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FLYING Safety

MAGAZINE

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This Issue:

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HQ AFSC Photo by TSgt Michael Featherston

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FSM notams

MECHANICS OF THE HUMAN MIND

Courtesy ASRS *Callback* #248, Feb 00
NASA's Aviation Safety Reporting System

A general aviation pilot rushed to make a VIFNO (Void IF Not Off by) departure time for an IFR flight at night. Once in the clouds, he suffered a gyro failure and subsequent disorientation. He reported to ASRS that his prior instrument and simulator training were unequal to the "mechanics of the human mind" experienced during the incident:

I filed an IFR flight plan. I filed and received a void clearance to depart...less than 10 minutes from the time it was issued. I quickly preflighted the aircraft, started the engine, taxied to the runway and performed a fast prop and mag check. I departed...and called Approach on climbout and heading 220... While I made radio contact with Approach, I noticed the attitude indicator showing a bank in excess of 50 degrees, while the heading indicator appeared to be spinning. I tried to roll wings level with the turn coordinator, but found myself losing altitude quickly... I was able to recover below the cloud deck and asked Approach for heading and distance to departure airport. I remained VFR and landed.

I feel several factors led to this:

(1) My accepting a clearance which left me little time to prepare the aircraft and myself for a flight in night IMC.

(2) The aircraft was probably running for 5 minutes or so after sitting outside for two days in 40° damp weather. This didn't allow enough time for the gyros to completely spin up. The attitude and heading gyros are older units with many years and hours of service. These will be overhauled.

(3) Partial panel procedures. All my initial and recurrent partial panel training has been accomplished using suction cup style covers over the attitude and heading indicators. In this actual event, I found it difficult to ignore the erroneous information presented by these instruments. I found myself overcorrecting and my instrument scan diminished and was more fixation than scan. I wish there were an acceptable method of reducing vacuum to create a realistic partial panel training environment. This [would] help pilots to modify their instrument scan and 'tune out' the failed gyros.

(4) I found [that] my thought processes and instrument scan declined with the seriousness of the situation. When faced with unusual attitudes [at] 2,000 feet or less AGL, decision-making ability suffers and thought processes narrow and become focused on one aspect of the situation instead of analyzing and evaluating the whole situation. Practicing unusual attitudes under a hood with an instructor cannot create the fear and alarm needed to enlighten the pilot on the mechanics of the human mind.

While our reporter searches for improved training aids for partial operations, he plans to work with an instructor on gyro failure and other emergencies.

Microburst: An Aviator's Worst Nightmare

Microbursts can occur anywhere, normally from spring through fall in the United States—thunder storm season.

MAJ DAVID T. LAWYER
HQ USAFA/DFEG

"Boy, this is a really strong rain shower!" exclaims Charles Phipps, Delta Airlines training Captain, retracing the 2 Aug 85 flight of Delta 191 in a flight simulator. Using data from the flight recorder, Captain Phipps experiences the ill-fated approach into the Dallas-Forth Worth airport shortly after 1800 local time. "We're losing some airspeed…strong tailwind. Wow, look at the tailwind! Come on baby, you can fly! Come on, come on, fly baby, you can make it, come on, come on…oh…aghh…"

The plane slams down in a field, careens across a freeway, enters the airfield at full speed, and smashes into two four-million-gallon water tanks before coming to a complete stop. The wreckage is scattered over several hundred yards, with 137 bodies strewn over the airfield.

Investigation revealed that the mishap was caused by a strong microburst, first noticed over the northwest portion of the airport. What appeared to be just a "typical" rain shower turned out to contain winds strong and turbulent enough to cause the pilot to lose control upon approach. Could it have been avoided? Perhaps. Could the pilot have aborted the landing in time? Maybe. Were there telltale signs that the pilot could/should have used to make (in this case) a better decision? Probably.

The purpose of this article is to provide a refresher on microbursts, including identifying when and where they occur frequently, visual recognition clues of their presence, and a report on the latest advances in microburst detection.

What is a Microburst?

A microburst is a small-scale (usually less than four kilometers across), short-lived, intense downdraft characterized by a strong core of cool, dense air descending from the base of a convective cloud that produces hazardous low altitude wind shear. Microbursts can occur anywhere, normally from spring through fall in the United States—thunderstorm season. They occur most frequently between 1200 and 1800 hours local time, with maximum occurrence between 1500 and 1700. Observations have shown that about five percent of all thunderstorms are capable of producing a microburst. Microbursts are typically only a few hundred to 3000 feet across. As a microburst contacts the ground, it usually fans out in a radial pattern (see Figure 1), which can produce headwind-to-tailwind speed differences greater than 50 knots. Because of their small size and rapidly changing wind conditions over very small distances, extreme wind shear conditions often exist. Most microburst winds intensify just after ground contact and typically dissipate in about 10 to 20 minutes.

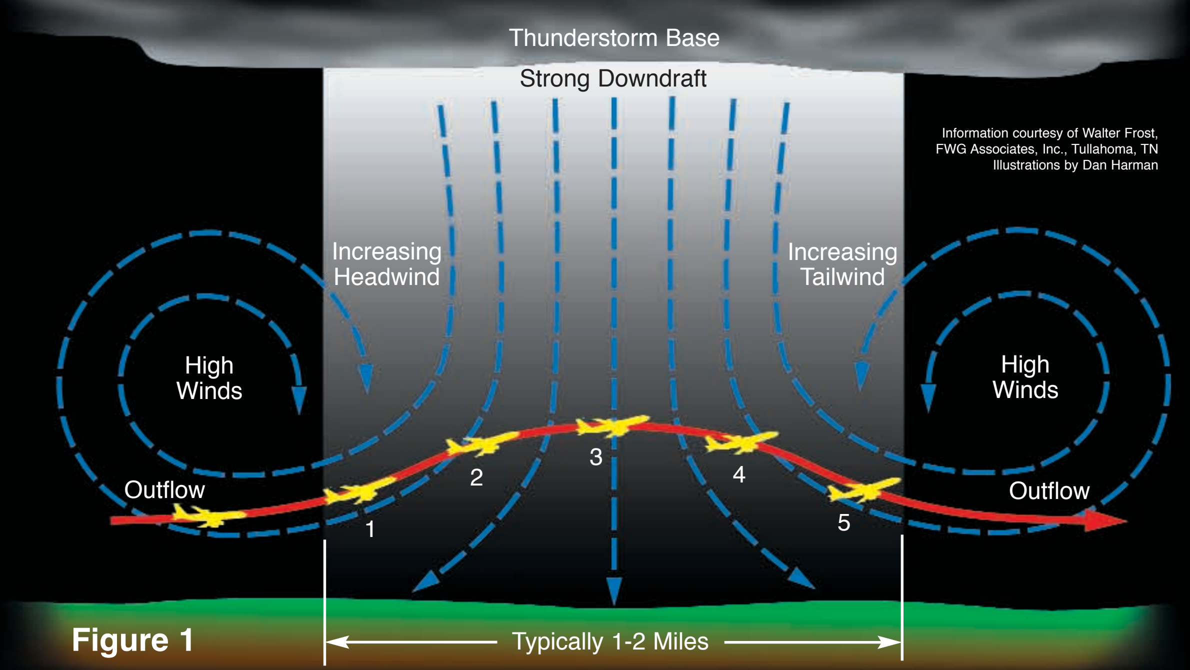

Figure 1

1. Aircraft first encounters a headwind and experiences increased performance...

Followed in quick succession by:

2. a decreasing headwind component

3. a downdraft

4. a strong tailwind

2-5 result in decreasing performance of aircraft.

5. Represents an extreme situation just prior to impact.

Are There Different Types of Microbursts?

There are basically two types—*wet* and *dry*. The main distinguishing characteristic between the two is the prevailing environment in which they are produced. Dry microbursts, as the name implies, develop in an extremely dry environment where moist convection is just barely possible. They often occur from the front range of the Rocky Mountains to the Western Plateau region. The atmosphere is moist at high altitudes, but at lower altitudes conditions are exceedingly dry.

The process of a microburst begins when the updrafts in a convective-type cloud can no longer support the weight of the ice and water particles. As the particles begin to fall, they drag the air downward, causing a downdraft. This is the beginning of a precipitation-induced downdraft. The downward motions are strengthened when air from outside the cloud is mixed with saturated air of the cloud. As the moist air descends through the cloud and eventually below the cloud deck, evaporation of the water particles further cools the air and increases the downward motion. In addition, snow melts at lower elevations, contributing to the cooling of the air and the strength of the downdraft. If the cloud bases are high enough and the air beneath the cloud dry enough, rapid cooling takes place, resulting in strong, downward-rushing air. Because of the lack of abundant moisture, much of the precipitation evaporates before it reaches the ground (called virga) (Figure 2). However, in the dry microburst, the air continues to rush downward, striking the ground at speeds approaching 25 knots—in some cases, wind speeds may approach 100 knots!

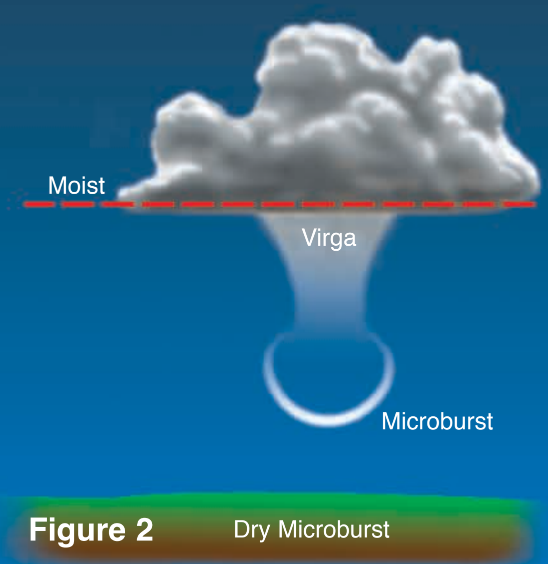

Figure 2 Dry Microburst

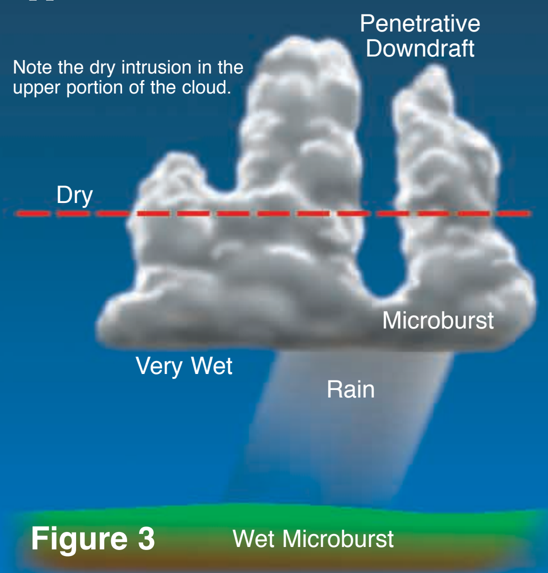

Figure 3 Wet Microburst

continued on next page

The only evidence that a microburst may be occurring is blowing dust on the ground beneath the cloud. Once the air reaches the ground, the wind spreads outward radially and will often curl upward along its outer boundary (see Figure 1). If the winds are strong enough, the air will curl upward and back over the outward rushing air. An aircraft that encounters a headwind of 40 knots with a microburst may expect a total shear of 80 knots across the entire microburst and the direction may reverse 180 degrees across the centerline of the microburst. Amazingly, all that I've just described, from the initial downdraft to the final dissipation of the microburst, can happen within 10 minutes. Unfortunately, with the speed at which microbursts occur, pilots have little time to react once their aircraft encounters that first gust.

In sharp contrast, wet microbursts generally occur with thunderstorms which are embedded in heavy precipitation. These often occur in very humid environments, typical of areas east of the Rocky Mountains. The atmosphere is usually moist through a very deep layer, except for an elevated dry layer (Figure 3). If the elevated dry layer is cold enough and high enough above the ground, as precipitation occurs there is enough energy to drive a severe downdraft. All of the processes are similar to the dry microburst, except heavy rainfall accompanies the strong wind shear environment. Once a pilot encounters this type of microburst, it is even more difficult to maneuver, due to the low visibility. However, from a distance, these are easier to spot.

The only evidence that a microburst may be occurring is blowing dust on the ground beneath the cloud.

What are the Visual Clues?

Nature does provide pilots with visual clues of microbursts that can help them avoid flight into hazardous conditions. Obviously, not all of the microburst situations are the same, but hopefully these examples will provide enough useful information for identification.

A dry microburst is shown in Figure 4. Notice there is no visible connection between the cloud base and the ground, except for the presence of a small area of virga just above the dust rings. This virga and curling of the dust along the outer edge is evidence of a strong shear environment between the cloud and the ground. Figure 5 is the same microburst a few minutes later. Note how the cloud along with the virga is farther downwind from the blowing dust on the ground. This is often the case in a strong wind shear environment.

Figure 4 A dry microburst (small ring of dust, bottom left) just beginning to form under a prominent virga shaft (top center) extending below the high base of a cumulonimbus.

Figure 5 Moments later in the same dry microburst of Figure 4.

For wet microbursts, there is a definitive, visible connection (usually a rain shaft) between the ground and the cloud (Figure 6). Lightning frequently accompanies this type of microburst and is an indication that downdrafts are present. (Since air is a poor conductor of electricity, the downdraft helps distribute the charge through rainfall from the base of the cloud to the ground. Once the downdraft/precipitation approaches the ground, the negative earthward-flowing charge is able to "meet" the upward-flowing positive charge, thus connecting the charges to produce lightning.)

continued on next page

Unfortunately, with the speed at which microbursts occur, pilots have little time to react once their aircraft encounters that first gust.

Figure 6 A wet microburst on 20 May 1974, characterized by a well-defined foot-shape on the left side of the rainshaft.

Figure 7 is a series of sequential photographs from the descent of the microburst to the radial spreading of the winds upon contact with the ground. These phenomenal photographs were taken within a five-minute period!

Figure 7

Over a 20-year period (1976-1996), approximately 43 percent of U.S. aircraft accidents were considered to be caused by wind or wind shear.

Has Microburst Detection Improved?

To answer this, we have to start from the beginning. In 1976, the Low Level Windshear Alert System (LLWAS) was first developed, consisting of a centerfield wind sensor and five other sensors placed along the periphery of the airfield. Over the next 11 years, LLWAS was installed at 110 Federal Aviation Administration (FAA) towered airports. The LLWAS's primary function was to detect large-scale events which created wind shear. However, it was not designed to detect microbursts and, in fact, false wind shear alerts were common. To help resolve this problem, from the mid 1980s to the early 90s, Terminal Doppler Weather Radars (TDWR) were installed at 41 major airports around the country. Detection accuracy increased from just 20-35 percent with LLWAS to nearly 95 percent with the TDWR. Also during this period, all of the LLWASs were upgraded with new hardware and software, further improving detection of microbursts/wind shear to around 98 percent.

However, due to the high cost of the TDWR (about $9 million per site), Massachusetts Institute of Technology's Lincoln Laboratory developed a Weather Systems Processor (WSP) add-on to the Airport Surveillance Radar-9 (ASR-9) that would provide wind shear warnings at 35 airports at significantly reduced costs. From the late 1990s through early 2001, the Integrated Terminal Weather System (ITWS) was developed to tie all the various detectors (TDWR, ASR-9, NEXRAD, LLWAS, etc.) into one integrated system. Currently, ITWS supplies weather and warning products to pilots, air traffic controllers, supervisors and traffic managers (See Figure 8 for the latest National Alert System for wind shear). Additionally, ITWS has archive capability for incident or accident investigations.

Conclusion

Since the early 1970s, microbursts have been known to cause severe wind shear for many pilots upon takeoff and approach. Over a 20-year period (1976-1996), approximately 43 percent of U.S. aircraft accidents were considered to be caused by wind or wind shear, resulting in over 600 fatalities. From visual recognition, to anemometers strategically placed around the airfield, to sophisticated radars and automated computer systems, microbursts are not as elusive as they once were.

Pilots need to better understand microburst processes and make good decisions based on the visual clues and observations from the NAS wind shear product system. Keep in mind that even though we have the latest and greatest technology available for our use, the final decision is still up to the pilot. It's up to you to "Fly safe"!

Detection accuracy increased from just 20-35 percent with LLWAS to nearly 95 percent with the TDWR.

Illustration by Dan Harman

Figure 8

AIR FORCE SAFETY CENTER 2002


USAF Photo by MSgt Patrick Nugent

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January

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USAF Photo by SSgt Phil Schmitten

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USAF Photo by TSgt Fernando Serna

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2002

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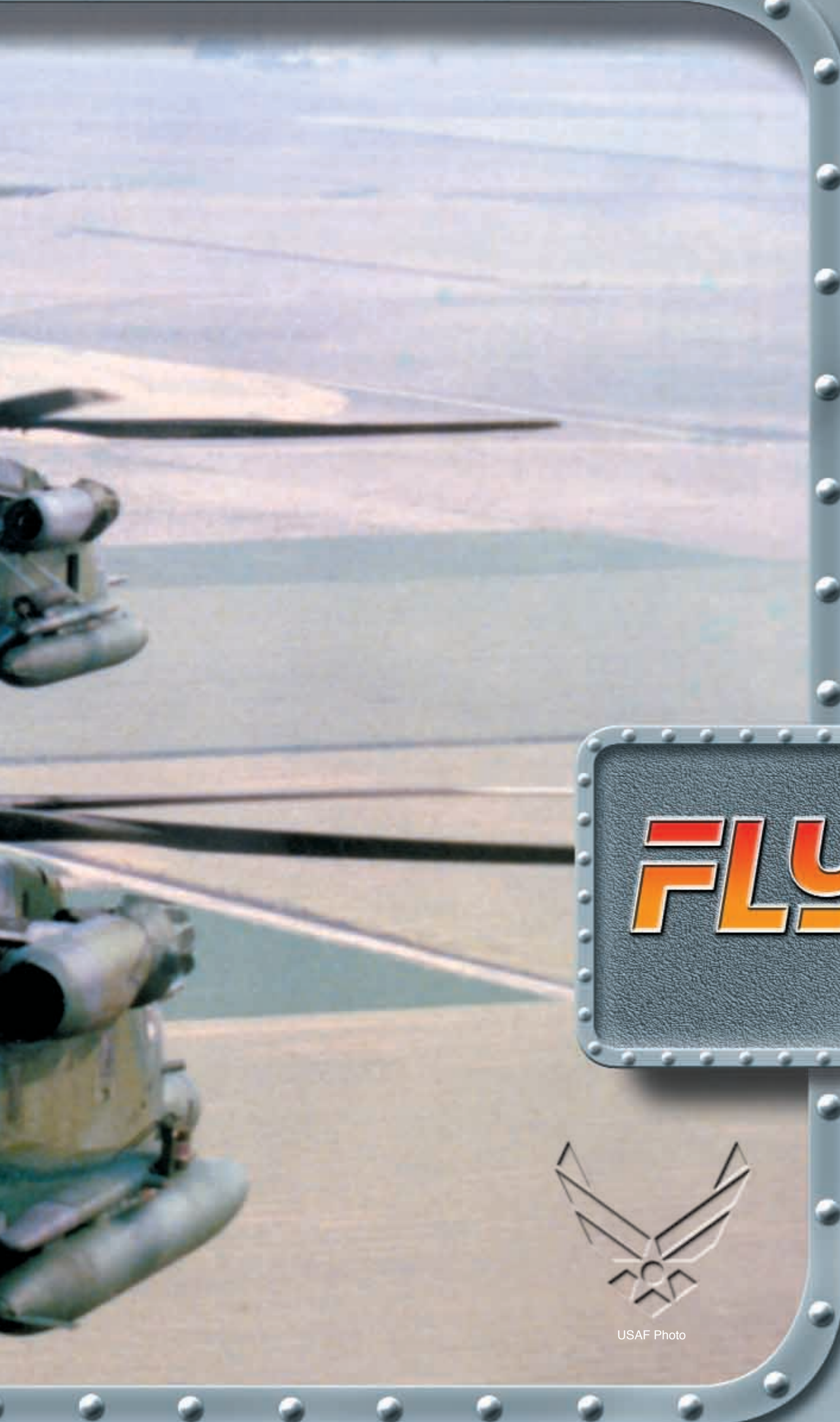
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USAF Photo by SSgt Alan R. Wycheck

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September

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USAF Photo by MSgt Boyd Belcher

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November

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December

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In The Hole

CAPT STEVE SCHNELL
89 AS
Wright-Patterson AFB OH

What the IP didn't know was that the taxiway had been closed since his last trip.

Make whatever analogy you like: Three links in the safety mishap "chain." Three factors in the safety mishap "equation." Just one break in the chain, or one factor removed, and the Navy T-2 Buccaneer would have departed Base X with no delay. Instead, it left three days later, after waiting on a new tire to replace the one destroyed in a "collision" with a four-inch hole, right in the middle of a *closed* taxiway. Fortunately, the damage was limited to one cut tire, and not a strut or the entire landing gear.

How the aircraft got there is our story. The lessons learned may help others avoid future, more costly taxi mistakes. There are three areas that could have prevented the outcome: aircrew, airfield operations and control tower.

The Aircrew

The instructor pilot (IP) and student pilot (SP) filed a stopover flight plan, and planned a brief layover for a weather update and a bite to eat. They stepped to their jet with the sun rapidly falling in the west, and fired up for taxi. The IP, having been to Base X numerous times, admitted to a familiarity with the airfield and the (mishap) taxiway, since it is the most commonly used entrance to/exit from the ramp. What the IP *didn't* know was that the taxiway had been closed since his last trip. On the other hand, the SP acknowledged he was aware the taxiway was closed, but didn't communicate this to the IP. As a result, when the IP began his taxi, he headed toward the intersection of the open taxiway and a small portion of the closed taxiway which extended slightly into the open taxiway. As he turned, now head-on for the extended area of the closed taxiway, he turned *off* his landing lights so as not to blind oncoming traffic, because he was heading opposite landing traffic. As the IP taxied farther he noted small, barely visible, flashing yellow lights to his left, similar to roadwork signs you'd see on signs marking highway construction. He failed to see any on his right until he had advanced *well past* the signs in the closed area. He probably sensed something was very wrong and, at this point, without notifying tower or Base Ops, attempted to 180-it back the way he had come. Unfortunately, he planted the right main gear in a four-inch hole in the middle of the closed taxiway (imagine that!). Next, instead of stopping and requesting assistance, the IP elected to power out of the hole. Using a moderate amount of thrust and knocking over some of the yellow lights in the process, he managed to free the Buccaneer and returned to parking to examine the aircraft. One damaged tire later, the air-

Photo Illustration by Dan Harman

crew headed to billeting for what turned out to be a few more days of Base X hospitality. If the story ended here, it would be one fraught solely with "operator error." It does not.

Airfield Operations

The night prior to this incident, airfield ops personnel had elected to *remove* numerous orange plastic 50-gallon drums, which were marking the closed taxiway. They were removed to avoid a taxiing KC-10's jet-blast from blowing them over. They were never put back. In their stead, flashing yellow lights (at least one was inoperative by dusk) were placed on the taxiway. However, the time of day (dusk), combined with the lights' proximity to the ground, made it nearly impossible for a low-seated aircraft like a T-2 to see them.

Control Tower

The controllers in the tower also played a critical role in this mishap. At engine start, the IP called the tower and advised "negative information," since he was unable to receive the transmitted ATIS advisory information (which included the closed taxiway information). The tower acknowledged his radio transmission, but responded to the IP by giving him "runway in use, winds, and altimeter." There was no mention of the closed taxiway. Incidentally, for those of you screaming for the IP to read his NOTAMs, this type of airfield advisory information is *not* NOTAM material! Additionally, the tower had inadvertently turned on *all* taxiway lights—including the ones for the closed taxiway—as darkness descended on the field. This helped give the IP a false sense of comfort in his taxiing.

Lessons Learned?

You bet! For starters:

- The orange drums were put back in place.
- The IP acknowledged the dangers of complacency, especially those associated with familiar fields.
- Hopefully, the SP will never again be silent to a mishap-in-progress as he continues pursuit of his wings.
- The tower has added procedures to avoid inadvertent switching *on* of lighting on closed taxiways.
- The tower also briefed all its controller crews on items to be instructed when a pilot has "negative information."

All three factors—aircrew, airfield ops and control tower—contributed to a minor mishap that could have been more significant.

For you safety junkies, this is another perfect example of the safety chain (or equation), and how just one link (factor) removed could have prevented the result. To avoid adding to mishap statistics, keep those proverbial bolt-cutters (or erasers) handy!

If the story ended here, it would be one fraught solely with "operator error." It does not.

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

"Just Gimme The *What*, Coach, And I'll Figure Out The *Why* Myself"

This column frequently regales you with true stories of the *mental* mistakes made by your fellow operators. For this month's column, Ops Topics focuses on events that more properly belong in the realm of the *physiological*. Natch, you will see a definite connection to the "mental" that *culminates* in a "physiological"—as when an aviator makes a conscious decision to fly when not fully prepared, forgets the basics of flying, flies when ill, etc. Still, the focus here is primarily on *what* happened, rather than *why* it happened. No admonishment, pontification or editorializing here—you get to decide for yourself *why* something occurred. No doubt, your "why" will serve you better than anything we could provide …

***What* Happened: Number One**

The mishap pilot (MP) was flying aerobatics training to maintain currency. On reaching the designated airspace, the MP got with the profile and had no problems until he performed an aileron roll with his aircraft between two cloud decks. Using outside references alone, the MP maneuvered wings-level (to what appeared to be) right side up, then pulled back on the stick to regain altitude and have a little more fun. In fact, the MP's fun was *already* over, because his aircraft was inverted. Pulling back on the stick just turned him into a missile, accelerating ever faster toward terra firma. Fortunately, the MP realized he was experiencing spatial disorientation (SD) before it was too late and successfully recovered, using—what else?—cockpit instruments.

***What* Happened: Number Two**

This MP was also flying a local training sortie. He arrived at altitude and initiated some G-warm-up exercises prior to beginning scheduled events, but started feeling unwell after a final warm-up AGSM (anti-G straining maneuver). The MP's "unwellness" was so acute that he had difficulty executing planned maneuvers. Concluding it was just a touch of airsickness, the MP took a short breather, then continued the mission. Continued, that is, until he once again experienced difficulty executing intended maneuvers.

The MP wisely decided to curtail further flying and returned to home station where he sought medical advice. Once the Flight Surgeon learned the MP had been experiencing fatigue, head pain, extremity pain and some uncontrollable shaking at altitude, he decided the MP was suffering from something more than a simple case of airsickness, like maybe…Type II decompression sickness (DCS). The Flight Surgeon immediately got the MP to a hyperbaric chamber for treatment.

Airsickness, hypoxia and DCS all share some common symptoms. If you ignore the warning signs when you don't feel "right" and decide to gut it out for the sake of preserving an image of invulnerability, you're only fooling yourself. A bout of airsickness *might* make you wish for death. But hypoxia or DCS *will* kill you. Symptoms of hypoxia and DCS—particularly Type II DCS—require immediate recognition and corrective action to prevent incapacitation, permanent injury or death. Leave the invulnerability shtick to Superman.

What Happened: Number Three

The mission was planned as a night vision goggle (NVG) surface attack sortie, with a profile that included low-level work. The mishap pilot (MP) knew there would be little ambient light due to nighttime, winter weather flight conditions. Planning, briefing, preflight, start and takeoff were all uneventful.

Flight to the range in NVGs and entry to the low-level route went as expected, as did the low-level run at 1000 ft. AGL—until the aircraft's systems commanded a "fly up" maneuver. Just after flying above the pre-briefed minimum safe altitude (MSA), and while still in a relatively shallow climb, the aircraft entered weather. The MP pushed the nose over gently to return to the MSA and descended right through it, evidently unaware he was continuing to descend. The aircraft systems caught the descent though, and correctly commanded another "fly up." The aircraft pitched to re-establish a positive climb back up to the MSA, when the MP overrode the automated system. Despite the fact his aircraft was in a low-angle dive, the MP felt he was still climbing and pushed the nose over even more.

Pause, now, and put yourself in this pilot's place: It's nighttime and you're on NVGs. Maybe you can't shake the feeling something's not quite right, but you never check your aircraft attitude (30 degrees nose-low), airspeed (accelerating through 500 knots) or altitude (descending through 2000 ft. AGL). What would you do? Luckily, the MP's training kicked in—or maybe his Spider-Man senses just started tingling?—because he suddenly got lucky on several counts:

- With the rest of his life measurable in milliseconds, he guessed correctly and pulled back hard on the stick.
- He exceeded aircraft G-limits during the pull-up, but the wings stayed on.
- He didn't GLOC (G-induced loss of consciousness) from the hard pull.
- Despite forgetting the "Recognize—Confirm—Recover" rubric, he survived. Too many don't.

Didja notice how, until now, we never once mentioned anything about spatial disorientation (SD) and the folly of choosing to trust seat-of-the-pants instincts more than cockpit instruments? Regardless if you fly by yourself or as part of a crew, situational awareness is something you can't live without (no pun intended), especially when flight conditions are ripe for an episode of SD. From low-level entry to life-saving pull-up, the MP's unrecognized, near-rendezvous with the Grim Reaper developed in just over one minute. As Mark Twain said, "It's better to be careful a hundred times than to be killed once."

What Happened: Number Four

Student pilots are, by definition, inexperienced. Instructor pilots, old pros in mishap prevention, provide the lessons and techniques students use to fly mishap-free for an entire career. Flight data recorders, voice recorders and videotape recorders found in many of today's aircraft have also proven themselves crucial to mishap prevention. They allow reconstruction of inflight events so that lessons learned can be passed along to the student and the experienced aviator alike, so mistakes aren't repeated. Consider the following example…

The sortie was scheduled as a two-ship B-course syllabus, high-aspect BFM mission, with the IP as No. 1 and the mishap student pilot (MSP) as No. 2. The mission was uneventful through the third set. The fourth set consisted of a 2.5 mile perch setup with the MSP offensive. After entering the turn circle and completing 120 degrees of turn, the MSP called "Terminate." Reason? The MSP stated he'd gotten behind in his AGSM (anti-G straining maneuver) and grayed out a little, but was now fine.

Even though the next setup was uneventful, the MSP reported the Gs were still a little tough to handle, but he was managing Okay. The IP counseled the MSP on G-strain techniques and the flight proceeded to execute a sixth, and final, engagement, another 2.5 mile perch with the MSP again offensive.

During this engagement the MSP pulled more than eight Gs through 150 degrees of turn before relaxing the rate to a single G. His aircraft attitude went from a 90-degree roll, 13 degrees nose low to 120 degrees of roll, 35 degrees nose low. Six seconds after relaxing to one G, the MSP rolled his aircraft to wings level, pulled eight-plus Gs to regain lost altitude and declared "Knock it off." Reason? He was still getting behind on the Gs. Hmmmmmm… The flight then headed home for an uneventful landing. The MSP's aircraft was impounded and given a thorough checkout by unit Maintainers where all aircraft equipment and systems were judged to be functioning as advertised.

Hindsight—our ever-present companion with 20/20 vision—leads us to speculate a more experienced aviator would likely have called it a day after having difficulty getting on his AGSM the first couple of times in order to preclude the possibility of a GLOC (G-induced loss of consciousness). Could this have been the MSP's last flight? Sure. If a parameter or two had been altered slightly—say, available altitude—this student pilot could easily have ended up a smoking hole.

Just conjecture on our part, but we posit that this student pilot, his peers and the entire instructor cadre subsequently did some serious reflection on circumstances and motivations that preceded this near-Class A mishap and have since taken positive steps to avoid a similar event.

The term "I can hack it" is synonymous with "G.I." But when "hacking it" overrides common sense and good judgment, you've set yourself up to become a casualty, just as surely and effectively as if the enemy shot you down.

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

Maintenance Matters Presents…The "*Why*" Edition

This isn't the "*why*" used in the interrogative, as in "Why do we have to do that?" This "*why*" is the one used in the affirmative, as in "This is *why* bad things happen to good people who get complacent (or don't use tech data, or don't consider the consequences of their actions, etc.)." Take a close read at the following real-life mishaps, learn what you can and resolve that it'll *never* be you or your troops setting a similar example from which we urge others to learn…

Why It Pays To Be Careful Around Running Engines

The jet was undergoing the final stages of its major periodic inspection. It was on the trim pad for some engine-running op checks and three Maintainers—an engine run person, a ground person and a specialist-type person—were responsible for seeing to it they were done.

With engines running, op checks proceeded until a problem developed and the specialist-type Maintainer entered one of the aircraft's engine intake "Danger Areas." He didn't get sucked in, but his comm cord did, into an engine that was running at "only" 75 percent. Result? Another set of "onlys." Only several additional days of aircraft down time. Only one more preventable engine FOD mishap. Only $20,000 taxpayer (that's you and me) money worth of engine damage. Only several days of mishap investigation and report writing. And only a few bucks for a pair of new jockey shorts.

You can never be too careful around running aircraft engines, particularly if you're an old head. Comfort can lead to complacency. Your *only* defenses against FOD or serious injury—even death—are a thorough pre-run briefing in accordance with the aircraft checklist and local directives; clear, unambiguous communications; and maintaining total awareness of where you are and what you and your buds are doing.

Why The Boss Tells You To Always Use And Follow Tech Data

The F-15E mishap Maintainer (MM) was tasked to service a depleted canopy accumulator on one of the unit's jets. His first shot at pressurizing the canopy accumulator with a nitrogen servicing cart was a bust, but he was able to re-charge the accumulator after a couple of attempts. Not too many hours later, during routine maintenance, damage was discovered to some of the Strike Eagle's radar system components. *Pressurized* components—the transmitter, receiver/exciter and the ICMS (internal countermeasure system) antennas on the left and right wings. A coincidence? Sadly, no.

Tech data for servicing the canopy accumulator on an F-15E is clear and concise. It contains detailed, step-by-step instructions, as well as illustrations showing the general location of the canopy accumulator servicing port in the nose wheel well. Specifically, the canopy accumulator Schrader valve is located on the forward, left side of the nose wheel well and there's an adjacent placard identifying it as such. Servicing it with nitrogen at 2000 psi isn't uncommon. Interestingly enough, there's also a port for monitoring radar system wave-guide pressure in the nose wheel well, but it's located on the *aft, right side* and placarded appropriately, too. It also has a "Warning" that max servicing pressure is *25* psi.

Hmmmmm… Ever see a "Caution" or "Warning" in a T.O., think, "*Any* idiot knows you shouldn't do *that*" and then ask yourself why the people who write tech data overstate the obvious? Here's why: Those "Cautions" and "Warnings" are there to: (a) Either prevent somebody from doing something stupid; or (b) Because somebody already *has* done something stupid, causing personal injury or equipment damage. Those precautionary "Caution" and "Warning" words stand out in tech data to ensure we don't repeat others' mistakes—in this case, a $30,000 mistake.

Never forget that tech data discipline is made up of two steps: *Usage* and *compliance*. 'Nuff said?

Why They Call It "Training"

Working on big aircraft requires big AGE (aerospace ground equipment) and special equipment. As a result, the vast majority of C-5 Galaxy Maintainers are familiar with the Calavar Condor™ (sometimes called a "cherry picker" or "high-reach"). This special-purpose vehicle provides a truck-mounted, extended-reach work platform that elevates, rotates and can safely get Maintainers to heights from anywhere above ground level to 60 ft. and higher. If there were a choice between lugging equipment to the top of the C-5's T-tail using its internal T-tail stairs or using the Calavar, I'd opt for the "Calavar elevator" in a heartbeat. The Calavar's a great piece of equipment to have. It can reduce aircraft down time, increase aircraft availability and make maintaining large aircraft safer, to boot. But *only* if used properly and in accordance with tech data and other directives. A case in point…

On the day of the mishap, Maintainers were working in a C-5's T-tail using a Calavar. At the end of the shift, the Calavar-qualified operator lowered the platform to the ground, allowed his co-workers to make their exit and then shut it down—platform boom in a vertical position—so he could tend to other matters. Upon returning to the Calavar, he lowered the platform boom to the horizontal to make it safe for transport, retracted the vehicle outriggers and did a final walkaround to ensure all was ready before driving it back to the designated parking area. He started the Calavar, got clearance to move from his spotter and safely drove away from the aircraft.

Safely drove away, that is, until he made a turn. That's when the unsecured, ten-ton, platform boom, obeying the immutable laws of physics, maintained its forward-direction inertia and tipped the Calavar onto its side. The driver escaped serious injury, but the Calavar wasn't so lucky. It sustained nearly $80,000 damage.

Stunningly, several qualified Calavar operators at the mishap unit stated the training they received didn't instruct them on proper boom stowing procedures when preparing to move the vehicle.

Lessons worth remembering from this mishap? Simply these:

• Next time you're scheduled for initial or recurring training classes on *anything*, recognize the schooling for what it is—a golden opportunity to improve your skills. *Seize the opportunity*.

• The best training involves two-way communication. Don't expect your trainer to know when you don't understand something. Ask questions. Give your trainer feedback. *Take an active role in learning*.

• And if the training's inadequate, demand better so that you can do your wartime mission. *Take personal responsibility for your training*. We all lose when a team member can't do his (or her) job safely and effectively.

Why You Do An Op Check

The MH-53 Pave Low arrived at its new station of assignment via aerial delivery. The aircraft was unpacked, required inspections were completed and it was made ready for an acceptance check flight. Prestart, start and taxi checks were completed. On climbout for the acceptance check flight, however, the airspeed and baro altimeter indicators pegged to "zero" and the VVI (vertical velocity indicator) operated in reverse. The aircrew wisely decided to abort the check flight and landed uneventfully.

A look-back at previous maintenance determined the aircraft had undergone isochronal (ISO) inspection just prior to transfer to the new duty station and hadn't flown in nearly two months. It was also determined that one of the pitot-static system lines had been replaced with a temp line during ISO. What is unknown is whether or not a tech order-directed pitot-static system test was accomplished before the aircraft left ISO. If you work with pitot-static systems, you understand—and know—that tech data requires a leak and op check every time system lines are cracked.

The Pave Low arrived at its new station of assignment with the 781s free of any write-ups indicating a pitot-static system check was required. Since a pitot-static system inspection wasn't required during aircraft build-up after the aerial delivery, a serious problem remained undetected until the most critical time—during flight. Problems like this have killed aircrews and destroyed aircraft before, but we dodged a bullet this time.

Aircrews trust Maintainers to provide reliable, safe aircraft for every mission. If tech data tells you to do something, there are lots of reasons you're *compelled* to do that something. Feel free to choose one—or more—of the following motivational factors that mean the most to you:

• To provide aircraft that get an aircrew there and back safely;

• To help put bombs on target, succeed at CSAR, gain air supremacy, conduct reconnaissance/surveillance, train aircrews or get fuel, personnel or cargo where needed, when needed;

• It's a personal integrity gut-check;

• Tech orders are military *orders*;

• (Insert your own reasons here).

USAF Class A Flight Mishaps

Final FY01 Flight Mishaps Totals (Oct 00 - Sep 01)

25 Class A Mishaps
6 Fatalities
21 Aircraft Destroyed

04 Oct	♣✶	An RQ-1 Predator UAV crashed while on a routine test mission.
12 Oct	♣	An F-16C crashed during a routine training mission.
23 Oct	♣✶	An RQ-1 Predator UAV went into an uncommanded descent.
13 Nov	♣♣	Two F-16CJs were involved in a midair collision. Only one pilot survived.
16 Nov	♣	An F-16CG on a routine training mission was involved in a midair collision.
06 Dec	♣	A T-38A impacted the ground while on a training mission.
14 Dec	♣	An F-16C crashed shortly after departure.
12 Jan	♣	An A-10A crashed short of the runway.
02 Feb	✶	A B-1B sustained Class A Mishap-reportable engine fire damage during ground operations.
09 Mar	✶	During a ground maintenance run a KC-135E's No. 2 engine suffered catastrophic damage.
12 Mar	✶	A USAF NCO died during a range training mishap.
21 Mar		An F-16B experienced a bird strike but recovered safely. A fire developed after landing. The aircraft suffered structural and engine damage.
21 Mar	♣	An F-16C experienced engine problems soon after takeoff and crashed.
26 Mar	♣♣	Two F-15Cs crashed during a routine training mission. The pilots did not survive.
03 Apr	♣	An F-16CJ crashed while on a routine training mission.
04 Apr		An F-15E on a routine training mission recovered safely after sustaining a bird strike.
07 Jun		A KC-10A sustained Class A Mishap-reportable engine damage.
12 Jun	♣	An F-16CG crashed during a routine training mission. The pilot was fatally injured.
21 Jun		A C-130H sustained Class A Mishap-reportable damage during landing.
06 Jul	♣	An F-16CJ crashed while on a routine training mission. The pilot was fatally injured.
17 Jul	♣	An F-16B flying a chase mission crashed. The two crewmembers suffered fatal injuries.

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18 Jul ♣ An F-16CG crashed while on a routine patrol mission.

23 Jul ♣ An F-16DG crashed while on a routine training mission.

26 Jul ♣ An F-16C crashed while on a routine training mission.

16 Aug A C-5A sustained Class A Mishap-reportable damage during takeoff.

24 Aug ♣♣ Two T-38As crashed following a midair collision. One pilot was fatally injured.

04 Sep ♣ An A-10A crashed while on a crosscountry flight.

05 Sep ♣ A T-37B on a routine training mission crashed 30 minutes after takeoff.

05 Sep A C-130E sustained Class A Mishap-reportable engine damage.

25 Sep A C-5A sustained Class A Mishap-reportable engine damage during takeoff. (Revised repair costs resulted in this being downgraded to a "non-reportable" mishap.)

26 Sep A C-17A sustained Class A Mishap-reportable engine damage during flight.

FY02 Flight Mishaps (Oct 01)

3 Class A Mishaps
0 Fatalities
1 Aircraft Destroyed

FY01 Flight Mishaps (Oct 00)

1 Class A Mishap
0 Fatalities
1 Aircraft Destroyed

14 Oct ♣ An HH-60 crashed into a river while flying a low-level training mission.

17 Oct An F-16CG was severely damaged following an aborted takeoff.

25 Oct An F-16C departed the runway after landing.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF military fatalities.
- "♣" denotes a destroyed aircraft.
- "✶" denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.
- Flight and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html
- **Current as of 29 Oct 01.**

HQ AFSC Photo by Gerald C. Stratton
Photo Illustration by Dan Harman