the attitude indicator against the standby attitude indicator, or against the other pilot's indicator. Crosscheck the angle of attack indicator, if available.

Some aircraft have an alternate static source located in the cockpit for use in the event the static ports become blocked. If a cockpit alternate static source is not available, you can make one by breaking the glass seal on any instrument using static pressure, such as the VVI, Altimeter, Airspeed Indicator, Mach Indicator, etc. Select an instrument that is not mandatory for recovery, such as the Mach Indicator. In the event it becomes necessary to use in the cockpit alternate static source, don't forget that you will have to dump cabin pressure. You may, as a result, have to descend to comply with AFR 60-16 oxygen requirements.

An IMC recovery without airspeed or angle of attack would be, to say the least, difficult. The best idea would be to find good weather and remain VMC until landing. If that's not possible, a join-up and formation recovery would be appropriate for those having that capability.

If neither of the above is possible, MSgt Roy Jones offers a technique that he teaches in the simulator. The technique is basically to experiment in the simulator and in the aircraft (in good weather) to determine the pitch and power requirements that are needed for the different maneuvers needed to get the machine back on the ground. The pitch and power requirements must of course be noted so you can use them later if you decide to accept the mission of an IMC recovery without airspeed. Here are the most important items to note:

1. Prior to takeoff and on level ground, set the attitude indicator pitch trim knob so that the arrow is on the index. *Do not change this setting.* The flight manual will tell you what the pitch picture should be while on level ground. For example, the T-38 is 3° below the horizon; the T-39 is 3° below the horizon; and the T-37 is level, 0°.

2. After takeoff, establish normal cruise airspeed and note the pitch indication and power setting required to maintain zero vertical velocity. This indication is based on a percentage of stall which automatically corrects for weight.

3. Establish gear extension airspeed in level flight and note the pitch and power setting. This pitch picture will be needed to ensure you do not exceed the gear extension airspeed during your recovery without an operable airspeed indicator.

4. Establish final approach airspeed and configuration. With zero VVI, note the attitude indication.

5. Once you are established on final approach with zero VVI, trim the aircraft. To begin the final approach descent, lower the nose the number of degrees required for the approach and control the rate of descent with power. Do not re-trim the aircraft since it is trimmed for final approach airspeed.

This technique is used to determine the pitch attitudes required for different airspeeds and configurations (L/D ratio). The important aspect to remember is, if you hold your predetermined pitch attitude and power setting and the VVI is zero, the aircraft will not stall. Trim is extremely important. Once the aircraft is trimmed for an airspeed, power will control the rate of climb and descent. The L/D ratio is a function of angle of attack and will remain constant regardless of weight, provided the trim is not changed. Since different airspeeds are required for each aircraft weight, you should learn the following key attitude pictures:

1. Holding
2. Penetration

IFC Approach

continued

3. Maximum gear extension

4. Instrument maneuvering (Normally 1.4% of stall speed)

5. Final approach (Normally 1.3% of stall speed)

6. Landing (Normally 1.1% of stall speed)

Remember, don't try this approach technique without practice in VMC. Treat it as a last resort measure for a weather recovery. Anytime you are out of control and have the capability, do not delay ejection to a point where you are below the flight manual's recommended minimum ejection altitude.

If you need an alternate static source in an emergency, break the glass on one of these instruments (pick one you can afford to do without).

CORRECTION

Since writing the March 1976 article, we have obtained additional clarification from the FAA. If you keep copies of the articles, make a note that the first question and answer under LOST COMMUNICATIONS — EN ROUTE should read as follows:

"Q: If a pilot experiences radio failure after he has been given an en route clearance limit and an expect further clearance (EFC) time, what does ATC expect him to do when he reaches the clearance limit fix?

A: Hold at the clearance limit fix in a charted holding pattern or, if no holding pattern is published, hold on the inbound course in a standard holding pattern. Depart the clearance limit at the EFC and proceed by either, (1) the route assigned in the last ATC clearance, (2) in the absence of an assigned route, by the route that ATC has advised may be expected, or (3) in the absence of an assigned route or a route that ATC has advised may be expected, by the route filed in your flight plan."

Help the USAFIFC help you. If you have recommendations or suggestions which will improve instrument flying—let us know. Call AUTOVON 487-4276/4884. ★

OPS TOPICS

STRESS CORROSION

The T-43 was taxiing for takeoff when the number two generator dropped off the line, and the crew detected a strange odor in the cabin. The aircraft was pulled off into a parking area, and the crew exited normally after engine shutdown. Maintenance troubleshooting uncovered the fact that the generator feeder wiring was burned through. This was the result of the mating of two dissimilar wires (copper and aluminum). This set up stress corrosion and high resistance in the wires with a result that the wires overheated and the splices failed. The unit involved has checked their other aircraft but found no further problems.

LOST DOOR

After the C-141 landed, the crew found that the APU oil service door was missing. The door had not been properly secured, and the scanner did not physically check the door during his thruflight inspection. The door was found on the runway after the aircraft had departed.

FAA CAUTIONS AIR TRAVELERS ABOUT CARRYING LOOSE BOOK MATCHES IN LUGGAGE

The Federal Aviation Administration has warned air travelers that it both is dangerous and illegal to carry loose book matches in their luggage.

The matches could ignite in a suitcase and start a smoldering fire that could ruin travelers' personal belongings. Moreover, there always is the danger of a small fire becoming a large one or triggering an explosion on an aircraft in flight.

Persons who carry loose book matches in their carry-on or checked luggage also are subject to fines for carrying hazardous materials on board an aircraft in violation of FAA regulations.

A fire can start when the cover of one match book is open and vibration or movement brings the heads of the matches into contact with the striking strip of another book, the agency said. The usual result is a small, smoldering fire in the suitcase with the damage confined to the contents of suitcase. But in one case an explosion resulted when the smoldering fire ignited the contents of a can of hair spray. Fortunately, the suitcase was not aboard an airplane at the time.

FAA said that twice in the last two months it has received reports of matches starting fires in luggage. Others may have been started and gone unreported, it added.

In one of the two cases, FAA said, the fire was discovered when a baggage handler noted smoke coming from the suitcase while unloading it from the aircraft. In the other, only two books of matches actually caught fire, but there were 89 other books of matches in the same suitcase that could have been ignited.

The FAA classifies matches as hazardous because the heads are a flammable solid. They can be legally carried on aircraft only when they are tightly packed in a closed container within the suitcase.

The penalty for violation of the regulation is a fine of up to \$10,000. If criminal intent can be proved, the maximum penalty is a \$25,000 fine, five years in prison, or both.

OPS TOPICS

LOAD SHIFT

A C-130 loadmaster had two toes crushed when an improperly secured pallet shifted on takeoff roll. This is the last in a series of mishaps involving unsecured cargo on pallets. This one was serious enough. Next time we may not be so lucky.

HARD TO EXPLAIN

The O-2 pilot reported to his aircraft at an X-C base for the return flight home. He waited awhile for transient alert service but when no one came the pilot preflighted and then started the aircraft alone. After receiving taxi clearance, the pilot left the parking spot and, as his attention was diverted toward clearing some other equipment, the aircraft struck a fire extinguisher stand about 10 feet in front of the parking spot.

A DIFFERENT (?) WAY

The helicopter was engaged in a cargo drop test. A qualified rescue specialist was standing beside the left jettisonable window hatch spotting the drop zone. Shortly after he moved away from the window it separated from the CH-3. The release was probably caused by clothing or the interphone cord moving the release handle. The unit has suggested a safety wire on the handle as a fix.

PILOT'S NOTICE

If you are going to Kelly AFB, be careful. Transient aircraft have been mistakenly landing on the parallel taxiway east of runway 15/32. This taxiway is marked with big (85 x 30 ft) letters that spell "Taxiway," and there is a note in the IFR supplement. Be sure you are lined up with the right piece of concrete before you touchdown. It can save some embarrasing moments later.

PROPER PREFLIGHT PREVENTS . . .

During postflight, the maintenance supervisor discovered damage to the helicopter fuselage. Apparently the damage was caused by a passenger seat belt left hanging outside the aircraft during the flight.

BIRDSTRIKE!

The F-4 was on a range mission. As the aircraft turned final, a bird hit the left side of the windscreen shattering it, and then struck the pilot on the left shoulder and left side of the helmet. Fortunately, the pilot had his head turned to the right at the time of impact so his face was somewhat protected. This is just one more good reason for keeping your visors down.

BAD SIGNAL

The UH-1 (owned by another service) took off on a routine mission. Shortly after takeoff, the rudders froze. The pilot returned to base and made a sliding landing. The KY-28 radio had slipped from its mount and lodged between the pilot's rudder pedals.

BLAST

When the pilot applied breakaway power to the RC-135 to move out of the chocks (this required almost 80 percent), the blast caused damage in a parking lot some distance behind the parking spot. In this day of high powered engines and heavy gross weights, it is essential that the aircrew be aware of what effect blast will have on objects or people.

OPS TOPICS

ANALYZE THE PROBLEM

The F-4 scrambled on an intercept training mission. During the second intercept, as the pilot maneuvered to complete the intercept, he rapidly retarded the throttles out of AB to prevent an overshoot. At this time the right engine flamed out. When the master caution and warning lights came on, the crew assumed that there was an oil system failure, and the pilot shut down the engine and made a single engine landing. The oil pressure and other indications were indicative of a flameout rather than oil system failure.

YOU HAVE TO LET THEM KNOW

The crew of an F-4 became hypoxic while at altitude and made an emergency descent. At the time, the F-4 was under the control of the range controller, not ARTC. The crew did not declare an emergency with the range controller, so when he turned the F-4 over to RAPCON, RAPCON was told that the aircraft had not declared an emergency. Ten minutes after the initial descent the F-4 crew declared an emergency with RAPCON. However, the transmission was blocked and the controller did not receive it. As a result, there was no emergency response at the recovery field. While there were several contributing factors in this misunderstanding the aircrew could have done a great deal to prevent it by, (1) declaring an emergency as soon as the emergency developed, (2) squawking emergency 7700 on the IFF. You have to let the controllers know what you want.

PHANTOM STRIKE

An F-4 was struck by lightning without the crew realizing it. The crew had been carefully avoiding build-ups that showed up on their radar. However, they flew almost the entire mission in cirrus clouds. Evidently, there was sufficient static build-up to produce a lightning discharge which damaged the left wing tank and wing tip light. Even if you don't fly directly into a build-up, conditions in cirrus clouds near such build-ups can produce lightning.

BE PREPARED

Just as the F-100 lifted off, a compressor stall occurred. The pilot cleared the stall and, because he was too far down the runway, continued the takeoff rather than abort. He flew a wide pattern and an uneventful straight-in approach to a successful landing. When maintenance looked at the engine they found two birds. While there was no real damage and the engine ran properly, the pilot had no way of knowing that at the time. The important thing is that this pilot had a plan. He obviously had thought about a situation like this, so when it happened he reacted correctly. How about you? Are you prepared?

FIRE LIGHT

The crew of the B-52 initiated an NRT climb to FL 350. In the climb the number eight fire light came on. Even though all engine indications were normal, the crew proceeded with the emergency procedure and shutdown the engine. After landing, they found a 1½-inch hole burned through the engine cowling and the adjacent area charred. It is a good idea to follow the Dash One procedure whenever there is a fire light. It just might save an aircraft. ★

I'M OK YOU'RE OK

1LT MARK N. BROWN
1LT LAWRENCE M. COSTELLO
87th Fighter Interceptor Squadron
K I Sawyer AFB, Michigan

The incident described in the following article is true. The aircraft involved was a T-33. The crew consisted of two first lieutenants of the 87th Fighter Interceptor Squadron. The two narratives that follow are the first-hand reports of what each pilot saw, felt, and did between the time of takeoff and the eventual safe recovery.

1LT MARK N. BROWN

Preflight and engine start were normal and all before-taxi checks were completed. The only abnormal thing I noticed came during the speed brake retraction. The hydraulic pressure drop was normal and the pressure did recover to the normal range; however, it seemed to me that it took slightly longer than usual to recover. While taxiing out to the active, Larry checked the navigation equipment while I did the remaining checks. Everything was functioning normally.

After being cleared for takeoff, I taxied onto the runway and performed a line-up check. Everything was still okay so I released brakes and made the takeoff. The weather was fairly low and I remember mentioning to Larry that we entered the weather at 1650 feet MSL. Field elevation is about 1220 feet MSL. I entered the weather doing 250 kts.

I rolled into a 5-10 degree left bank to start our turn out of traffic. Although my attitude indicator indicated that I was holding a constant bank angle, it felt to me like we were still rolling to the left. I shrugged it off as a slight case of the leans and concentrated on the departure. I noticed that my VVI was slowly decreasing from about 3000 fpm down to 2500 fpm, so I increased back pressure to maintain my rate of climb. I noticed that the airspeed was slowly decreasing from about 250 kts, and I felt I was in a 60 to 70 degree left bank and about 2 bar widths nose high.

I tried to roll out of the bank that the attitude indicator showed but the bar didn't move. My airspeed was still decreasing and I was holding an abnormal amount of back pressure to maintain my rate of climb.

Suddenly the VVI jumped and pegged itself at 6000 feet a minute climb. I was startled because my attitude on the J-8 hadn't changed. Larry told me to push the nose over and I released most of the back pressure. I was extremely confused at this point and thought that I must have vertigo, so I told Larry that I had vertigo and told him to take the aircraft.

I felt him shake the stick and take it. I was staring at my instruments trying to get my head on straight. My airspeed was slowly decreasing past 230 kts, my VVI was pegged at 6 grand climbing, we were passing about 6400 feet MSL, and yet my attitude indicator was showing a 5 degree left bank and two bar widths nose high. I also noticed that my heading indicator still showed my takeoff heading.

I felt Larry roll the aircraft to the right and noticed that my J-8 hadn't moved. Larry stopped the roll and increased the back pressure until we could feel the burble. It finally dawned on me that I didn't have vertigo but that my attitude indicator, which was now slowly rolling, was inop and yet there was no off flag.

Our VVI had now gone from 6000 fpm up to 3000 fpm down. We were passing 3600 feet and I put my hands on the handles and was about to order an ejection. Larry then told me that he was extremely disoriented. I was also staring at the partial panel at the time and thought we were in about a 30 degree right bank.

I took the aircraft passing about 3400 feet, rolled to the left until the turn needle centered and began increasing back pressure. The instruments indicated that we had stopped turning and were decreasing our rate of descent. We were passing 3200 feet or so at this time, and I decided to delay ejection since it appeared that I had the aircraft under control. We bottomed out in the dive at 2800 feet MSL. I held about a 1000 ft a min climb until we broke out on top at about 7000 feet. I remember being rather elated to see the sun.

1LT LAWRENCE M. COSTELLO

Everything went really smooth up through preflight, engine start and taxi. The only write-up in the forms was that my rear cockpit heading indicator sometimes would temporarily stick through 10 to 20 degrees of turn. I checked my heading indicator on the ground along with all the other navaids which checked out just fine.

On line-up, both my attitude indicator and heading indicator were good. We made a normal takeoff and started our climb into the weather. We entered the soup about 1600 feet MSL. That sort of sticks in my head because I mentioned to the forecaster that we would give him a call after departure.

As we entered the weather, Mark made a shallow left turn out of traffic to intercept our course outbound. We were now solely on instruments. I first noticed that my heading indicator hadn't moved but I felt a very positive rolling tendency to the left. My attitude indicator at this point showed us to be in approximately 10 degrees left bank with the aircraft silhouette still sitting on the horizon. Our airspeed showed us at approximately 250 kts. At this point, I felt a little vertigo coming on and remember thinking to myself that I was sort of glad Mark was flying. (Nobody likes flying with that "vertigo" feeling.)

The next thing I can remember noticing was that although I was tapping on the glass of my heading indicator, neither that nor my attitude indicator had budged. Simultaneously, as the VVI went from about 2000 fpm climb to 6000, my aircraft silhouette shot straight up and the horizon fell to the very bottom of the case.

I remember telling Mark to get the nose down. I now had the indication and the definite sensation that we were in a good 60 to 70 degree climb continued **I'M OK, YOU'RE OK**

with our airspeed decreasing through 220 kts. Mark told me he had a bad case of vertigo and gave me the aircraft. I thought for a second of trying to nose it over, but I felt we would have stalled before I could get the nose down and break the climb. I attempted some sort of a roll which I thought to be around 120 degrees and pulled to get the nose down. I had pulled to the point of a very apparent buffet indication, then relaxed the back pressure somewhat and started to initiate a roll-back.

At this point, I can remember my VVI going from 6000 fpm climb to a 3000 fpm descent and my attitude indicator apparently binding again on the horizon. Our airspeed was accelerating through 230 kts and I felt totally disoriented. I now told Mark I too had a bad case of vertigo and gave him back the aircraft. We were passing about 3500 MSL.

At that moment, when Mark took the aircraft, my feet went into the stirrups and my hands to the handles. I can vividly remember taking a few deep breaths in preparation for leaving the aircraft. I now felt Mark roll the plane slowly, and I began to feel the Gs as Mark started a smooth but positive pull out of the dive. I felt that we had gained control of the aircraft and had passed level flight.

We bottomed out at 2800 MSL. Mark transitioned to a shallow 1000 fpm climb and we broke out at about 7500 feet. That rich, blue sky has got to have been the best sight I've ever laid my eyes on. We started to check the aircraft to see if our tips were still there and if our ECM pods were still attached to the pylons. My G meter was registering 3½ positive Gs and one negative G. I can remember finding my approach plates on the floor and the glass holder laying up behind my left shoulder.

SUMMARY

Lt Col Brooks G. Bays
Operations Officer, 87 FIS

Here were two young pilots faced with a situation which would have curled the hair of even the most experienced of pilots. Their reaction to the situation and successful recovery of the aircraft was the result of one primary factor—PREPARATION!

Preparation for flight is a continuing day after day program. While it is a rather simple matter to prepare for an individual mission, we, as aircrews, must always be prepared for the unexpected things associated with FLIGHT. In this case there simply was not enough time for these young men to sit back and discuss the situation before taking action. *Positive* and *correct* action had to be taken immediately, or there would have been another smoking hole in the ground.

Let us look at some of the factors.

WEATHER: The reported weather for takeoff was something like 300 scattered, 600 broken, 1,200 overcast with 1½ miles of visibility.

MALFUNCTIONS: The probability of having both heading and attitude indicators fail simultaneously (without an inverter failure) is undoubtedly quite low. (Since having first flown the T-Bird in 1958, and spending a few years in safety, I cannot recall having ever heard of everything going at once like this.) However, in this instance, the crews were able to, first, recognize these insidious failures and, secondly, take the proper actions. When was the last time you tried to recover from unusual positions using only needle, ball, VVI, and airspeed? Perhaps on an instrument check, but doubtful. The old attitude indicator may have "popped up" in your cross-check, out of habit. The big point I am trying to make on this is that the crews were able to identify the erroneous indications by cross-checking other instruments. Then, after they got that sorted out, recover the aircraft, using what was left.

CREW COORDINATION: I believe that crew coordination was probably the most important factor in the safe recovery of this aircraft. They had flown together many times and were each confident of the capabilities of the other. They communicated—Larry telling Mark to get the nose down. Each telling the other when he was disoriented. Shaking the stick when taking control of the aircraft.

JUDGMENT: While I applaud their successful efforts to save the aircraft, I would have faulted neither had they elected to pull the handles. Certainly those who were less prepared might have taken that option. However, they knew the terrain and the weather. Each man was prepared to eject, mentally and physically. But most importantly, based on the information available only to them in the cockpit, they were in agreement that the situation had not yet deteriorated to the point where ejection was necessary. And, they were right.

In summary, these young men were PREPARED for flight. That preparation did not begin 2 hours before the flight, the night before, or even the week before. It began when they entered UPT, and has been continued through an aggressive training program in the squadron. They are continuing that preparation today. Mark is at Tyndall, checking out in the F-106 and by the time you read this, Larry will have completed upgrade to IP in the T-33. ★

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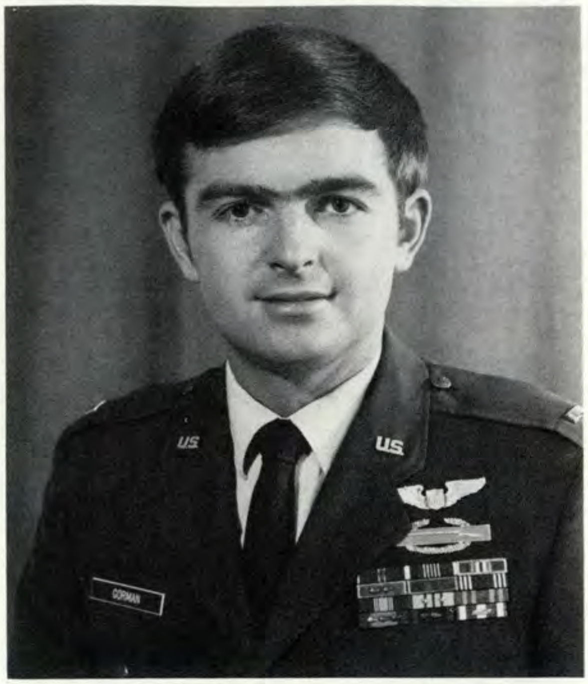

First Lieutenant

THOMAS R. GORMAN

102d Fighter Interceptor Group

Massachusetts Air National Guard
Otis Air Force Base, Massachusetts

On 5 November 1975 Lieutenant Gorman, piloting an F-106A, was on a routine flight that proceeded normally until, at 35,000 feet and 30 miles west of Albany, New York, the master caution warning light and oil pressure light suddenly illuminated accompanied by the oil pressure gauge indicating zero oil pressure. Lieutenant Gorman immediately started a turn back to Albany and declared an emergency with the RCC. Before he received a reply, all aircraft systems failed and the engine flamed out. Seconds later the flight controls froze. Lieutenant Gorman immediately deployed the ram air turbine, regaining use of the primary flight control system. Unable to inform any agency of his critical emergency and having only battery power available, Lieutenant Gorman reviewed checklist procedures in preparation for ejection. After analyzing his position, altitude, weather and runway environment, he made the decision to attempt a flameout landing at Albany Airport. Lieutenant Gorman successfully maneuvered the aircraft to arrive at an 11,500 foot high key, 90 degrees to the runway heading. Deprived of all cockpit instruments except the airspeed indicator and altimeter, Lieutenant Gorman began a right descending 270° turn toward the runway. He delayed the decision to emergency extend the landing gear until he was sure he could make the runway, then rolled out on a short final for a precision landing 500 feet down the 6000 foot runway. Maintenance and safety personnel subsequently determined that the engine accessory drive case had cracked, due to internal failure, which resulted in the complete failure of the engine and all related aircraft sub systems. Lieutenant Gorman's exceptional skill, judgment, and rapid assessment of the situation were responsible for the successful recovery of a valuable aircraft. WELL DONE! ★

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