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SAFETY AUGUST 1981

MAYBE, Maybe Not

Uncharacteristic physiological symptoms may be a result of hypoxia— or toxic exposure. In any case, immediate corrective action is required.

MAJOR ROGER W. PAGE
Asst Chief, Aerospace Physiology
HQ Air Force Medical Service Center
Brooks AFB, TX

■ It was a clear day in Death Valley, California, in November when a four-ship of F-4s blasted sunward. Passing 18,000 feet, number three noticed the cabin pressure indicated 18,000 feet. They were unable to correct the problem, but continued the mission below 25,000 feet. After leveling at 25,000 feet, both the student pilot and instructor pilot felt dizzy and slightly nauseated, BUT NEITHER INFORMED THE OTHER OF HIS SYMPTOMS.

Flight lead noticed unusual actions from number three and fulfilled his obligation to his flight by directing a descent. He also directed number three to activate the emergency oxygen system. The instructions were repeated several times before number three complied. As the symptoms subsided, the number three crew realized they may have had a hypoxia problem.

A "hindsightful" examination of this incident shows:

- Maintenance found worn high pressure O_2 hose fittings, a severe leak in the O_2 supply line, and a faulty LOX converter. Selecting 100 percent O_2 would have severely increased respiratory effort and alerted the crew to a problem. Therefore, there was probably no O_2 preflight or PRICE check.
- Neither crewman thought to check the O_2 system or select 100 percent O_2 when they discovered the F-4 was not pressurizing.
- Neither crewman told the other of his symptoms, nor did they consider telling lead.
- If lead had not been alert and willing to take the proper action, a disaster could have resulted. THANKS, LEAD!

One April morning two A-10s brushed aside the fog of England and climbed to a maximum altitude of 10,000 feet MSL.

While working in and out of the weather at approximately 1,500 feet, lead began making inappropriate radio communications and flying errors. Lead felt mentally slow, had difficulty thinking of what actions to take, became mildly nauseous and requested that wing take the lead. After asking wing to take the lead, Lead proceeded to bury his head in the cockpit for the rest of the flight. When wing asked him if he felt all right, he said, "no."

At this point, Wing declared an inflight emergency and directed Lead to go on 100 percent oxygen, which he did. Lead did not, however, use emergency oxygen as he was directed. Wing carefully talked him through the required procedures to a safe landing. The symptoms gradually cleared after selection of 100 percent oxygen, but did not completely resolve until about one hour after landing.

A further examination of this incident shows:

- The flight did not go above 10,000 feet MSL, so lead did not suspect hypoxia.
- The pilot who flew the plane prior to this flight experienced similar symptoms, but not so severe.
- Both maintenance men who subsequently worked on the oxygen system (and breathed through the hose) experienced similar symptoms.
- The pilot was slow to recognize the onset of a physiological problem.
- If wing had not been alert and willing to take the proper action, a disaster could have resulted. THANKS, WING!

Are there some lessons in these two instances? Here are some:

- Hypoxia symptoms won't always be recognized in the same sequence as they were in the altitude chamber. The individual may be so preoccupied that he or she misses the first few symptoms.
- Uncharacteristic physiological responses may not result from hypoxia. They may be caused by a toxic substance.
- Aircrew who are adept at physiological self-monitoring will be able to take early action to avoid disaster.

What other lessons do you see?

Be alert for uncharacteristic physiological responses. If you find yourself doing "funny things" while flying, look for the cause and take the corrective action required by the situation. Don't hesitate to communicate a perceived "problem" to your wing or lead. It could save your life . . . or his. ■

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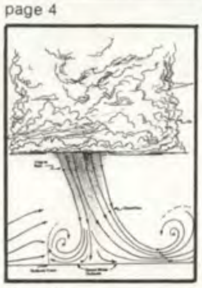

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SPECIAL FEATURES

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 $17.00 per year domestic; $21.25 foreign; $1.50 per copy, domestic; $1.90 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 26 Jan 1982, unless its continuance is authorized by the approving authority prior to that date. Distribution: 1 copy for every 2.5 aircrew and aircrew support personnel.

The OTHER Side Of The Coin

ROBERT W. HARRISON, Editor

■ Safety magazines have a tendency to dwell upon our failures. Articles dissect mishaps, discuss causes, point the finger of blame and, in the last paragraph, tell how the event could have been avoided.

Since mishaps involving crew participation outnumber those attributable to what we euphemistically refer to as "logistics factor," aircrews, especially pilots, take quite a few hits. There is no intent to demean anyone, but, on the contrary, a sincere desire to prevent mishaps by sharing lessons learned with the readers.

What this does sometimes is to make pilots seem to be inept, ham-handed, over-aggressive or, in some cases, helpless blobs of jelly victimized by weather, broken parts or malfunctioning equipment. Let's set the record straight: Pilots/aircrews actually save more aircraft and lives than they lose.

It's impossible to say how many mishaps pilots have prevented. But we know it's a bunch. Therefore, let's look at the reverse side of the coin and talk about some *saves*.

▪ During takeoff the F-4E accelerated smoothly in AB until just after rotation at 140 kts. Then a series of bangs accompanied a severe loss of thrust that threw the crew into their harness. With the nozzles fluctuating and rpm decreasing, the pilot pulled the throttles to idle and aborted the takeoff, taking the BAK-13 cable. This near-mishap was caused by the failure of a resistor in the CADC. A mishap was prevented by fast, smart action by the pilot.

▪ Low level at 500 kts is no time for your controls to act up. It happened recently to an F-104 pilot during a bomb pass recovery. At about 400′ AGL, the aircraft began a series of severe pitch oscillations. The pilot gained control by countering the pitch inputs manually and turning off the automatic pitch control (APC). Minimum altitude was about 100 feet; the pilot considered ejecting, but decided he was out of the seat envelope. This incident was caused by an insidious break in the wiring in the stab trim actuator and pitch servo disconnect. During G loading, the wires separated. Unloading reconnected the wires. Only after the system was deactivated by the pilot did the oscillations cease.

▪ The crew of an RF-4C had just completed the level off checklists and engaged the autopilot when the aircraft rolled violently to the right. The rudder went hardover and most of the warning lights came on, including engine fire and overheat, R generator out and bus tie open. The pilot depressed the paddle switch and gained control, but the hard right rudder remained. After several procedures failed to correct the situation, the rudder trim CB was pulled and slowly the rudder returned to neutral. This occurred at night over water. During the entire sequence, the heading indicator in the front cockpit continued to spin. With a night weather penetration and barrier arrestment facing them, the crew planned a no-gyro penetration and approach. However, the bus tie closed, electrical power was restored and a normal landing followed by an approach end arrestment was made. Another case of a crew saving an aircraft and, perhaps their lives.

▪ From time-to-time, birdstrikes are severe enough to threaten destruction of an aircraft and loss of a crew. A number of pilots have performed admirably in those situations of extreme trauma. In many cases they have received excellent support from the guy in the other seat. Here's such an event involving the crew of an F-111E. The windscreen was not penetrated but was so badly damaged that the pilot had no forward visibility. The WSO had forward and right side visibility. With the WSO and radar controller giving verbal instructions, the pilot successfully made a "blind" landing. A case of excellent crew coordination.

▪ Nearly every day there is a near midair collision (NMAC) reported by USAF pilots. Very often the other aircraft, most often light, single engine planes, take no evasive action and make no report. Presumably, they did not see the military aircraft. Such a case was an encounter between an F-111 and a Piper PA-23. The F-111 was flying an IR when the pilot spotted the light twin. The USAF pilot took evasive action and passed within 200 feet of the PA-23. The other pilot did not see the F-111 and was only vaguely aware of the low level route, although he had an air transport rating and over 7,300 hours flying time. Here is another example of an alert USAF pilot preventing a very possible mishap.

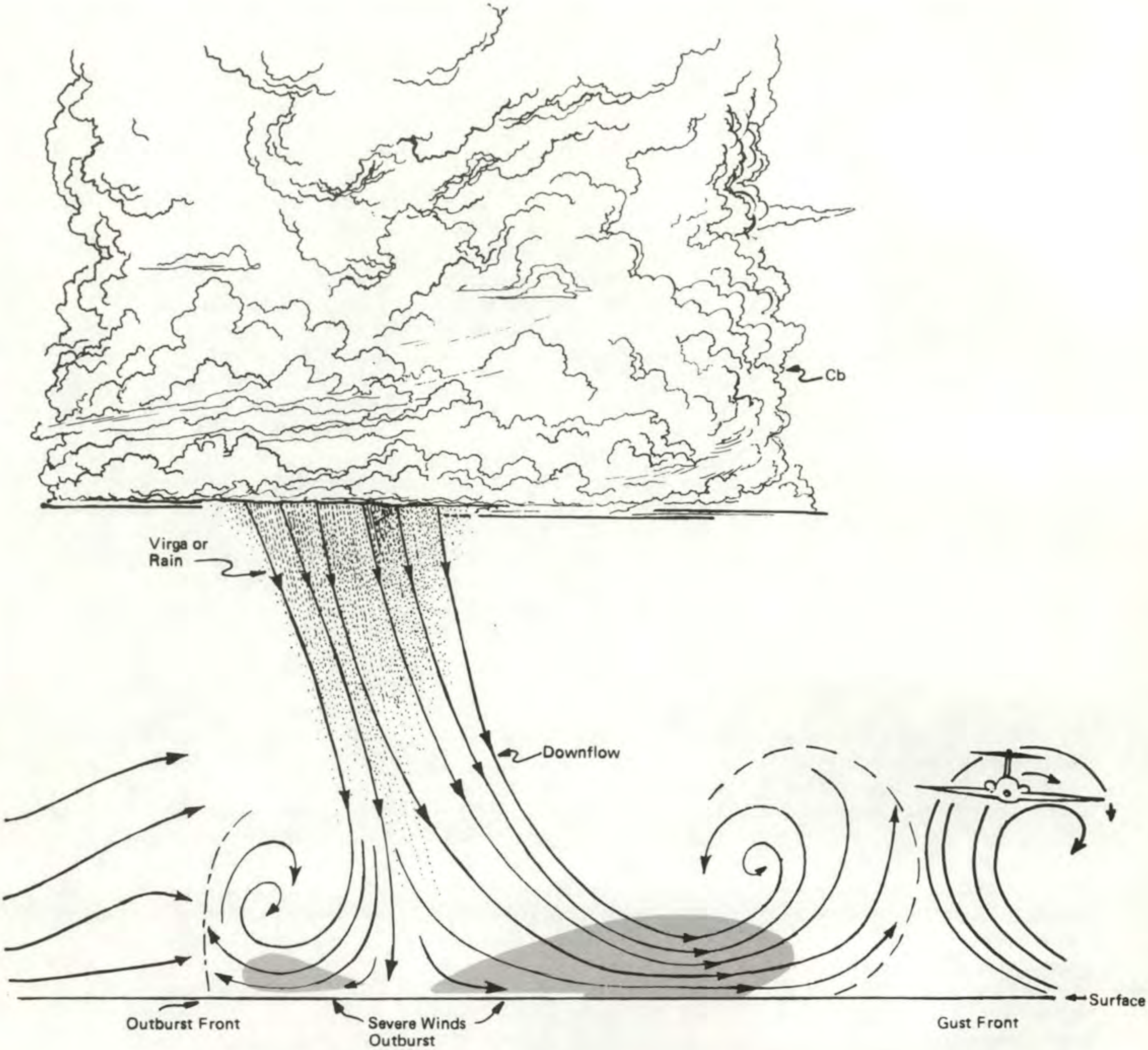
▪ On downwind, just after gear down, a T-37 pilot spotted a C-172 about 150 feet below and to the right. The T-37 took evasive action while the C-172 continued across the control zone, oblivious to the hazards in the vicinity of the air base.

In nearly every serious mishap, a series of events leads to the ultimate conclusion. Interruption of the series can avert a mishap. Sometimes the events happen so quickly that interruption is nearly impossible. In other cases, the sequence develops slowly enough that a mishap could be averted by action at one of several points. Those are the truly preventable mishaps, and it is distressing that too often the sequence is permitted to develop to a catastrophic conclusion.

Conversely, we should give a great deal of credit to the aircrews, usually pilots, who make the decisions and take the actions that avert what could have been a disaster.

It is important to recognize that aircrews seldom cause mishaps. Most often when one occurs, it's because the crew failed to prevent it. We have almost, but not quite, eliminated the "kick the tire, light the fire . . ." attitude which marked the accident waiting for a place to happen. We could, however, do a little better in training and developing our crews in recognition of an approaching mishap and the proper remedial actions.

Every day aircrews demonstrate that ability and thereby save many aircraft and lives and an untold number of dollars. Keep up the good work. ■



WIND SHEAR

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

■ "Tonto 55, final controller, how do you read . . .?"

"55, loud and clear."

This has been a good flight thought the IP as the pilot in front smoothly and efficiently transitioned to the GCA final. I enjoy being an instructor on days like this.

"Tonto 55, begin descent. Slightly above glide path, on course. Seven miles from touchdown."

He's really smooth on this GCA, just a little trouble getting down to the glide slope.

"Slightly above glide path, on course. Five miles from touchdown."

"Slightly above glide path, on

course, wind 050, 10 kts. Cleared to land Runway 05. Four miles from touchdown."

This approach is not taking much thrust. Maybe they tuned up the engines last night.

"On glide path, on course. Two miles from touchdown."

"Slightly below glide path. One mile from touchdown."

"Going well below glide path. Well below glide path."

Wow, the bottom dropped out of this approach. Add power. "I've got it!" Light burners, light!

"Tonto 55, too low for safe approach. Climb immediately! Contact departure."

"Did we hit those lights? Uh, GCA, Tonto 55, on the go. Going Tower."

"What happened?"

What happened, indeed? How could two experienced pilots let themselves get so far behind the aircraft that they crash into the approach lights on a perfectly clear day? A few years ago the answer would have been a simple "pilot error." Everyone would shake their heads and go on as usual. Now, thanks to increased research and experience, we are more aware of the complex problem of wind shear.

What is wind shear? According to the Air Force Manual *Weather For Aircrews* (AFM 51-12), wind shear is a change in wind speed and/or direction over a short distance. It can occur either horizontally or vertically and is most often associated with strong temperature inversions or density gradients. Wind shear can occur at high or low altitude. This article will discuss only low altitude wind shear. There are four common sources of low level wind shear: Frontal activity, thunderstorms, temperature inversions, and surface obstructions.

Frontal Wind Shear

Not all fronts have associated wind shear. In fact, shear is normally a problem only in those

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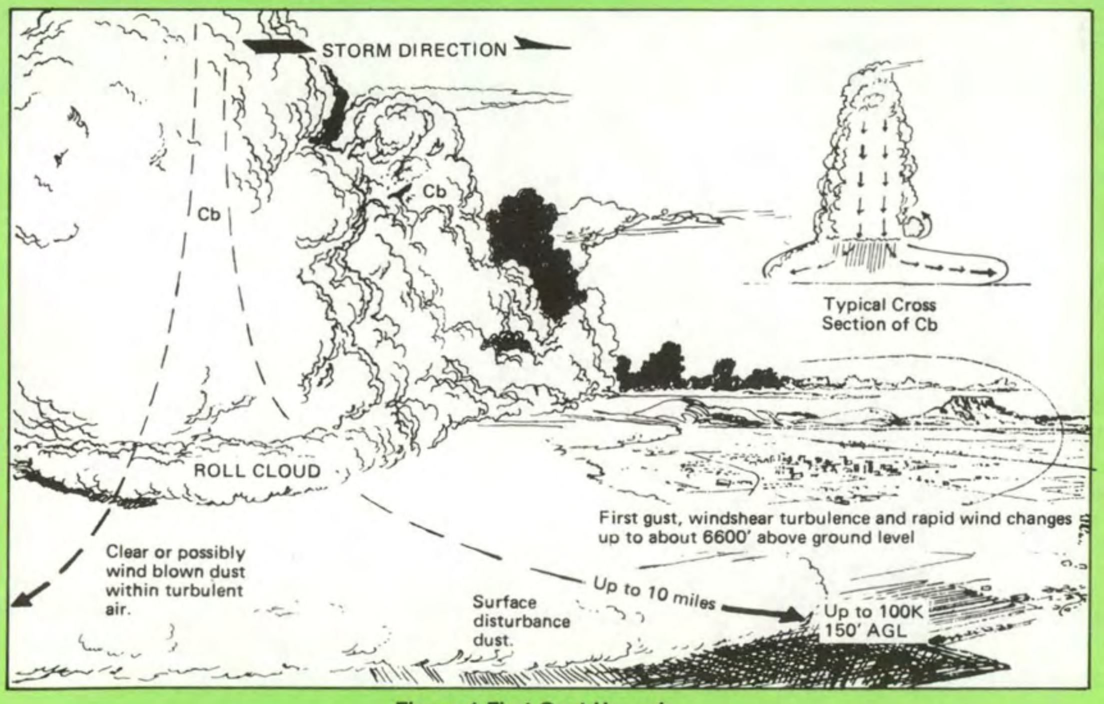


Figure 1 First Gust Hazards

WIND SHEAR continued

fronts with steep wind gradients. Like so many things in weather, there is no absolute rule, but there are a couple of clues: (1) The temperature difference across the front at the surface is 10 degrees F (5°C) or more; and (2) the front is moving at a speed of at least 30 knots. You can get clues to the presence of wind shear during the weather briefing by checking these two factors. Ask the briefer, and if they are present, be prepared for the possibility of shear on approach.

Thunderstorms

Wind shear is just one of the many unpleasant aspects of thunderstorms. The violence of these storms and their winds are well documented. The two worst problems outside actual storm penetration are shear related. These are the "first gust" and the "downburst." Most everyone has seen the rapid shift and increase in wind just before a thunderstorm hits. This is the first gust.

The gusty winds are associated with mature thunderstorms and are the result of large downdrafts striking the ground and spreading out horizontally. These winds can change direction by as much as 180° and reach velocities of 100 kts as far as 10 miles ahead of the storm. The gust wind speed may increase as much as 50 percent between the surface and 1,500 feet, with most of the increase occurring in the first 150 feet. The implications for a shear on approach in such a case are obvious.

The other wind problem mentioned earlier, "the downburst," is also downdraft related. It is an extremely intense localized

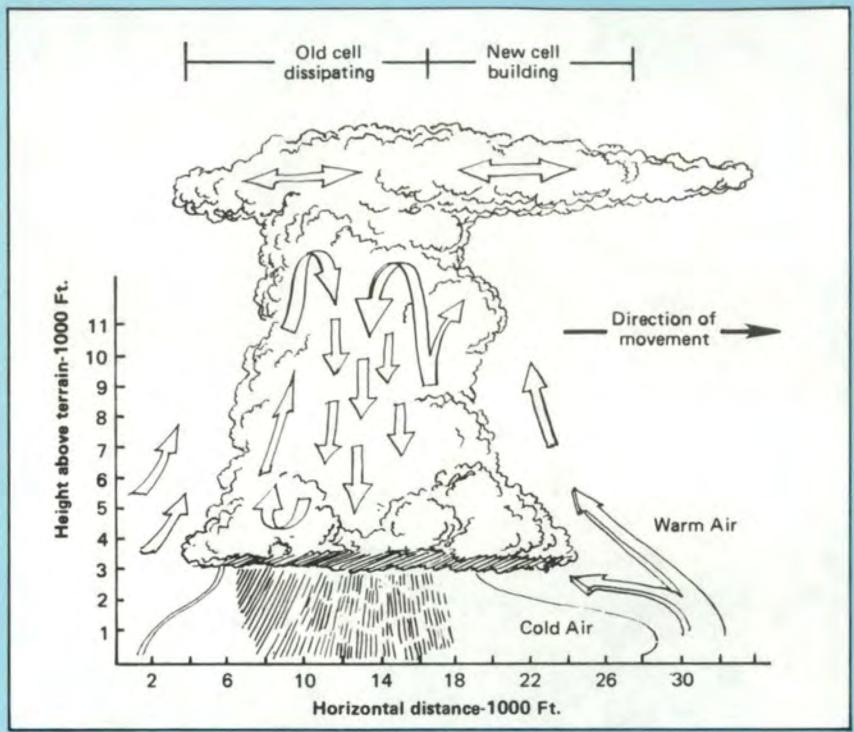


Figure 2

Strong downdrafts from a dissipating thunderstorm cell spread horizontally as they approach the ground. This wedge of cold air provides a lifting force on surrounding warm air which may be sufficient to initiate formation of new thunderstorm cells.

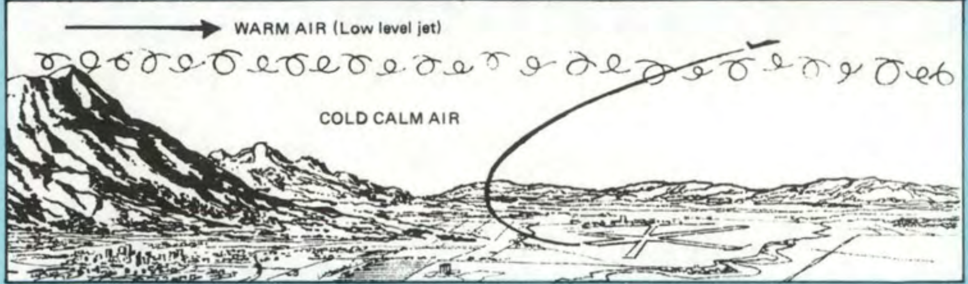


Figure 3

Turbulence at boundary between calm, cold air and a low-level warm air jet stream.

downdraft from a thunderstorm. This downdraft exceeds 720 feet per minute vertical velocity at 300 feet AGL. The power of the downburst can actually exceed aircraft climb capabilities, not only those of light aircraft but even as is documented in one case, a high performance Air Force jet.

The downburst is usually much closer to the thunderstorm than the first gust, but there is no absolutely reliable way to predict the occurrence. One clue is the presence of dust clouds or roll clouds or intense rainfall. It would be best to avoid such areas.

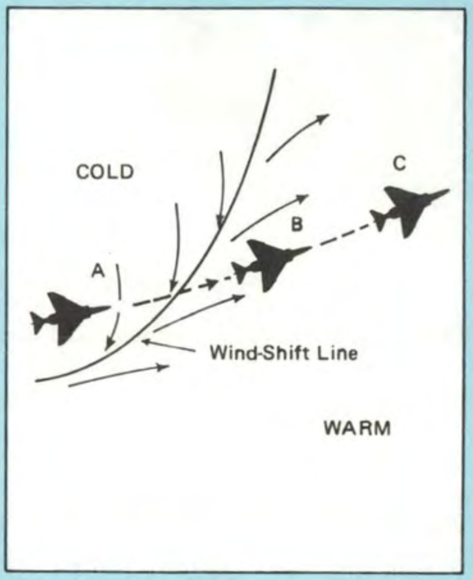


Figure 4

Temperature Inversions

Pilots who have flown in the Southwest or in Southern California or Colorado are familiar with this weather pattern. Overnight cooling creates a temperature inversion a few hundred feet above the ground. This, coupled with high winds from what is known as the low level jet, can produce significant wind shears close to the ground.

One particularly bothersome aspect of temperature inversion shears is that as the inversion dissipates the shear plane and gusty winds move closer to the ground. At some bases in the Southwest 90° change in direction and 20-30 knot increases in surface winds in a few minutes are not uncommon. Obviously, such a shift would make an approach difficult at best.

Surface Obstructions

This is usually thought of in terms of hangars or other buildings near the runway. The sudden change in wind velocity can seriously affect a landing. (The big hangars at Offutt AFB are a good example.) But there is another type of obstruction.

Some airfields are close to mountain ranges, and there are mountain passes close to the final approach paths. Strong surface winds blowing through these passes can cause serious localized wind shears during the approach. The real problem with such shear is that it is almost totally unpredictable in terms of magnitude or severity. A pilot can expect such shears whenever strong surface winds are present.

Types of Wind Shear

Wind shear can be divided into horizontal and vertical shears. Although both components can affect an aircraft simultaneously, it is easier to discuss each separately.

Horizontal shear occurs when the flight path of an airplane passes through a wind shift plane. Figure 4 shows how such a penetration would appear as an aircraft crosses a cold front.

The other type is the one most often associated with an approach. The vertical shear is normal near the ground and can have the most serious effect on an aircraft. The change in velocity or direction can drastically alter lift, IAS, and thrust requirements and can exceed the pilot's capability to recover.

Wind shear in its many forms can, in a matter of seconds, change a routine approach into an emergency recovery.

This has been a brief look at the kinds of wind shear and their sources. In the next issue we will discuss the affects of wind shear on an aircraft, pilot techniques for coping with shear, and new developments in forecasting wind shear. ■

ALTITUDE DEVIATIONS

■ *Altitude deviations are a serious problem. Here are three accounts taken from the* NASA ASRS Callback.

Score: One All

■ Approach Control cleared us to maintain 4,000. We called out of 8 for 4; as we were going through 5 he said we had been cleared to maintain 6,000. He then told us to continue on down to 4. This is not a CYA* report—my A is already C'd because I had the CVR tape removed and listened to by my supervisor and it turns out that we really were cleared to 4,000. I don't know what caused the controller's mistake. Finding out it was not our mistake is saving me a lot of mental anguish, but this does not solve the problem. Altitude busts are becoming epidemic!! I am going back to writing down every altitude change. I stopped doing this when we got altitude reminders in the airplanes. . . .

Small transport filed for FL260 on an Eastbound flight (wrong altitude for direction of flight). When the aircraft was handed off to me (working the high sector), I assigned him FL250. Pilot acknowledged "Flight level two five zero." I later observed Mode C readout of 252, 257 and climbing. I asked the pilot his altitude. He responded, "Flight level two six zero" (which by some strange coincidence is what he filed for). I advised him that he was cleared to FL250 and that FL260 was a wrong altitude for his direction of flight. He apologized and descended to 250. No problem, thanks to the computer (RDP) and Mode C readout . . . But, had we been using the back-up radar system (broad band)—no computer, no Mode C readout—who knows what evil may have lurked . . .? Advisory to ALL pilots: Just because you file for it, don't ASSUME you're gonna get it!

*CYA: Cover Your Anatomy. In short, to seek immunity.

Score? Nobody Seems to Know

. . . cleared to cross the 40 DME fix at 13,000′. The descent was started in plenty of time; during the descent the old-style auto-pilot allowed the rate of descent to shallow out to less than our company-approved profile, resulting in the aircraft crossing the 40 DME fix at 19,000′ instead of 13,000. This is a characteristic of this auto-pilot and must be watched carefully by the pilot. It was not caught in this case because both the captain, who was flying and I, the F/O, were distracted trying to get the latest basketball score for a group of fans in the cabin. The use of the newer auto-pilot and/or more attention to flying the aircraft by the crew would have prevented this incident.

1″ = 1,000′—Once More

We have discoursed a couple of times before on this insidious trap for the unwary. It can be set by any of a number of circumstances. A good policy is to be especially alert when an altimeter setting seems unusually low—or high. A controller (1) and a pilot (2) illuminate:

1. Aircraft "A" departed with clearance to climb and maintain 7,000 feet. Aircraft "B" at 8,000 feet was head-on traffic. I issued advisory traffic to both aircraft. When the aircraft passed each other "A" complained about the separation. Investigation revealed that "A" had incorrectly set his altimeter to 29.40 when the area altimeter was 30.40.

2. We departed IFR to climb to 7,000. Center advised opposite direction traffic at 8,000, 15 miles. Leveling at 7,000 traffic was spotted. Seemed low. Traffic passed off our left side and same altitude, approximately one mile. Queried Center as to his altitude; confirmed at 8,000. Other aircraft confirmed 8,000 with altimeter setting of 30.40. The altimeter—or rather the altimeter setter—was the culprit. The last time my aircraft had flown, the altimeter setting was in the lower 29's. On preflight both altimeters were set to what was thought to be field elevation, but instead were set 1,000 feet below field elevation—29.40.

Callbacks indicated that takeoff was from a non-tower airport about 500′ above sea level so altimeters showed 500 OK, but did not show it was minus. Gotcha! ■

A Slight Mixup

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

■ It was a beautiful summer evening when Joe arrived at the local airport. Ever since he had retired, a year or so before, Joe had been following his life-long dream of being a pilot.

Now he had his private pilot license and in a week or so would take the flight exam for his commercial. Tonight he was going to get some more practice in the retractible gear Beechcraft he planned to use to take the flight exam. Preflight planning and preparation went smoothly.

After an uneventful takeoff, Joe cleared the field and headed out to the local training area. For about half an hour he practiced air maneuvers, chandelles, lazy eights and spirals, improving his feel for the airplane. Then he proceeded to a nearby airport for some landing practice.

The pattern entry and approach went just as planned. Joe was very proud of his touch down as he reached for the switch to raise the flaps for the touch-and-go. But as he flipped the switch, the nose gear began to retract. The gear warning horn's blare alerted him to his mistake, and he immediately reversed the gear switch. Too late! He felt the nose settle slightly and heard the sickening crunch and scrape of the propeller hitting the runway. Joe then turned off the master switch, and the aircraft slid to a halt.

A few days later, Joe was talking with his instructor about the mishap. He could not understand how the mishap could have happened. Everything mechanical in the aircraft checked out perfectly. The gear had been fine and he distinctly remembered checking the gear on base leg. He had had a good night's sleep and a good meal before flying and was well prepared for the flight. There had been no problems in his checkout. So why the mishap?

The instructor sipped on his coffee and thought for a few moments, then he asked "Joe, haven't you been getting quite a few hours in 873P, the Cessna 172?" Joe thought about it and agreed that he had been flying the Cessna quite a bit. "Well," said the IP "Think about the 172 procedure for touch and go's. When and how do you raise the flaps?" As Joe mentally went through the steps, he suddenly saw the answer. "Of course, it's SOP to raise the 172 flaps electrically on a touch-and-go! And the flap switch is just about where the gear switch is on the Sierra!"

"Right, and because you were above the gear retraction cut out speed as soon as you hit the switch the gear cycle started. The problem of habit pattern interference in flying is not new, Joe. During the years I've been flying I've known of several cases. I don't have any absolute answer. All I can tell you is that every time you transition to a new airplane be alert for these little traps.

"Now the Sierra is repaired, so let's go out and get some landings and get you recertified so you can take that flight check." ■

A New Look At Weather

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

■ You are planning an aero club flight, but the weather office at your base is not open on weekends. Where do you get a weather briefing?

You are enroute over Southern Colorado, and out to the east you see a line of thunderstorms that look a lot bigger than what you heard in the weather briefing. You can't raise an Air Force weather station on PFSV. What now?

For most pilots the answer was not difficult—call a Flight Service Station (FSS). However, it took time to get the info you wanted. Often the FSS weather information was disjointed, incomplete or out-dated. The system just was not responsive to pilot needs. Now that has changed. Since this past spring some 150 Flight Service Stations have a new service called Service A System (SAS). This is a computer-based system which gives real-time weather information designed specifically for the pilot.

But in order to use the system effectively, you need to know a little about how it works. If you go to an FSS and look at the system, the most visible part of the SAS is the keyboard display terminal. This looks just like what it is, a typical computer terminal with keyboard and cathode ray tube (CRT) display above it. Behind that is the heart of the system—the micro processor.

The processor is continually at work collecting weather information as it comes over various circuits. This includes SIGMETs, AIRMETs, synoptics, forecasts, PIREPs, current weather, NOTAMs, etc. The processor stores the information and keeps it revised and up-to-date.

It is this processor which makes the system so unique. Where before the FSS briefer had to manually research teletype reports and hand massage the data to give you a briefing, now he or she types out a request on the terminal for exactly the information wanted. Within seconds, the processor has found the information you want and displayed it on the CRT. The briefer can then give you a concise, informative briefing which covers everything you need.

There is another feature of the system which is very handy. If, by chance, you go to the FSS to get your briefing, you can get a printed copy of the information. All the briefer does is push one button and a high speed printer goes into action. That is a handy piece of paper, especially for those of us who are used to having a 175-1 to carry with us. By the way, the copy also has the NOTAMs if you forgot to check with the Base Ops dispatcher for civilian NOTAMs. *The system doesn't tie into the military NOTAM system, so you still need to check the NOTAM board.*

Perhaps the best part of the SAS is a thing called "the collective." This is an aggregate of information a pilot needs along a particular route. Most stations have the programmed primary routes of flight in the area and so can have the information in seconds. As an example, the Ontario, California, FSS can, within seconds, have a complete weather briefing for all the main routes from LAX to COS or SFO.

And if you want to go beyond those points, in a second or two more the Ontario processor can tie into the main computer in Kansas City and get you information on any airfield or route available in the system. The information available for the collective includes all the station forecasts as well as winds aloft, radar reports, and severe weather warnings.

One limitation of the SAS is that it doesn't show weather maps and charts. However, some stations such as Ontario FSS have set up a closed circuit TV which displays this information. At Ontario, the briefer has a TV screen and a CRT display side-by-side to give the most complete information available. The National Weather Service is working on a new system to provide graphic printouts of charts and maps, but this will not be available for a year or so.

The majority of Air Force pilots will not have much opportunity to use the preflight weather briefing service by the FSS. But while airborne, they will find that this service can be of real help. In fact, there is now a special frequency just for airborne weather information called "Flight Watch." The system operates on VHF 122.0. This cuts down some of the congestion on the other FSS frequencies and allows more complete uninterrupted weather briefings.

If you are in an aircraft without VHF and need weather info call 255.4 and ask for what you need. The FSS weather briefings won't replace the pilot to metro. The briefer at an FSS is not a forecaster and is not always familiar with military operations. (The system won't give you very much information on military training routes, for example.) But it is one more tool available to pilots in the never-ending struggle for timely, accurate weather information. ■

Thanks to Mr. Jim Ball and the staff of the Ontario, California Flight Service Station for their assistance in preparing this article.

MACPLAN

■ MAC and Lockheed Aircraft Service Company are teaming up to implement an advanced computerized flight planning operation.

Under an Air Force program, Lockheed has been converting its JetPlan software to USAF computers. The JetPlan system is currently in use by various government services and agencies including the US Navy, NASA, airlines and corporate aviation customers.

JetPlan, a computerized flight planning system, matches the aircraft, payload, and engines with worldwide weather information that is being regularly updated throughout the day. The computers then do all the calculations necessary to furnish the aircrew a flight plan for the most economical, fuel-saving route between any two points in the world.

Lockheed is completing the final steps to enhance the USAF Optimized MAC Computer Flight Plan. The new system software update is being accomplished at Air Force Global Weather Central Headquarters, Offutt AFB, and the Lockheed facility at Los Gatos, California.

The Air Force has been testing the new system (nicknamed MACPLAN by Lockheed) using C-141s and C-5s from McGuire and Travis AFB's. Future tests will be expanded to include C-130s.

Current plans are to have MACPLAN fully operational before the end of the year. ■

FUEL AWARENESS

MAJOR MICHAEL E. THORN
25th Flying Training Squadron
Vance AFB, OK

■ Have you ever gritted your teeth and watched the fuel quantity gauges creep lower and lower as you went missed approach or received radar vectors *away* from the airfield? Did you swallow your pride and declare "minimum (or, bite the bullet, emergency) fuel," or did you rely upon your superior skills to put it on the ground the next time with no one being the wiser? Regardless of your decision, do you remember that impending sense of disaster? How about the feeling that you knew you had pushed it too far this time, promising that you would never, never, never allow yourself to be caught in a situation like that again?

Except for a kite or glider, fuel is an absolute necessity to the conduct of flight. Without it, your superior skills are all for naught. An adequate supply of fuel is often taken for granted at takeoff, but the converse—a diminishing supply—is frequently the primary reason for landing. In the final analysis, all of your mission planning is devoted to determining that you have sufficient fuel to fly the planned mission. AFR 60-16 and MAJCOM supplements address this fundamental issue directly and lay down some very specific guidelines. Why, then, do we periodically put ourselves in situations where the margin for error can become critical?

There are, of course, many reasons why pilots and aircrews find themselves in adverse fuel situations. The most common reasons are summarized below.

- Flying one too many activities/overflight of a Bingo fuel.
  - *RBS Runs*
  - *Aerial engagements*
  - *Acrobatic maneuvers*
  - *Instrument approaches*
  - *Landings*
- Stretching a mission beyond the required fuel reserve.
  - *Flight planning to the nearest IAF*
  - *Planning on an enroute descent*
  - *Disregarding fuel for a divert*
- Unexpected weather enroute or at destination.
  - *Headwinds (or lack of a tailwind)*
  - *Low ceilings and/or poor visibility*
  - *Thunderstorms*
- Failure to make a timely divert decision.
  - *Runway closure*
  - *Deteriorating weather*
- Inattention to fuel status.
- Fuel system malfunction/aircraft emergency.
- Aerial refueling abort (receiver or tanker).

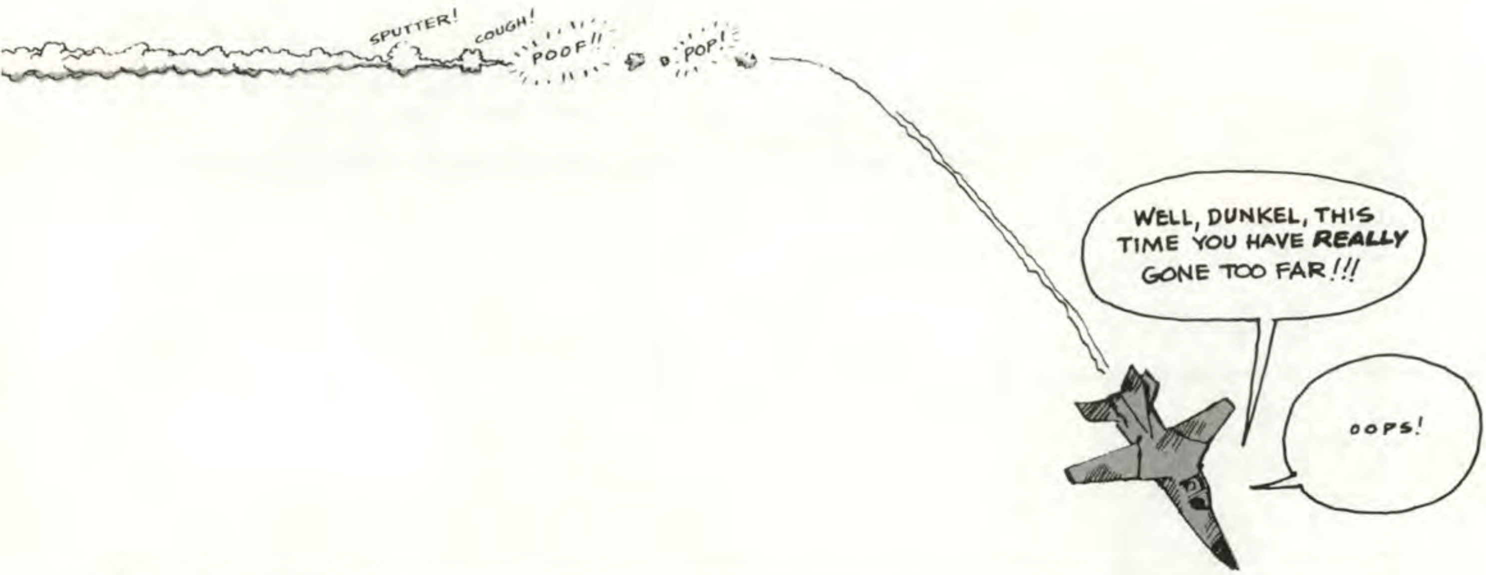
Regardless of the reason, though, there is almost always an underlying cause. Except for fuel system malfunctions and air refueling aborts, the cause is often inexperience or poor judgment, or both. Stated differently, flight discipline and safety have been compromised.

Note that the lack of flight discipline and safety is normally not a simultaneous event, but sequential. That is, a compromise of flight discipline resulting in a decrease in available fuel almost always translates to a corresponding decrease in available options (e.g., another turn in holding, a second or third approach, diversion). This violates the first, and most fundamental, principle of flight:

> *"Always leave yourself an 'out'."*

Failure to do so means that the pilot becomes increasingly reliant upon his own skills and those of others. In other words, the margin for error can become critical, and may not be totally within the control of the pilot.

Theoretically, the experienced pilot is aware of this potential sequence of events and allows for an increased margin for error. However, he is also prone to rely upon his skills to handle a decreasing set of options. The net result is a zero sum game where the



experienced pilot can easily find himself in essentially the same position as the inexperienced aviator. This leads to the second principle of flight:

> *"A superior pilot is one who uses his superior judgment to avoid having to use his superior skills."*

How does one develop "superior judgment?" Through many avenues, but one of the most fundamental is experience, which leads to the third principle of flight:

> *"Experience is the best teacher–as long as you do, in fact, learn from it, or as long as you personally do not have to experience it to learn the lesson."*

In sum, then, adverse fuel situations can happen to the best of us and invariably produce at least an uncomfortable feeling. Further, it is a distressing fact that we, more often than not, do it to ourselves through any of the reasons listed. As noted, the majority of these reasons can be avoided. More to the point, they must be avoided if we are to remember and practice the professional approach to aviation. In a few words, there is no mission requirement that overrides flight discipline and safety, especially in peacetime and training environments.

So much for the cause, often unnerving effect, and general corrective action. What do we do about it specifically? Regroup, give ourselves a stern lecture, write more regulations? Sure—but that has all been done in the past, and with occasionally marginal results. Given the best efforts of our training programs (and supervisors' veiled threats) to infuse us with a keen sense of fuel awareness, it is still our responsibility to develop a timely recognition of a potentially adverse fuel situation if we are to avoid an often rapidly developing crisis.

Individual aircraft instructors must carry the burden for teaching others how to develop this timely recognition. There are, nonetheless, several factors of universal concern to all pilots:

- Realistic flight planning/setting of a flight profile.
- Realistic fuel reserve/setting of a Bingo fuel.
- Careful consideration of possible contingencies and corresponding courses of action.
- Establishment and use of key fuel checkpoints during the mission.
- Comparison of not only actual vs planned fuel quantity, but also actual vs planned fuel flow.
- Awareness of one's options with regard to fuel, weather, etc.
- Willingness to declare an adverse fuel situation.
- Knowledge of one's skills in relation to available options.

It may be personally embarrassing to declare a low fuel situation (with all of the attendant paperwork) or to admit that you cannot hack it and must divert, but is the alternative of a flameout on short final any better? Stated differently, a late recognition of a low fuel situation or a tardy decision to divert is almost as bad as no recognition/decision at all and will absolutely guarantee a full-blown emergency.

When all is said and done, it is always the pilot's responsibility to exercise flight discipline and sound judgment so as to safely recover his aircraft without endangering others. This means planning the mission or adjusting the profile in flight to be able to adjust to unexpected conditions, including diversion to an alternate if necessary. Further, this basic requirement applies as much to local sorties as it does navigation flights. The bottom line is simple—maintain fuel awareness in relation to your mission and situation. Do not allow pride or an overemphasis on mission accomplishment to put you in a crack. ■

SAFETY AWARDS

for distinguished contributions during 1980

CHIEF OF STAFF INDIVIDUAL SAFETY AWARD

Presented To Air Force personnel who made significant contributions to safety during 1980.

LIEUTENANT COLONEL DWIGHT A. SWEET
314th Tactical Airlift Wing, Little Rock AFB, Arkansas (MAC)

As Chief of Safety, Lt Col Sweet was manager of the safety program for the largest tactical airlift wing in the USAF. His excellent program reduced aircraft mishaps significantly in addition to major reductions in AFMV mishaps and no two-wheel vehicle mishaps.

MAJOR HENRY FIUMARA
49th Tactical Fighter Wing, Holloman AFB, New Mexico (TAC)

Major Fiumara had the distinction of being Chief of Flight Safety for the wing whose flight safety and safety surveillance/trend analysis programs were rated best in TAC. The safety awards program was tops in the Twelfth Air Force.

MAJOR JOSEPH A. PAPPE, JR.
HQ USAFE

As Nuclear Safety Officer, HQ USAFE, Major Pappe significantly improved the command nuclear safety posture and readiness. Because of his efforts, the ability of USAFE to perform its nuclear mission was greatly improved.

MSGT ROBERT J. DELANEY
Weapons Safety Superintendent, HQ PACAF

MSgt Delaney resolved long standing, major explosives quantity-distance problems, which enabled the command to upgrade contingency and readiness facilities. His leadership resulted in an enhanced ability to train for the PACAF combat mission.

THE KOREN KOLLIGIAN, JR. TROPHY

When a severe engine fire began after takeoff, Major Mestre displayed outstanding ability by coordinating his crew in returning to the airport, landing and evacuating 94 passengers and crew with no serious injuries.

MAJOR RICARDO W. MESTRE

301st Military Airlift Squadron (Associate)
Travis AFB, CA (MAC)

THE COLOMBIAN TROPHY

Symbolic of excellence in military aviation safety, The Colombian Trophy for 1980 was awarded to the 3d Tactical Fighter Wing. The wing flew more than 19,000 hours in a variety of aircraft. Although it had the highest F-4 sortie average in the US Air Force, there were no F-4 Class A mishaps and overall the number of Class C's was reduced by 33 percent. The achievements occurred while the wing flew a demanding, diverse mission which included numerous exercises and overwater deployments.

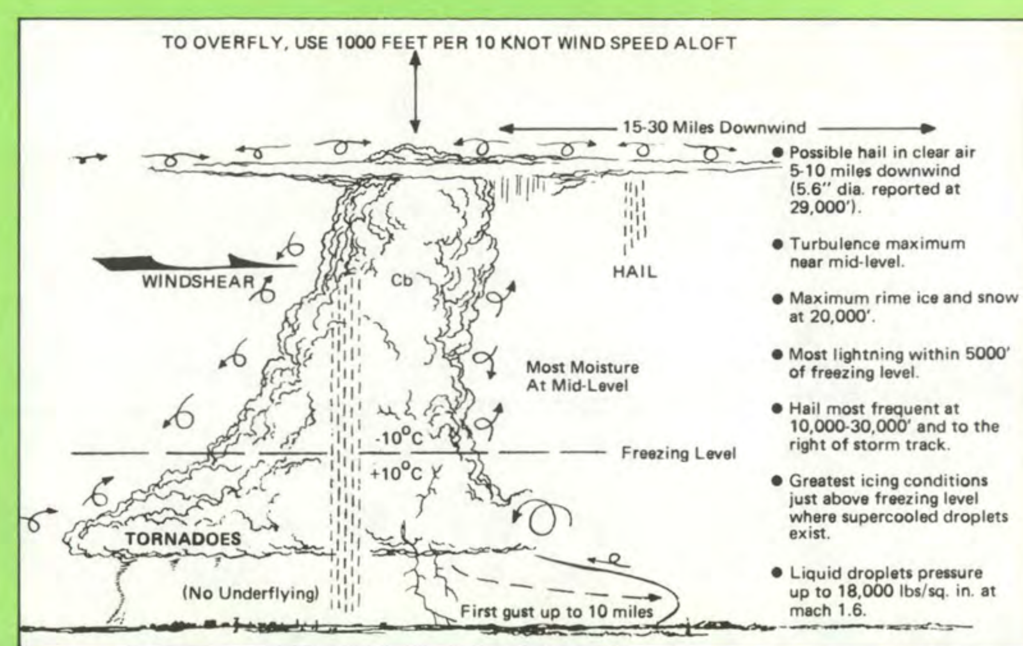
3D TACTICAL FIGHTER WING (PACAF)

THE SICOFFA AWARD

Awarded by the System of Cooperation Among Air Forces of the Americas for excellence in aircraft accident prevention. The 436th Military Airlift Wing had no Class A or B aircraft mishaps while flying 23,000 hours in the C-5 aircraft. The wing participated in many exercises often deploying to austere airfields with minimum air traffic control facilities.

436TH MILITARY AIRLIFT WING

Dover AFB, DE (MAC)



Thunderstorm Avoidance

MAJOR JOHN E. RICHARDSON • Directorate of Aerospace Safety

■ Flying can be sporty when there are thunderstorms around. Very few people are foolhardy enough to intentionally fly into thunderstorms. And, most Air Force crews are careful to adhere to the published avoidance distances whenever they can.

Unfortunately, thunderstorm avoidance is not a simple proposition. In fact, even if you are successful, you may still get into trouble with the derivatives of thunderstorms, lightning, turbulence, hail. Here are some examples:

■ An RF-4 was enroute at FL 250 (VMC) when the pilot saw weather ahead. The radar was inop so when it became clear that the aircraft needed to deviate around the storms, the crew requested avoidance vectors from Center. They received the vector but still entered some high cirrus. They encountered light turbulence and hail, and during the one or two minutes in the cloud received damage estimated at over $5,000.

■ The T-38 crew received a comprehensive weather briefing including a forecast for isolated, severe thunderstorms, but radar summaries showed no activity. While enroute at FL 310, the crew saw some severe thunderstorms about 50 miles north of course. A cirrus deck appeared ahead co-altitude. The crew continued, feeling that they could top or briefly penetrate the cirrus. The tops were slightly above the flight level when the aircraft entered the cirrus. Within 10 seconds of entering IMC, the aircraft encountered heavy rain, hail, and moderate turbulence. The crew asked for a 180 degree turn. In the turn, the aircraft lost 3,000 feet. As they broke into the clear, the crew saw heavy, dark clouds back in the direction of their route of flight. These clouds were identified later as a rapidly building thunderstorm cell. After landing, the crew discovered hail damage to the pitot boom, nose cone, wings, and tail.

■ A T-43 was over Eastern New Mexico when the aircraft encountered a cirrus deck. There were no significant returns along the route of flight other than the thunderstorms 40 NM south of track. The aircrew asked for and received a vector to avoid the thunderstorms. Within moments after entering the cirrus the T-43 encountered light rain followed by light icing and ice pellets. The icing was followed by moderate, then severe, turbulence combined with severe hail (1 - 2 inches in diameter). The crew also saw three bright flashes of lightning. The severe weather lasted for about two minutes and did more than $25,000 damage.

In each of these cases the aircrew was complying with established directives and doing their best to avoid the thunderstorms. What got them was the cirrus which, blowing out from the storms, masked the presence of severe weather. It is impossible to always stay clear of cirrus. But when you do penetrate a deck with thunderstorms in the area, be aware that your risk of an unpleasant surprise is much, much greater. ■

The 'eyes' have it

ROBERT W. HARRISON, Editor

■ A Cessna 152 had taken off on Rwy 14 and was climbing toward the 7,500′ floor of the TCA. At the same time two T-39s, 3 miles apart, were on final for 32. The pilot of the Cessna had turned only 10 degrees left to 150° which very nearly aligned him with the T-39s. When he saw the first one, to his right, he made a left turn to get more room but set himself up for the second T-39.

Meanwhile, the first T-39 warned of seeing the Cessna which alerted the second T-39 crew to begin looking for it. They spotted it and took evasive action, missing the Cessna by about 200 feet.

Pretty sporty, you say. True, it was. None of us wants to get within 200 feet of another aircraft—except in formation or in the parking lot. Each individual pilot may think the Cessna/T-39 near midair collision (NMAC) a rare event. The fact is that it was not rare or unusual—there were 283 NMACs reported by Air Force crews in 1980, 302 in 1979.

Those numbers can be alarming if one thinks of them as potential collisions. Another way of looking at them is to consider them as collisions averted by Air Force crews working the "see and avoid" concept. The following account of a NMAC illustrates this concept.

A flight of four A-7s, in route/MACA formation (midair collision avoidance), spotted a light plane at 12 o'clock. One of the flight called "pull up" and Lead pulled 4 - 5 G to avoid a collision. He estimated the miss distance as 300 feet. The light plane apparently took no evasive action and made no report. Presumably, he did not see the fighters. As is often the case, radar did not paint the light aircraft, which may not have been transponder equipped.

So far this year there have been 36 NMACs reported, most of them near airports, i.e., 36% in a terminal environment (excluding ATA, TRSA and TCA), 22% in ATAs and 19% in TRSAs. A significant number, 11% occurred on MTRs.

The low level routes provide some unusual hazards in addition to midairs with birds. Skydivers sometimes present a hazard. Recently, a B-52 and an aircraft engaged in skydiving operations got within an estimated 150 feet of each other.

Some NMACs occur because the small airplanes aren't painted by radar, often because they have no transponder and because they are hard for primary radar to paint. Radio incompatability, VHF and UHF, has been a factor. Restricted/controlled traffic zones are violated; pilots just don't see other aircraft. Civilian pilots often intrude on MTRs without knowing it. Most of the time both aircraft were operating legally in a system that depends on separation of much of the traffic by pilots' eyeballs.

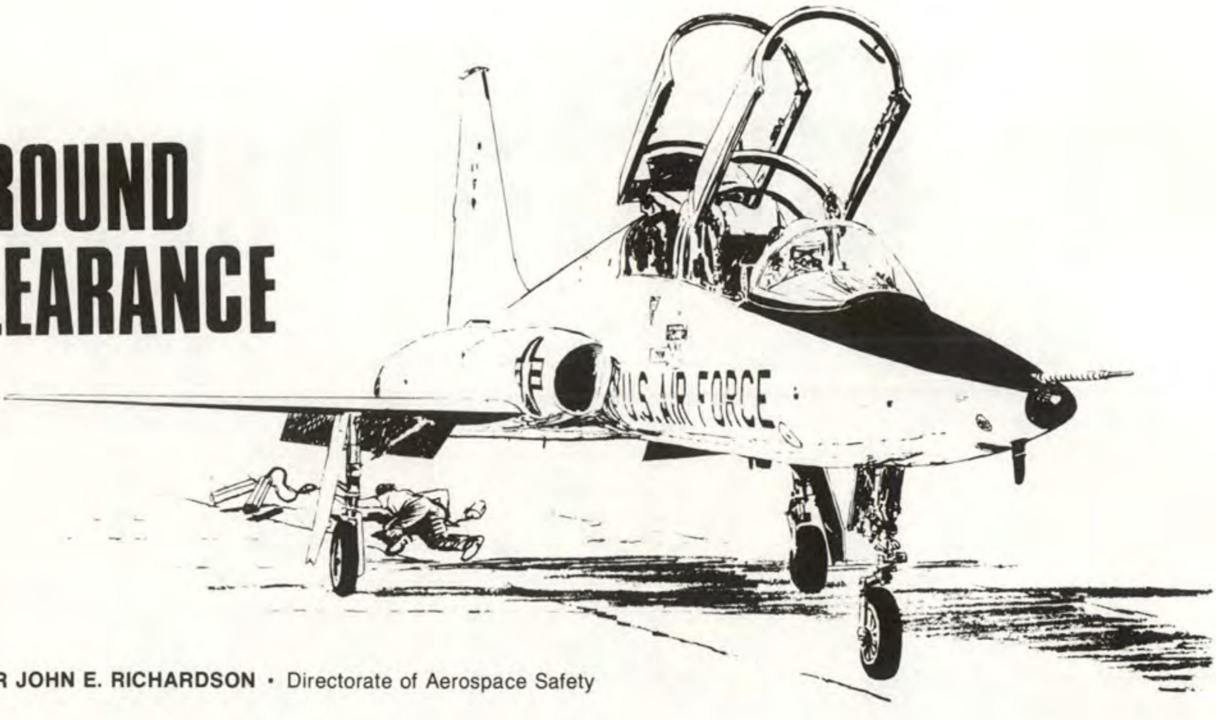
A recent NMAC involved two different types of Air Force aircraft operating from two bases located only a few miles apart and using a landmark as a common check point. Neither pilot had time to take evasive action; although, the only means of separation for the aircraft, one on an IR and the other on a VR, was the pilot's themselves.

Although "see and avoid" is basic to traffic separation—on the freeways as well as the skyways—it has its limits. Imagine, for a moment, that you are flying a low level route over rolling terrain. Along the route is a large cotton field and a duster aircraft reaches the end of the field, pops up for a one-eighty right in front of you. There's a good chance you never saw him until he popped up. Something like this happened recently, and the miss distance was estimated at 200 feet.

A B-52 flying the same route less than a month later pulled up just in time to miss a light aircraft by about 200 feet.

Military pilots must know the several different Air Traffic Control services available. Many general aviation pilots do not. Military pilots should keep in mind that, at any time in airspace that is not under positive control, a conflict can develop between two aircraft if one of them is VFR. If you always remember that and keep your head up and eyes working, your chances of making 20 will be immeasurably increased. The "eyes" have it. ■

GROUND CLEARANCE



MAJOR JOHN E. RICHARDSON · Directorate of Aerospace Safety

■ After reading an account of a commercial airline mechanic who was almost run over by the airplane he was launching, I began to think of some of the near misses I've experienced in Air Force operations.

It began early in my career when, as an eager young lieutenant, I was defending America as a part of SAC's nuclear force. I had learned my procedures well (so I thought), and I was ready when the klaxon went off. Once at the airplane, I scrambled into the right seat of our B-52 and with a cursory glance out the window I called "clear" and fired the starter cartridges. I had not seen the crew chief but, since the engine plugs were removed, I assumed he was clear. A loud yell over the interphone changed my mind. Fortunately, the only thing damaged was my self-image.

Years later, as a "seasoned" T-38 instructor pilot, I was taking a student on his first out-and-back navigation mission. As is usually the case, we were slow getting turned, and I was getting impatient. Once the engines were started, I was pressing my student to get the checks done and get our clearance. To save time I called for the clearance and started briefing the SID. Meanwhile, the student signaled chocks out and started to taxi. I was preoccupied with the clearance and only looked up when I realized that we had turned with too much power on.

Looking back over my shoulder, I saw a very angry transient alert technician picking himself up off the ground. He had still been under the wing pulling chocks when the aircraft started to roll. Only by throwing himself flat on the ramp did he avoid being hit by the flaps or tail. (But the jet blast got him anyway.)

All such things come in threes, I've found, and, sure enough, a few years later as a grizzled (slightly) T-39 AC I landed at a rather remote civilian airdrome. Once again the pressures of launching in an unfamiliar environment came into play.

There were no facilities and the general aviation ramp where we parked was very poorly lighted. After start, the ground crew member hopped on the tractor used as a combination start cart and follow me and left, or so I thought. So, assuming (again) that I was on my own, I made a quick, cursory scan of the area and started a smart right turn to depart the ramp.

Fortunately, my copilot was alert and suddenly slammed on the brakes. It was then that I realized that the tractor had merely pulled ahead and to the right a few yards. Without lights on the tractor on the dark ramp I failed to see it. Thanks to a sharp-eyed copilot we only came within three feet of the tractor.

There is one thread linking all three of these occurrences. In every case I was in a hurry. I knew the correct procedure but tried a short cut to speed things up. The only reason I am not the cause of an aircraft ground mishap is luck.

Maybe a few years in safety have seasoned me for I'm a lot more careful on the ramp now. Of course, I'm not as fast as I was as a lieutenant, plus they don't seem to light the ramps as well any more, or at least it's much harder to see the marshallers. It couldn't be my eyes, could it? Anyway, I don't intend to ever have another ground clearance problem. I hope you don't either. ■

THERMAL STRESS

MAJOR JOHN E. RICHARDSON • Directorate of Aerospace Safety

■ During the summer months, Air Force flightlines get about as hot as anywhere in the world. All that concrete bounces back the sun's heat. Aircraft become like furnaces. The temperatures generated in such an environment can be hazardous for people working there. A little knowledge about how the body copes with heat and some of the precautions each individual can take reduces this risk to manageable proportions.

The human body can control its temperature through several mechanisms. Of these, the most important for our individual on the flightline, are radiation, convection, metabolism and evaporation.

The loss of body heat by radiation and convection are very important when the temperature is low. Radiation and convection, as heat loss mechanisms, cease when the air temperature reaches body temperature (98.6°F). Without proper clothing, at high temperatures, radiation actually increases body temperature by absorption through exposed skin.

continued

THERMAL STRESS

continued

(There is more than AFR 35-10 to justify wearing a shirt on the flightline.)

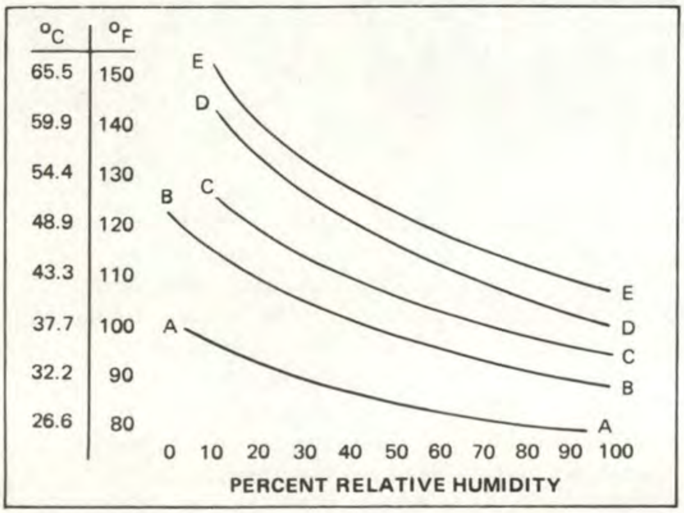
Once the temperature reaches 98 - 99°F, evaporation is the only method of heat loss the body has. Evaporative cooling is achieved by heat transfer from the secretion and drying of sweat and the exhalation of water vapor. This is where humidity comes into the game. If the air is perfectly dry and an individual drinks enough water and wears proper clothing, the person could survive very high temperatures (assuming no exertion). But as humidity increases, evaporative cooling becomes ineffective and thus heat tolerance decreases. This difference is obvious to anyone who has worked flightlines in Georgia and Arizona during the summer. The actual relationship is displayed graphically below.

Another point, air movement aids evaporation because the layer of saturated air next to the skin is replaced by dryer air. This is why fanning helps cool you off. Sweat must evaporate to cool you. Sweat dripping off your body is useless as a cooling mechanism.

The three most critical effects of heat stress are exhaustion, cramps, and stroke. Heat exhaustion is the result of excessive sweating, usually over several days, with inadequate replacement of water and/or salt. The victim's circulation volume actually drops, he will usually be weak, with cool, clammy skin, will complain of fatigue, and have slight mental confusion. He usually feels excessively drained, but not hot. Even mild effects can contribute to inattention and improper procedures, increasing your risk of mishap and injury. This commonly hits the maintenance troop working in an airless, enclosed "sweat-box" where the lack of circulating air hinders evaporation and renders sweating ineffective. If you or your troops

Figure 1

Relationship of temperature—humidity effect. The limiting environments of temperature and humidity for human tolerance, employing criteria which range from easy to difficult: AA, the upper limits of summer comfort zone; BB, the limits of evaporative cooling, with little or no rise in body temperature; CC, the limits of compensated hyperthermia; DD, 60-minute tolerance limit. (Winslow, Herington and Gagge; Robinson, Turrell and Gerking.)



feel weak, tired, are sweating profusely and are short of breath, get out of the sweat box, drink fluids (not coffee or alcohol), and rest.

If you are not used to high temperatures, you are most prone to heat exhaustion, but even a person acclimatized can develop the symptoms. Inadequate fluid intake is the cause. So if you are flying a couple of sorties on a nice, hot day, make sure you get enough to drink between missions. If you are sweating and have an inadequate salt intake, you may experience cramps in muscles being exercised. These cramps will continue until the salt deficiency is corrected. Generally, a little extra salt with meals is all that is necessary. Be sure you take plenty of liquids, too. You can overdo it with the salt—but not the fluids.

Heat stroke is the most serious of the thermal stress effects. It is a true emergency. Typically, the victim is working hard, generating a metabolic heat load in excess of what his cooling mechanisms (evaporation radiation) can dissipate. This, too, usually occurs in high humidity, rendering sweating relatively ineffective. What happens is the core temperature of the body begins to rise—and at a certain point—usually around 103° - 104°F, the body's temperature control center in the brain shuts off. Now, sweating stops altogether, and the temperature really shoots up. The victim's skin is red, hot and dry. Even the armpits will usually be dry. He is confused, may have seizures, and may lapse into a coma. Without immediate cooling, he will incur brain damage and likely die.

The treatment is to immediately cool the body by immersion, cold blankets, cold water spraying and fanning, and cold water enemas. Don't give fluids if unconscious. Most important, GET MEDICAL AID, FAST.

There are several things a person can do to prevent heat stress.

- Slow down. With physical exertion, more than 75 percent of the increased metabolism appears as heat. Muscular exercise can raise the body temperature 4°F or more. So plan for extra time to preflight, and if you have to get a spare aircraft and are hurrying to make a TO or range time, be extra careful. The increased exposure to heat can affect your performance in the cockpit.
- Drink more. The normal person needs 2 - 3 quarts of water per day, without exertion or hot weather. You can lose almost that much in an hour working in high heat.
- Eat sensibly. For most people, salting food provides enough salt (approximately 3 grams per day). If not, supplemental salt may be necessary. However, supplemental salt should only be taken on advice of the flight surgeon. During hot weather, low protein diets are best since protein increases heat production. Sorry steak lovers.
- Don't overdo it. If you start to feel any of the signs of heat stress, quit, get to a cool place, drink some fluids, and if you really feel bad, see the flight surgeon.

Heat is a part of everyday operations, and for some of us a welcome change from the cold and damp of winter. With the proper precautions, we can continue to do the job assigned without undue risk and still be able to enjoy the fun of summer. ■

THE FORM-FIT HELMET

■ During the summer months, temperatures within a closed cockpit can reach 200°F. These temperatures can drastically affect your form-fit helmet. During tests conducted at Wright-Patterson AFB, the material used on those helmets began to change shape at 160°F, and between 175°F to 180°F, the material actually expanded. It was also discovered that this material could expand so much that chances of getting the helmet on were remote. However, if the helmet could be put on, it would cause "hot spots" and poor blood circulation about the head.

These facts are nice to know, but the real thing to remember is to take your helmet with you, especially when you RON during cross-country sorties. Best place to leave it is with life support. Realizing this may be hard to do at cross-country bases, try to find a cool dry place to store it. Remember not to leave it in a closed vehicle or the trunk of a car. The same high temperatures could occur there.

The helmet, like all life support equipment, is designed to give years of service provided it is treated with care and respect. Keep it in a cool place.—Courtesy *ATC Safety Kit*. ■

Conflict Alert

MAJOR JOHN E. RICHARDSON · Directorate of Aerospace Safety

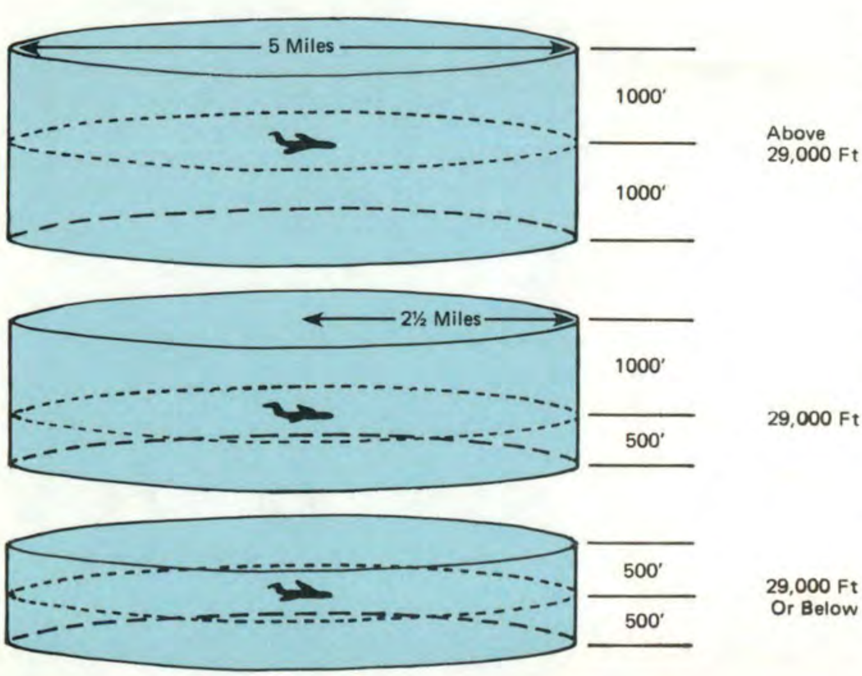
■ Increased traffic, higher speeds, more congestion: All these are a very familiar part of today's aviation environment. It is becoming more difficult each day to maintain adequate separation between aircraft.

The FAA has an aid in this effort. Called Conflict Alert, it is a computer software program which detects potential conflicts between aircraft and sounds an alarm. The detection of conflicts is based on prediction of future flight paths for an aircraft. A computer program in the ARTCC takes altitude, heading, and speed data and projects the current aircraft track position into the future (2 minutes). The data for this prediction is taken from long range radar and Mode C altitude readouts. If an aircraft is not Mode C capable, the controller can enter pilot reported altitude into the computer.

Each aircraft is surrounded by a protective envelope of airspace. This envelope is in both horizontal and vertical components (see Figure 1). These parameters are 5 miles horizontal separation (2½ miles for each aircraft) and vertical separation below FL290 of 1,000′ and 2,000 feet above. VFR on top separation is 500′.

The Conflict Alert is generated when the projected tracks of two aircraft impinge upon the protective envelopes. This can be in any relative attitude or altitude (Figure 2). When this occurs, the computer sounds an aural tone warning and flashes a visual warning next to the two aircraft depictions on the controller's scope.

Figure 1



This sounds like (and is) a good system and a positive aid to midair collision avoidance. But it is not the perfect solution. There are several limitations which degrade the overall effectiveness of the system.

■ First, an aircraft must be tracked by ARTCC. This includes VFR flights which are being provided services by ATC. Any aircraft not being served by an ARTCC (VFR low level, for example) will probably not even show up in the system.

■ While the computer used with the Conflict Alert is a high-speed, reliable system, its resources are limited. Programs like Conflict Alert must share computer time with other ATC processes. Therefore, the computer cannot inspect every track continuously. However, once a potential conflict is detected, the computer will initiate continuous processing until the conflict is resolved.

■ Long range radar has a relatively slow scan rate. Thus, because radar tracking and predictions are based on history, there is an inherent lag. This becomes especially important for military aircraft since rapid or abrupt maneuvers can cause undetected conflict situations.

■ This time lag is the reason that some areas cannot use Conflict Alert—those with extensive military operations involving aircraft maneuvering or extremely busy centers where data entry can fall behind. As a result of these conditions, the system can produce unnecessary or inaccurate alerts, thus forcing the controller to suppress the system for individual aircraft or for the sector.

Terminal areas are a special case. The limited airspace and increased traffic density make the enroute system unworkable. Therefore, the system had to be adapted to the different terminal area environment. The basics of the system are the same—potential conflicts predicated on future position. The difference is in the time and distance parameters. The protective envelope of airspace in the airport area is ¾ of a mile horizontal and 375 feet vertical separation. Outside the airport area, horizontal separation is 1¼ miles.

The major problems within the terminal area are traffic congestion and unidentified aircraft. The Conflict Alert system does not consider such factors as altitude restrictions, so an alert may sound if an aircraft descending to 4,000′ is predicted to overlap the airspace of another aircraft level at 3,000′. Thus, in some cases, the system becomes overloaded. The other serious problem is unknown traffic. Many terminal area facilities cannot track aircraft without transponders. Thus, while on approach, you are protected, from *known* IFR and VFR traffic, but the unknown VFR light plane transiting the area will not trigger the system.

Despite its limitations, Conflict Alert is a valuable tool for controllers and pilots. It can greatly reduce the potential for a midair collision. Yet, despite the rapid advances in capability for Conflict Alert, the following statement from an FAA Advisory Circular on Conflict Alert is worth careful consideration. *"There is no operational program or procedure in current use that will replace the 'see and avoid' practice from the cockpit**. The use of Conflict Alert in no way relieves the pilot of his responsibility for the safe operation of his aircraft as prescribed in the Federal Aviation Regulations." ■

*Emphasis added (Ed.)

Figure 2

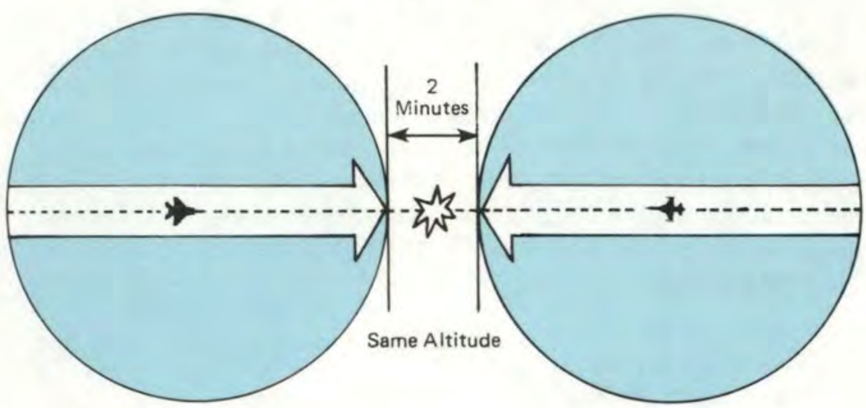
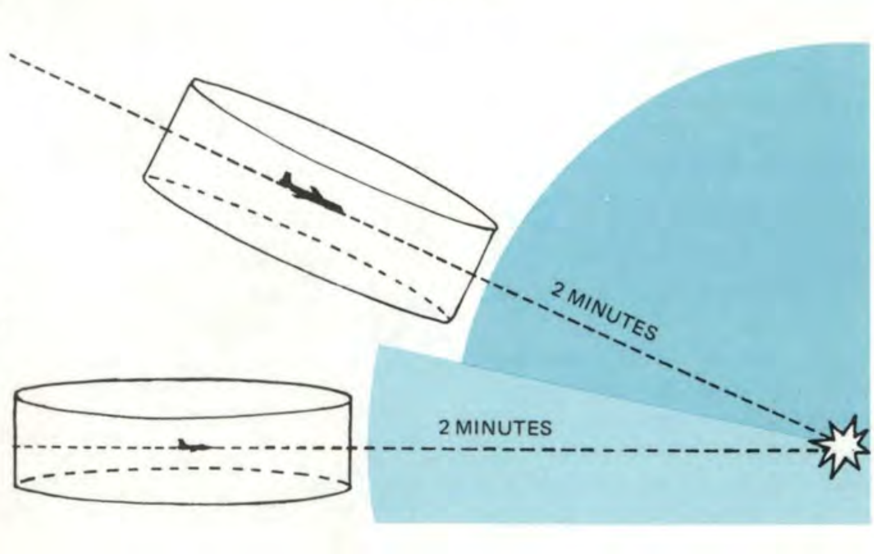


Figure 3



NEWS FOR CREWS

Career information and tips from the folks at Air Force Manpower and Personnel Center, Randolph AFB, TX.

BRIGHT FUTURE FOR TANKER AIRCREW: KC-10 AND E-3A

CAPTAIN STEPHEN R. POPELKA
Bomber/Tanker Career Management Section

AWACS. Sentry. Advanced tanker. The Extender. All these terms describe two new and exciting multiengine additions to the tanker weapon system group. If the smell of a new airplane and the challenge of diversified missions capture your interest, read on. This article will focus on the missions of these new "heavy" aircraft and relate their roles in expanding flying opportunities for crew members.

KC/10

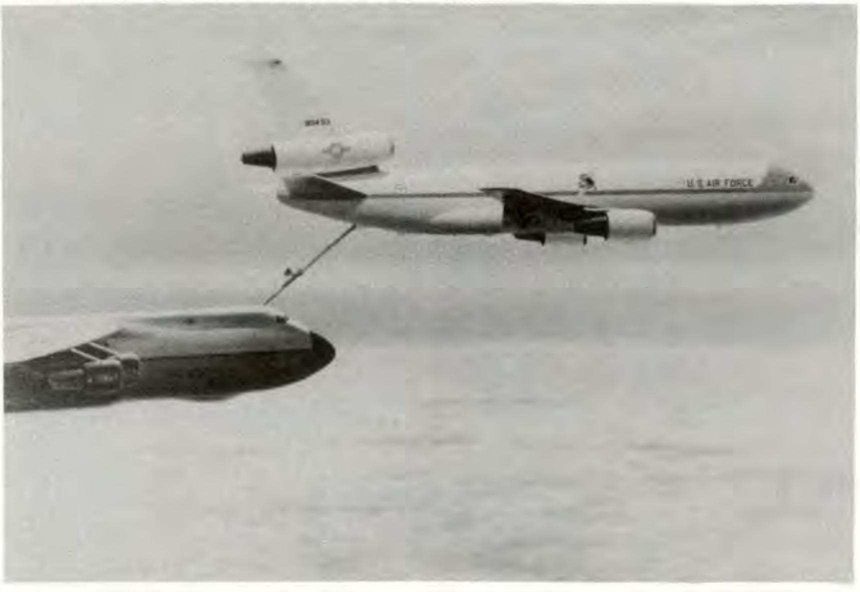
■ The KC-10 will extend the range of US forces, worldwide, with its ability to carry out aerial refueling and cargo missions without significant dependence on foreign basing; hence, the KC-10 has been dubbed the "Extender." A receiver aircraft, the KC-10 is designed to refuel a wide variety of aircraft, including fighters and strategic airlifters flown by other service branches and allied countries. Typically operating from US bases, the Extender can refuel fighters deploying to any trouble spot in the world, while simultaneously transporting essential personnel and support equipment.

The first KC-10 was accepted by the Air Force on 17 March 1981. Based at Barksdale AFB, the aircraft will be owned by SAC; however, the 3:1 crew ratio will be divided equally between active duty and reserve aircrews. The Air Reserve has been a partner throughout the acquisition process. The partnership will continue through the reserve associate aircrew program. The first reserve crew will begin training later this year along with active duty crewmembers. By 1985, 60 crews are forecast to be in place flying a total of 20 KC-10s. Thirty of those crews will be from the Air Reserve. The crew composition consists of pilot, copilot, flight engineer (enlisted), and boom operator (loadmaster qualified). All active duty crewmembers are screened and selected at Headquarters SAC from a list of eligible volunteers. Officer volunteers are selected via Forms 90 and enlisted volunteers are solicited via message from HQ SAC/DO8T. A selection board convenes in conjunction with projected aircraft delivery dates and selects crewmembers from the pool of qualified volunteers. Minimum eligibility criteria follow:

Pilot (1065D) 2,500 hours minimum, total flying time; or 1,750 hours total flying time with one year as aircraft commander in multiplace, multiengine aircraft; or 1,500 hours total flying time with a minimum of two years as aircraft commander in multiplace, multiengine aircraft.

Copilot (1063D), 1,200 hours minimum, total fly-

KC-10, new USAF tanker aircraft, refuels C-5A. Both a receiver and a dispenser of JP, the KC-10 will enhance USAF aircraft mobility.



Opportunities are opening up for KC-10 aircrew positions. Reservists will get 50 percent of the jobs. Goal is 60 crews flying 20 KC-10s by 1985.

ing time; or 1,000 hours total flying time of which 700 hours are 1st pilot/instructor pilot. Qualified KC-10 pilots may upgrade to aircraft commander with a minimum of 2,000 total flying hours and 500 hours in the KC-10.

Boom operators, minimum of three years as a KC-135 boom operator.

Flight engineers, minimum of four years experience of which two years or 1,000 hours were as a fully qualified performance engineer. To date, two boards have selected 11 pilots, 15 copilots, 12 flight engineers, and 14 boom operators. Although most of those selected have been former tanker crewmembers, tanker experience is not a prerequisite, except for boom operators.

All volunteers will be considered regardless of major weapon system identity. Crewmembers desiring a KC-10 assignment should submit an Air Force Form 90 with 1065D (pilots) or 1063D (copilots) in the immediate assignment objectives block or the retraining block.

E-3A

The second multiengine addition to the tanker weapon system is Tactical Air Command's E-3A Airborne Warning and Control System AWACS). Stationed at Tinker AFB, Oklahoma, the primary mission of the E-3A is surveillance, command, and control of tactical and air defense forces. Nicknamed "Sentry," the E-3A is a highly mobile system, ensuring a high degree of flexibility and survivability. The E-3A's worldwide capability means plenty of flying time and the challenge of overseas flying environments. The average E-3A crewmember logs over 700 flying hours per year and can expect 130 - 150 days TDY overseas each year. The success of this unique and growing system has resulted in a continuing need to train crewmembers into the AWACS. The E-3A is fast becoming one of the largest tanker requirements as 22 crews are trained per year.

The "front end" crew consists of a pilot, copilot, and navigator. Since the airframe is similar to EC/RC/KC-135, most Sentry crews are former tanker crewmembers; however, a tanker background is not mandatory. AWACS experience will prepare officers for a variety of staff requirements – not only at the wing level, but in USAFE, TAC, and PACAF as well. All crewmember selections and many staff assignments are made by the AFMPC Rated Officer Career Management Branch. Form 90 volunteers are screened and selected based on criteria listed in AFP 36-6, Assignment Information Directory.

Briefly, the minimum qualifications are as follows:

Pilots (1325T), 2,000 hours total flying time and two years as an aircraft commander; or 1,500 hours total flying time and 500 hours jet time.

Copilots (1323T), 650 hours minimum, total flying time. Copilots may upgrade to aircraft commander after logging 1,500 total flying hours with 300 hours in the E-3A; or 1,200 total flying hours with 600 hours in the E-3A.

Navigators (1565T), no minimum flying hour requirements.

As with the KC-10, the Form 90 is the vehicle to express your volunteer status. A few minutes at the CBPO submitting a new Form 90 can launch your career in a new direction.

Those two new aircraft offer exciting, challenging opportunities for Air Force crewmembers. If an Extender or a Sentry has captured your interest, relay your preference to MPC on a new Form 90. Feel free to contact your career managers at MPC. You can reach the Strategic Tanker Team on AUTOVON 487-6378/6379. ■

GUARD AGAINST FUEL CONTAMINATION

Fuel contamination has caused many accidents in both jet and recip engine aircraft. This article will be of special interest to our people who fly aero club and other general aviation aircraft.

■ In 1978, the National Transportation Safety Board (NTSB) investigated 17 general aviation accidents involving fuel contamination *exclusive* of water as a cause factor, and 66 general aviation accidents involving water in the fuel as a cause factor. Investigation of a recent general aviation fatal mishap revealed that the fuel system showed evidence of extensive water and rust contamination; the underground fuel tank at the airfield where the aircraft was last fueled contained a large quantity of water and rust; the underground fuel tank's filtration system was heavily contaminated; and an incorrect fuel system dispensing filter, intended for use with diesel fuel, had been installed.

Current FAA regulations do not address fuel contamination even for certified airports serving major and regional airlines (air carriers excluding charters and cargo). However, the NTSB's informal communications with the FAA indicated that control of contaminated fuel is considered during airport certification via a rather broad interpretation of Federal regulations. Historically, NTSB's accident statistics do not indicate that fuel contamination has been a problem to air carrier aircraft.

A problem with fuel contamination does exist with airfields serving general aviation aircraft. In March 1980, a field office of the NTSB mailed a questionnaire to all known commercial/air taxi operators in a certain state. Of the operators who replied, 4 percent did not know what type of filtration assemblies and filters they used, 4 percent performed no inspections to determine when the dispensing filters should be changed, 30 percent inspected the dispensing filter daily, and 20 percent inspected the dispensing filter "at least yearly." The remaining operators inspected at intervals ranging from "once every 3 days" to "once every 3 years."

NTSB's recommendations to the Federal Aviation Administration will greatly improve the situation only if the FAA incorporates the recommended controls into Federal regulations. Ultimately, it is the individual aviator/flight crew who is responsible for guarding against taking off with contaminated fuel.

When JP4 contaminated with water is added to a fuel tank, approximately 15 minutes per foot of depth are required for most of the free water to settle to the bottom of the tank (time varies slightly with other fuels). The significance of free water in a fuel sample after this length of time is normally the result of the filtering system on the refueling equipment not being checked or changed and the filter itself being contaminated and no longer effective. Another danger is when an old filter starts to deteriorate internally and particles from the filter are pumped into the aircraft.

Dissolved water contamination can settle out as free water when the fuel is cooled to a temperature lower than that at which the water is dissolved. Such a cooling of fuel is likely at high altitudes, although it is possible that temperature differences can be sufficient for settling of dissolved water during field operations. The differences in temperatures between garrison (asphalt or other surfaces) and the field site may be enough to cause some of the dissolved water to be freed. Warm/hot days with cold/cool nights add to the problems associated with dissolved water in aircraft and fuel trucks. Once the dissolved water is freed, all dangers of "free water" exist.

Contaminated fuel is disastrous. Aircrewmembers and support personnel share a common responsibility for guarding against fuel contamination. It is imperative that all fuel checks be made and samples taken. — Courtesy *Flightfax*. ■

OPS topics

Lightning

■ On climbout from a range, two F-4s were in fingertip formation. As they climbed through cumulus clouds both crews saw a bright flash, the crew of number two heard a loud bang and noted loss of INS heading and attitude reference. The flight recovered with only minor problems and, after landing, confirmed a lightning strike to both aircraft. The strike occurred in clouds right at the freezing level, almost ideal conditions for lightning.

Thermal Runaway

The first time the T-39 ground crew from another service tried a battery start they found the battery too low to fire the ignitors. External power was applied to the utility plug and the battery charged for about 12 minutes. The engines then started and were run for 10 minutes to charge the batteries. Later, when the pilots attempted a start (the third of the day), they could not make a start. The aircraft was started from external power and proceeded to taxi. A tech rep and maintenance officer observing the procedure were concerned about the possibility of battery damage, so they had the aircraft recalled. Inspection of the batteries upon return showed that thermal runaway was in progress. Had the aircraft continued the flight, an explosion was probable.

Hatch Trouble

While the radar team was loading their flight gear and stowing equipment on the lower deck of a B-52D someone or something pulled the radar nav's hatch jettison handle. The system then worked as advertised. The lower deck of a B-52D is cramped at best. But then so are many other aircraft. The problems of stowing equipment and strapping in have caused many problems over the years. This is a case where a little extra care and patience can prevent a lot of damage and embarrassment.

Rush! Rush!

The day had not started well for the C-130 crew. The enlisted crewmembers ran into several hassles getting checked out of quarters. That, coupled with an aircraft change, made them about 40 minutes late for starting their preflight duties. Then, the new aircraft was not rigged as it should have been before crew show time. The crew rushed through the rerigging but before they could finish, the load arrived. They quickly loaded the aircraft but then had to down load because they had neglected to pin out the unused cargo locks in the dual rails. For the second time, the platforms were loaded and inspected. By now the crew was starting engines and the loadmasters completed the remaining ground checklists. The aircraft was now one hour late with only twenty minutes remaining until drop time. The takeoff was uneventful and the aircraft joined the formation prior to the IP. The crew set up for the drop run slowing the aircraft and lowering the ramp door. Then when the left hand locks for the aft platform were released, the platform exited the aircraft unexpectedly. The investigators discovered that the right hand locks had not engaged, and the crew, in their haste to make the drop time, had not caught the malfunction.

In A Scrape

As the F-15 crossed the overrun, the pilot initiated a flare slightly higher than normal. The aircraft started to sink, and the pilot corrected with pitch rather than power. At touchdown, the nose was in excess of 17 degrees high. The RSO saw the tail scrape the runway.

continued

OPS topics

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Fuel Crunch

As the aggressor pilot returned to base, he was directed to hold for traffic departing in the opposite direction. The pilot started a climb to FL 200 and declared minimum fuel. At this point, the F-5 had 900 lbs of fuel. After the traffic was clear, the pilot made an idle descent to a short initial. At level off the fuel remaining was 700 lbs. Since airspeed was high, the throttles were left in idle to reduce speed. Over the runway, the pilot initiated a 6 - 7 G turn to downwind. In the turn both engines flamed out. The pilot rolled wings level, got both engines started, and made an uneventful landing. The most probable cause of the flameouts was shifting of the fuel under high G which allowed air into the fuel lines. Once the aircraft rolled wings level, the fuel returned to a normal state, and the engines relit.

Subtle Failure

The two F-4s touched down normally and deployed chutes without a problem. At 120 knots the pilot in lead lightly touched the brakes and felt some deceleration. Then with 5,000 feet to go the pilot commenced normal braking at 110 kts. However, after 1,000 more feet, the aircraft was still traveling at 100 kts. The pilot applied more brake pressure, but there was no appreciable difference. The antiskid switch was on with no failure light. Believing that the antiskid had failed, the pilot turned it off and commenced manual braking. In the process of stopping, both tires blew. The aircraft finally stopped by engaging the MA-1A with the hook. Electrical failures in the antiskid system caused the system to intermittently sense a locked wheel and release brake pressure. There was no failure light and no clear indication of brake failure. As a result, the pilot did not immediately recognize the failure and so did not lower the tail hook (he was also concerned about his wingman in the event of an engagement).

A Traffic Problem

The base was preparing for an open house. As a result, aircraft were being parked opposite to normal parking. This, and other open house preparations, contributed to unusual amounts of activity on the flightline. A Cessna 152 was cleared to land, but as the aircraft approached the 2,000 foot marker (still airborne), tower saw uncontrolled vehicles crossing the departure end of the runway. The Cessna was sent around. On the second approach the same thing happened. The third time, the landing was without incident. The unusual activity had led some drivers to believe that the normal flightline driving restrictions had been lifted. Such unusual activity as an open house requires extra care on and around flightlines and runways.

Near Misses

It's summer and that means more general aviation traffic. As a reminder, here are two recent occurrences.

A B-52 was on a visual bomb run at about 600′ AGL. The gunner saw a light colored, high wing aircraft which had just passed 300 feet above the bomber. Neither aircraft took evasive action.

While on a low level route, an F-4 pilot cleared in front of the aircraft then looked inside to check his map for position. When he glanced up, the windshield was filled with a gold and white light twin engine aircraft. The estimated miss distance was 100 feet.

In both cases the weather was VFR, but the aircraft were light colored and hard to see. That, combined with the fact that at low altitude radar is not completely reliable, makes an alert, roving visual scan the only solution. ■

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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.

SECOND LIEUTENANT

Albert R. Wallace

82d Flying Training Wing
Williams Air Force Base, Arizona

■ On 2 October 1980 Lieutenant Wallace, a student pilot, was flying an advanced solo contact mission in a T-37B. Approaching the vertical position in his first practice maneuver, a loop, he heard sounds described as shotgun pellets penetrating sheetmetal followed by a metallic grinding noise. These sounds were accompanied by a sudden loss of thrust, aircraft yaw, and rapidly diminishing airspeed. He immediately aborted the loop by transitioning to a vertical recovery. During his recovery, the nr 2 engine rpm rapidly decreased toward zero. Upon reaching level flight, Lieutenant Wallace observed the nr 1 engine overheat/fire light illuminate, and instruments indicated that the nr 2 engine had failed and seized. Following nr 2 engine shutdown, he selected 100 percent oxygen, placed the cockpit air lever to vent, and turned his attention to the nr 1 engine overheat/fire light. Because the nr 2 engine had failed, Lieutenant Wallace could not apply the corrective action (shut down the nr 1 engine) to his only operating engine. The only supporting indication of a nr 1 engine overheat/fire was a slight amount of cockpit smoke, but this also could have been associated with the nr 2 engine failure. Lieutenant Wallace declared an emergency with the controlling agency and requested direct routing to the auxiliary field, the nearest suitable landing area. He then contacted the Supervisor of Flying (SOF); however, before he was able to fully explain his situation to the SOF, the cockpit suddenly filled with a dark, suffocating smoke coming from behind and between the seats. Lieutenant Wallace immediately returned to the controlling agency to update his emergency status and to inform them of a possible bailout situation. With dense cockpit smoke severely restricting visibility and causing his eyes to burn and water, Lieutenant Wallace jettisoned the canopy and began preparations for abandoning the aircraft. Approximately 20 seconds later, with the cockpit smoke continuing unabated, Lieutenant Wallace ejected. Elapsed time from beginning the loop to ejection was less than four minutes. Investigation revealed that the nr 2 engine seized when a bolt failed in the main bearing assembly and lodged in the accessory drive gears. The nr 1 engine overheat/fire indication and cockpit smoke were caused by a ruptured rear bearing oil pressure hose. Lieutenant Wallace's rapid and accurate assessment that the aircraft could not be recovered and his timely ejection prevented the loss of a valuable crew member. WELL DONE! ■

SAFETY AWARDS

CHIEF OF STAFF SPECIAL ACHIEVEMENT AWARD

832d Air Division
Luke Air Force Base, Arizona

The Chief of Staff Special Achievement Award is presented to the 832d Air Division, Luke Air Force Base, Arizona, for outstanding flight safety accomplishments.

During 1980, the combined tactical units of the 832d Air Division flew more than 52,000 hours of tactical fighter operations without a Class A aircraft mishap. That was the first year that Luke Air Force Base had not lost an aircraft since the base was established. Attaining that accident-free record while performing a demanding combat training mission in high performance aircraft, the 832d Air Division exhibited high standards of both safety and mission accomplishment that reflect credit upon the Division and the United States Air Force.

THE DIRECTOR OF AEROSPACE SAFETY SPECIAL ACHIEVEMENT AWARD FOR 1980

is presented to

Major John H. Smith
178th Tactical Fighter Group
Ohio Air National Guard
Springfield Municipal Airport, Springfield, Ohio

Major John H. Smith demonstrated superior airmanship during an inflight emergency by preventing the loss of his life and the aircraft he was flying as number 2 in an A-7D ground attack mission. While cruising at 500 feet and 300 knots, the aircraft collided with a large white sea bird. The impact shattered the left quarter panel, which, along with bird remains and other debris, struck Major Smith in the face shattering his visor, visor shell, eye glasses, and breaking his nose. Although blinded, temporarily without communications, and separated from his leader, Major Smith maintained control of his aircraft. After regaining partial sight in his right eye, but hesitant to attempt clearing his left eye because of glass fragments, Major Smith, with help from Center and a chase aircraft, flew 65 miles over water to Naval Air Station, Barbers Point, and successfully landed his aircraft.