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ARMY AVIATION RISK-MANAGEMENT INFORMATION

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Thunderstorms

One of Aviation's Most Hazardous Phenomena

Flightfax

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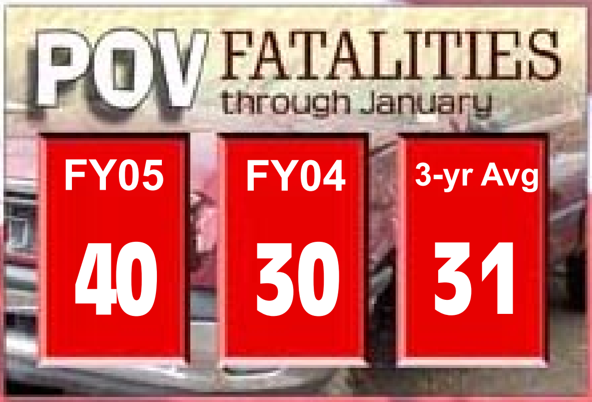
CONTENTS



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JOSEPH A. SMITH
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Commanding

Thunderstorms

One of Aviation's Most Hazardous Phenomena

LT COL Bruce A. Lambert (USAF)
HQ DA, G-2 Staff Weather Officer

I know pilots receive training on the dangers of thunderstorms, as well as I know weather forecasters and briefers pass on the necessary hazards forecast for the pilots' risk management assessment. Yet, some pilots still think they can safely fly through thunderstorms or use their radars to navigate their way through thunderstorms. Being in Air Force (AF) weather, I have seen my share of e-mail pictures with hail damage to aircraft in which the pilots decided to fly through a thunderstorm. All of this left me wondering how I could get people to read this article and take thunderstorm safety seriously. I think I've found a way.

Introduction to thunderstorms

There is, on average, at least one aviator who has looked squarely at a thunderstorm on radar or out the window of the aircraft while flying. Almost every second, on average, a lightning strike between the ground and a cloud occurs in the United States. Over 100 lightning strikes take place every second above Earth where over 44,000 thunderstorms are occurring at any given moment, which presents a significant hazard to aviation and ground operations. Therefore, there is a very good chance you'll encounter a thunderstorm within the next month or two. During that encounter, you will face the many and powerful hazards of a thunderstorm, including strong winds and windshears, heavy precipitation, lightning, hail, and tornadoes. Are you ready?

The weatherman's definition of a thunderstorm is pretty basic, yet misunderstood by many. A thunderstorm is any local storm with lightning and thunder produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes hail. However, the only official criterion a weather observer uses to identify a thunderstorm is thunder. That's all, just thunder, according to the handbook published for observers.

Cumulonimbus clouds are vertical columns of cloud mass with rain descending from them, which could potentially be thunderstorms. But technically, until the first thunder is heard, it is not a thunderstorm.

Weather manuals were recently changed to allow observers to report thunderstorms when the airport environment's regular noise would hamper the detection of thunder. Weather observers can now use the presence of lightning in the immediate vicinity (5 NM) or hail to identify when a thunderstorm is impacting an airfield. The weather observation will stop reporting thunderstorms 15 minutes after the last reporting criteria are observed.

This, however, begs one of aviation's biggest questions. How do the newly automated weather-observing systems found on civilian airports sense thunderstorms? The answer is that unless a human is augmenting the system, it doesn't. For this reason, the AF policy is not to use these systems at airfields unless augmented by an observer.

For the sake of space and to not overwhelm the reader with the scientific descriptions of how a thunderstorm develops and all the associated hazards within the thunderstorms, this information is readily available in AF Handbook 11-203, Vol 1, *Weather for Aircrews*, Col Tim Minor's article in the June 1998 *Flying Safety Magazine,* "Thunderstorms – Up (Too) Close and Personal," and other weather handbooks. I will address thunderstorm avoidance using some material from the National Weather Association.

Avoiding the thunderstorm in flight

Thunderstorms are laden with a myriad of unacceptable environmental hazards to aviation. In simpler terms, avoid thunderstorms while flying your aircraft.

How do you do that? The first technique is the old "see and avoid" concept. Look out of the cockpit for signs of convective activity. This is a small list of things to look for that give evidence of convective turbulence, lightning, hail, downbursts, microbursts, and severe windshears—

- Anvil cloud form approaching.
- Darkened color to clouds.
- Churning vertical clouds.
- Vertical clouds that are growing.

The next step is to use the weather radar (if you have one) available to you while airborne. Not every weather hazard in a thunderstorm is visible on weather radar. Since the radar is dependent on the return of reflected electromagnetic radiation, the ability of a particular hazard to reflect the beam will have a direct impact on what we can sense. See the Federal Aviation Administration's guideline for aircraft reflectivity below.

Radar will not sense the following: small cloud droplets, fog, ice crystals, or small dry hail or graupel (granular snow pellets). This list is significant for three reasons. First, if you are using your weather radar to scan your flightpath for weather that is out of visual range (150 to 200 NM), you may paint a group of individual cells and conclude you could visually circumnavigate them when, in reality, you may be facing a wall of clouds with embedded thunderstorms. Second, the low reflectivity of the surrounding clouds may not show up on the radar, creating the false impression that there is a "hole" in the clouds. Finally, the anvil portion of a thunderstorm does not appear on radar since it consists primarily of ice crystals.

Since radar is our primary method of sensing thunderstorms, it is important to know how each type of precipitation affects what the radar displays. The chart of reflectivity from least-reflective precipitation to the most-reflective precipitation shows us that "bigger and wetter" is more reflective than "smaller and drier." (See chart on next page.)

Depending on the precipitation type and its movement, recognizable thunderstorm patterns will show where the hazards are. It's important to know what to avoid on our radar screens.

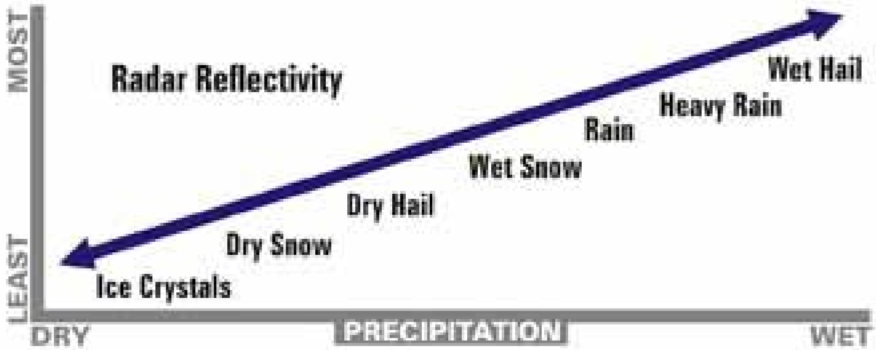
- Avoid a target with a dry intrusion (drier air being sucked into the thunderstorm) giving it a V or U shape. There are several reasons for this. Severe thunderstorms have dry air mixing in the middle altitudes which can create an intrusion. Hail rising and descending in a thunderstorm would also appear as a missing area cutout from the storm.
- Avoid a target with a hook or bow shape. Hook shapes are indicative of rotations taking place within severe thunderstorms. This is a strong clue to ground weather observers that hail and tornadoes are possible.
- Avoid a target with protruding "fingers." Like a hook, a finger shows strong possibilities for tornadoes and hail.
- Avoid a target with an asymmetric coloring and shape. Remember, severe storms created by windshears aloft will tilt to one side. This gives shapes and colorings that are not even or concentric.
- Avoid a target with an "arrow shape." Again, this is indicative of a storm with tilt and the possibility of severe hazardous weather.
- Avoid a target with scalloped edges. Scalloped edges show turbulent motions taking place within the cloud. There is a good chance for hail here also.
- Avoid a target with changing shapes. Rapidly growing shape show rapid motions taking place within the cloud. Turbulence will almost always take place under these conditions.
- Avoid a target storm with a few VIP Level 1 dots showing nearby. Hail falls many times outside of the thunderstorm. Checking the winds at altitude and correlating it to the side of the storm that hail will fall should help identify that potential hazard.

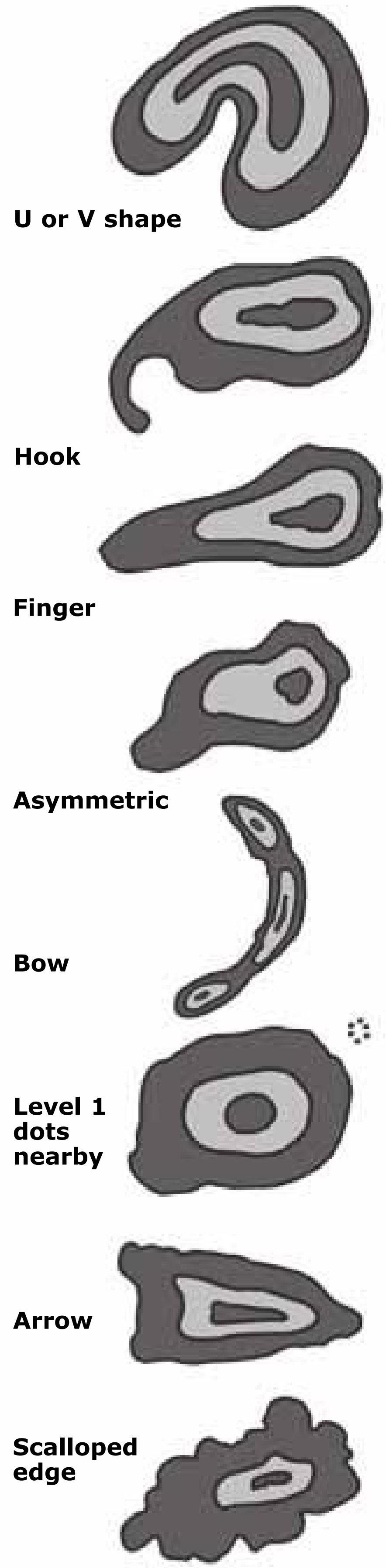
Federal Aviation Administration's Guideline for Aircraft Reflectivity

from FAA Advisory Circular 0045C

VIP Level*	Echo Intensity	Precipitation Intensity	Rain rate (in/hr) in stratiform clouds	Rain rate (in/hr) in convective clouds
1 green	Weak	Light	less than 0.1	less than 0.2
2 yellow	Moderate	Moderate	0.1 - 0.5	0.2 - 1.1
3 red	Strong	Heavy	0.5 - 1.0	1.1 - 2.2
4 red	Very Strong	Very Heavy	1.0 - 2.0	2.2 - 4.5
5 red	Intense	Intense	2.0 - 5.0	4.5 - 7.1
6 red	Extreme	Extreme	more than 5.0	more than 7.1

*VIP Level refers to the Video Integration Processor which interprets the reflected energy and provides a location and color to the return for display on the monitor.





Flying techniques to remember

Publications from the FAA and USAF give aviators numerous tips and techniques to help with that occasional encounter with a thunderstorm. Some, of which, are important enough to repeat again.

■ Don't fly over thunderstorms. Storms can grow rapidly through your altitude, producing severe turbulence. Also, hail can shoot through the top of the thunderstorm in clear air above and fall downwind.

■ Don't fly under the anvil where hail damage and lightning can occur.

■ Don't fly into virga where turbulence is likely.

■ Avoid all thunderstorms by 20 miles or more since lightning and hail have been known to extend that far from the clouds.

■ Weather warnings are for thunderstorms defined as "severe." These storms produce ¾-inch hail, tornadoes, or 50-knot wind gusts. There's a lot of damage that can occur in thunderstorms that are not flagged by warnings or a SIGMET (significant meteorological report).

If you have to penetrate:

■ Go straight. Don't turn around.

■ Avoid the altitudes with temperatures of plus/minus 8 degrees Celsius.

■ Don't chase altitude. Hold your attitude and watch airspeed.

■ Use all anti-icing equipment.

■ Turn all lights in the cockpit on full and lock shoulder harnesses.

Conclusions

Thunderstorms are one of aviation's most hazardous phenomena. They can impact aviation from windshears, lightning, heavy precipitation, tornadoes, and severe turbulence to hail. Knowing how to recognize and avoid thunderstorms and their hazards is one of the most important lessons of aviation weather training.

I promised you at the beginning of the article to state my idea to make you take thunderstorm safety seriously. Read the "Tempting Fate" article on page 6, which is a condensed version of the September 2001 *Flightfax* article. Now imagine one of two scenarios.

1. You are one of the investigators and you knew the flight crew.

2. You were one of the flight crew and your loved ones (parents, spouse, or children) are clipping the article to include in a scrapbook they have created since your funeral.

Think safety and fly safe. ♦

—LT COL Lambert is the HQ DA G-2 Staff Weather

Tempting Fate

There are no new accidents. The following accident happened several years ago. A C-23 aircraft was destroyed and 21 fellow servicemen died. It's easy to learn from mistakes, but that often means somebody had to pay the price for our re-education. I hope that as you read the account of this flight you are able to see what can happen when you don't stay on the ground, land early and take cover, or stay well clear of severe weather.

The flight

The mission was to transport 18 Air Force National Guardsmen (AFNG) from their training site to their home station. A C-23B+ Sherpa from the Army National Guard flew the mission. The commander briefed the mission and rated it as low risk. The crew departed home station and flew to the AFNG's training site to remain overnight prior to the mission.

The flight crew arrived at base operations approximately 1 hour before the scheduled takeoff time on the day of the mission. About 40 minutes before takeoff, the crew received a weather briefing. The forecaster identified an area of thunderstorms along the crew's filed route of flight with 16 to 45-percent coverage and maximum tops at 50,000 feet. He told the crew to fly as far east as possible before turning north to avoid the weather. The crew did not ask the forecaster any questions.

The crew filed an instrument flight rules (IFR) flight plan to fly a northeasterly route along a series of VOR airways to their destination. They requested a cruising altitude of 9,000 feet mean sea level and estimated their time en route as 3+ hours, with 5+ hours of fuel onboard. A passenger manifest listing 18 AFNG passengers was attached to the flight plan. The flight engineer loaded the aircraft with the passengers and baggage as the crew readied the aircraft. He computed the weight and balance for the flight prior to departing home station.

The crew departed the training site and, a few minutes later, air traffic control (ATC) had the aircraft under positive radar control at 9,000 feet. ATC then advised their traffic of Convective SIGMET 11E, which implies severe to extreme turbulence, severe icing, and the potential for microburst and windshear. The advisory stated there was a line of severe thunderstorms moving from 280 degrees at 30 knots with tops at 40,000 feet. Hail to 1 inch and wind gusts to 60 knots were also possible.

Traffic was further instructed by ATC to contact flight service or monitor Hazardous Weather In-flight Advisory Service (HIWAS) for the advisory details. The C-23 crew did not contact any flight service station for more information on Convective SIGMET 11E. (It is not known if the crew monitored HIWAS on any VOR in their vicinity.)

The crew continued to stay on their filed route of flight, avoiding buildups with small flight deviations. One approach control assisted them in avoiding some heavy thunderstorms (levels 3 and 4, and some level 5). The crew informed ATC their C-23 was equipped with weather radar and a Stormscope.

The Sherpa crew never deviated to the east farther than a heading of 063 degrees. They maintained their northeasterly heading throughout the entire flight with only short deviations for weather as each air traffic facility advised them of the line of severe weather.

Approximately 45 minutes after takeoff, the crew checked in with their last ATC facility. The crew was given the current altimeter setting, which they read back. ATC received a good transponder code from the aircraft that showed them at their assigned altitude. Soon thereafter, their altitude began to drop for no apparent reason; then, 10 minutes after checking in with this controller, the C-23 disappeared from the radar screen. The controller did not hear a Mayday call, nor did he receive a 7700 emergency transponder code. The controller made numerous attempts to contact the crew, but received no replies.

Lessons re-learned

The crew had encountered extreme turbulence and upper-level windshear in the vicinity of a severe and violently developing level 4 to 5 thunderstorm. The crew lost control of the aircraft, which experienced loads beyond its design limits. It broke apart in flight before impacting the ground. Everyone on board was killed.

For more than 3 months, the accident investigation board—which included expert meteorologists, structural and stress engineers, and members from other accident investigating agencies within DOD—toiled over every minute piece of information available from this accident. They didn't find any new accident causation factors; they simply re-learned what every aviator already knows. Thunderstorms can be deadly, and flying into them or near them is simply tempting fate. When the weather is bad, the safest place for an aircraft is on the ground. ♦

—Adapted from "Flying in Bad Weather is High Risk" in the September 2001 Flightfax. Mr. Gary D. Braman wrote this article when he was an aviation accident investigator at the former U.S. Army Safety Center. He is currently a System Safety Analyst for CAS in Huntsville, AL, and can be contacted at DSN 746-4177 (256-876-4177), or e-mail gary.braman@uh.redstone.army.mil.

Staying on top of the weather is a continuing challenge, but it's one all of us must recognize. Since no aircraft can withstand the full impact of the tornadic forces often generated by thunderstorms, avoidance is the best policy. One of the best protections against encountering thunderstorms in flight is being forewarned of their existence. If available weather information hints at thunderstorm possibilities, if your weather forecaster confirms their existence, and if those clouds in the distance begin to look boiling, think again before making the "go" decision. When in doubt, turn about!

Ask Yourself...

Even if it's legal to go, how prudent is it?
What happens if it's right at the limit—just good enough to take off? What if you take off and then it turns to soup 15 minutes into the mission? What are you going to do now? Can you land where you are and wait it out? What are you going to do if you can't?

Do you have a plan?
What if it gets so bad that you decide to turn around and you bump into the clouds? What are you going to do now? Do you have enough fuel? Are you prepared to deal with IMC?

Am I truly prepared to deal with IMC?
Do you have excellent proficiency? Are you totally prepared? Do you have a plan that you've coordinated with the rest of the aircrew? Have you briefed it? Is the aircraft properly equipped? Do you have NAVAIDS and are instrument approaches available? Do you have a coordinated plan to reduce the effects of spatial disorientation should it strike you or another crewmember in inadvertent IMC?

How bad does it have to get before I say no?
If you are routinely flying in the worst weather that's legal to fly in, it's only a matter of time until you find yourself inadvertent IMC. And if you're not ready—not fully prepared—this could be where the statistics catch up with you and you have an accident. And please remember that accidents resulting from inadvertent IMC situations are very rarely minor accidents.

Is this mission worth doing in this weather?
Maybe your unit should establish some weather criteria of its own. How much experience does the unit have? Are you a bunch of old-timers who have a lot of IFR time and are well prepared to deal with IMC? Or are most of you rookies who haven't been inside a cloud since you were with your IP in flight school? Or are you somewhere in between? Maybe you should have different unit minimums that consider not just crew experience but mission criticality as well. And what if you establish ahead of time the level at which go-no-go decisions are made—that if the weather is here, then the decision must be made at this level. In other words, what if you elevate the decision to a level that's consistent with the level of risk?

Sound familiar? Good! That's using good sense ... and basic risk management.

You know the airspace, but do you know the airspace you're in?

Arthur Estrada
USAARL

Sometimes a little self-reflection is good in order to identify and improve weaknesses. Are leaders, who are responsible for the training and proficiency of aviators, doing everything they can to ensure every pilot is prepared to safely operate Army aircraft? An area that could use more attention deals with airspace knowledge and inadvertent instrument meteorological conditions (IIMC).

Every aviator who has been around for a while knows the dangers of IIMC. It's extremely difficult to go from an orientation with outside visual references to one of flight instruments only. The results are sometimes catastrophic. During the last fiscal year, the Army experienced three non-combat mishaps due to IIMC: one Class E and two Class As. We lost three precious lives and two UH-60Ls. There is no way to know how many close calls were never reported.

So what's the problem? Why do we keep flying into weather we have no business in? Are we negligent? Are we irresponsible? Or are we a bunch of risk takers? My guess is our aviators get into trouble because they have a sincere desire to accomplish the mission, but they are inadequately trained in visual-spatial skills as they relate to airspace.

What are visual-spatial skills? Visual-spatial skills allow you to look at a two-dimensional visual flight rules (VFR) sectional map and visualize it in three dimensions, and then project it into the invisible airspace in front of you. This skill is critical to apply the appropriate flight rules to the appropriate airspace. Clearly stated: You cannot apply the appropriate rules if you don't know what class of airspace you're in. For example, if you're operating in Class E airspace (and don't know it) with only ½-mile visibility, you're setting yourself up for IIMC. Just because you can see the ground doesn't mean you're in compliance with VFR.

My 18 years as an instructor pilot (IP) have demonstrated clearly that Army pilots, in general, have command of the airspace rules during the oral examination at the table, but are very weak at applying these rules during the planning phase and especially during actual flights. (Recent interviews with many senior IPs corroborate this assessment.) All graduates of flight school remember the airspace class in which we were provided the dimensions (lateral and vertical) of the different classes of airspace and the flight rules (visual and instrument) associated with each. We know each class of airspace has its own set of rules which include the minimum visibility, minimum cloud clearances, and the aircraft equipment required in order to legally operate within that airspace. These rules keep you safe, especially on VFR flights. Before graduating from flight school, students had to pass written and oral exams regarding their knowledge of these rules. But what is not tested very well is the ability to apply and correlate these rules during actual flight. Many seasoned aviators know that it might take years to develop this ability.

How can IPs help?

Regardless of flight altitude, helicopter pilots tend to relate to the ground for orientation and awareness rather than to the airspace they are planning to fly through or actually flying in. How can you help change this intuitive perspective into one that includes the invisible air above the terrain?

Develop visual-spatial skills

IPs must ensure pilots, especially those with limited experience, develop visual-spatial skills. Make certain they are able to incorporate the vertical dimensions of airspace during the mission planning phase, and not just plan to "fly around" the lines printed on the VFR sectional to remain clear of a given airspace. Some pilots appear to intuitively visualize the printed lines as being on the ground and extending upward to infinity. Ensure pilots know that they might travel beneath or above the printed lines and still maintain that particular class of airspace through which they desire to fly.

Test application of flight rules during actual flights

This is key in developing pilots' visual-spatial skills. The goal of every IP is to assure the progression of learning to the highest levels: application and correlation. These "tests" need not be formal evaluations. During the conduct of a mission, IPs could quiz pilot(s) and the flight-leads of their formations as to the class or classes of airspace through which they are flying to ensure the maintenance of this important component of aviation situational awareness. If clouds are present, ask frequently about the maintenance of cloud clearances. This quizzing will reinforce situational awareness, test the proficiency of airspace knowledge, and better prepare aviators to recognize and take action at any signs of deteriorating weather.

Teach what to do when encountering deteriorating weather

Pilots know their IIMC procedures, but do everything in their power to keep from executing them, including running into trees and terrain. What they need to know is how to decide what to do before they HAVE to actually execute the procedures. First, they must be able to recognize when the weather conditions are becoming close to minimums by correlating the airspace they're in with the appropriate rules. Then, they must decide on a good strategy: land the aircraft (if possible), turn back or alter course/altitude to an area or class of airspace where VFR (the rules) or Special VFR can be maintained, or ask for and receive an IFR clearance. Bottom-line: **DON'T CONTINUE TO FLY VISUALLY IF YOU ARE NOT MAINTAINING THE RULES FOR THE AIRSPACE YOU'RE IN.**

Teach techniques to judge visibility

The ability to judge visibility is a critical skill that is not taught in any formal aviation course of instruction. Instead, we rely on experience, mentorship, and trial and error to develop a skill that is fundamental to the maintenance of flight rules. Pilots must be able to know what one statute mile of visibility looks like. (The mental image of a mile may be quite different to someone from Montana than it is to someone raised in the Bronx, NY.) Teach techniques such as using relative distances, map cross-referencing, and speed vs. ground-covered computations. Without the fundamental ability to judge visibility, pilots cannot be expected to maintain flight rules.

What can be done by the Army?

As alluded to earlier, the Army has continued to teach airspace in the same way it has for decades, by lecture method. Perhaps it's time for some innovative training methods to augment the lectures. A suggestion is to provide computer software and stations where pilots (especially student pilots) can fly "virtually" through airspace classes that are depicted in areas of differently shaded colors. In other words, after the necessary lecture, the student could reinforce all that was disseminated via a visual representation of how airspace is structured from a cockpit perspective. This would surely result in better visualization and comprehension, as well as be used to develop important decision-making skills.

The Army's flight simulation capabilities have improved exponentially and are very impressive. However, the visual emphasis has been on better representation of the terrain and of enemy forces. Just as threat ranges are depicted in volume-metric domes, the same technology could be used to represent the airspace structure as described above for the computer software. Imagine the usefulness of this feature during initial and refresher training and its importance as a tool for the development of pilot visual-spatial skills.

Conclusions

The Army continues to experience costly IIMC mishaps. Maybe it's time to look at the fundamental reasons for these events. Yes, the weather at times is quite unpredictable. Let's help our pilots develop the visual-spatial skills necessary to deal with it effectively and safely. Let's do this early in their careers before they become pilots-in-command. And then, let's continue to reinforce these skills throughout their careers. Let's ensure they progress beyond rote knowledge and understanding to application and correlation. Let's teach them what to do *before* they get into trouble, not just concentrate on what to do after they get in trouble. Last, but not least, let's help pilots by ensuring they know their airspace—and more importantly, at all times, they know what airspace they're in. ♦

—DAC Estrada is an IP and Research Helicopter Pilot at the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL. He may be contacted by calling DSN 558-6928 (334-255-6928) or e-mail art.estrada@se.amedd.army.mil.

You Asked For It!

MAJ Steven Van Riper
U.S. Army Combat Readiness Center

Aircrews are sometimes asked to give their passengers a memorable ride. Performing unnecessary maneuvers to satisfy passenger request, or for any other purpose, introduces unanticipated risks into well-planned missions.

The mission, consisting of two Army UH-60Ls and two Marine Corps AH-1Ws, was to provide a daytime quick reaction force capabilities demonstration at a forward operating base for visiting VIPs. The flight departed at 0930 and laagered south of their demonstration site awaiting their time-on-target. The accident aircraft was a UH-60L and Chalk 2 in the flight, with the AH-1Ws in the Chalk 3 and 4 positions and the other UH-60L was Chalk 1.

After 10 minutes of holding at the laager site, the flight was informed the demonstration would be delayed 10 to 15 minutes. Chalk 1 made a request to fly to the south and visually check some known Points of Origin (POOs) of recent rocket attacks. The USMC flight lead (Chalk 3) did not deny the request, so the flight departed the laager area and proceeded southeast to the known POOs.

En route to the POOs, the UH-60Ls transitioned to terrain flight while the AH-1Ws remained at attitude in the Chalk 3 and 4 positions. The flight had been briefed for terrain flight, although specific mention of visual reconnaissance of POOs was not included in the pre-mission briefing. After reaching one of the southeastern most POOs, the flight turned west and proceeded through the foothills back toward the flat terrain around the demonstration site. As the flight turned more northwesterly, the Chalk 2 PC transmitted "Taking room to maneuver" over the flight's internal radio frequency.

The copilot of Chalk 3 observed Chalk 2 decelerate and increase the separation between Chalks 1 and 2. As the separation increased, Chalk 2 was rapidly ascending and descending over the small hills in the area. After ascending over a hill and then descending, Chalk 2 impacted the ground in a near level attitude, heading 240 degrees, skidded 67 feet, bounced once, and continued skidding for 330 feet until hitting a manmade rock wall. The aircraft then pivoted vertically about its nose, yawed right 90 degrees, and rolled 270 degrees before coming to rest inverted. One crewmember suffered fatal injuries.

Unwarranted request and unnecessary flight maneuvers

An interview with a passenger in Chalk 2 indicates a request was made to the crew by one of the passengers before takeoff to "Fly hard." The request was relayed to the PC by one of the CEs. The request was denied by the PC based on the anticipated presence of senior officers at the capabilities demonstration. As the flight turned back toward the demonstration site, Chalk 2 transmitted "Taking room to maneuver" on the flight's internal frequency. Chalk 2 increased separation from Chalk 1 to approximately 10 rotor disk

diameters and began terrain flight over 400- to 500-foot-high hills. Just prior to this, a passenger sitting in the center forward-facing troop seat and wearing a communications headset, heard one of the CEs ask again to "Fly hard" and then heard a response from an unknown source say, "You asked for it."

The aircraft then negotiated one hill using a cyclic climb followed by a rapid, nose-low descent. The PC of the accident aircraft then used another cyclic climb to crest a second 400-foot hill. The board determined, from witness interviews with the PI, PC, and statements from other eyewitnesses, as the aircraft flew over the top of the hill, the PC placed the aircraft in a 30-degree nose down descent by moving the cyclic forward and lowering the collective to the full down position. This maneuver caused the passengers and crew to experience a period of weightlessness. Witness interviews revealed several unsecured items in the aircraft were floating. One passenger witnessed a wheel chock float between the cockpit and crew chief stations, and then into the cockpit area during the maneuver. The PC attempted to recover from the maneuver by applying aft cyclic and moving the collective upward. He found the cyclic moved freely but the collective could not be moved upward.

Preliminary results of the investigation revealed an unsecured wheel chock floated up and forward while the aircraft was experiencing negative G forces during the descent after cresting the hill, and came to rest between the right pilot seat and center console. The position of the wheel chock severely limited collective movement and prevented the PC from arresting the aircraft's rate of descent prior to the aircraft impacting the ground. The Accident Investigation Board determined the PC believed he needed to perform unnecessary flight maneuvers in response to requests by passengers to "fly hard."

Lesson learned and conclusions

Leaders must anticipate internal and external pressures placed on the aircrews and properly prepare them to deal with these situations. Professionalism must overcome pride and discipline must override showmanship. Every aircrew member must recognize and denounce unwarranted requests from passengers or fellow crewmembers and avoid the risk associated with unnecessary maneuvering. ♦

--MAJ Van Riper is Chief of the Attack/Scout Branch in the Accident Investigations Division, U.S. Army Combat Readiness Center. He may be contacted by calling DSN 558-2131 (334-255-2131) or e-mail steven.vanriper@us.army.mil.

This is Part 3 of a 3-part series. Other topics concerning ALSE will be published in succeeding issues of *Flightfax*.

Wear It Right

LTC Mark Adams,
CW4 Dennis Bergstrazer,
and Joe Licina
USAARL

ALSE has performance limits just like your aircraft. If you don't wear it or look after it correctly, it will not function correctly. The U.S. Army Aeromedical Research Laboratory (USAARL) doesn't always get the design absolutely right for every type and shape of aviator; that's why we depend on your feedback to tell us when equipment is uncomfortable or doesn't do its job. Hundreds of thousands of dollars are spent to produce the best ALSE possible to give you the best chance of survival in the event of a mishap.

Flight Gloves

In a fire-related mishap the alloys, composites, and plastics of the airframe may rapidly become too hot to touch during an emergency egress event. When a contact surface is too hot, the body's defense system keeps you from holding onto it; the natural reaction is to let go. This will delay your escape or prevent you from assisting someone else. Gloves protect you from this thermal hazard and allow immediate egress when seconds count.

Your flight gloves can lose their fire-resistant properties if they have grease, oil, fuel or other contaminants on them. Figure 1 shows a glove that is worn out, has holes, and is covered in petroleum, oil, and lubricant (POL) residue.

Figure 2 shows a glove that is also worn out. When the glove was exposed to a fire, the seams failed, no longer providing the protection needed. This resulted in the pilot receiving multiple permanent partial, disabling injuries.

The Army ALSE School at Fort Rucker, AL, has set the standard by instructing you to wear your gloves tucked inside your flight suit sleeve. But what if you need to look at your watch? Of course it's convenient to wear your watch on the inside of your flight suit sleeve, but then you have to pull the glove down and expose your wrist to look at it. If you do anticipate this need, consider securing your watch outside your glove or sleeve.

So what do we recommend?

■ Keep your gloves clean. The POL, body oil, dirt, or an accumulation of various contaminants can be cleaned easily by just using a mild dishwashing liquid or even a liquid hand soap and water. Put your gloves on and wash your hands. Rinse your gloves and be amazed at how dirty your gloves were. If you need to repeat the cycle, do it. Do not put them in a dryer. Wear them and let them dry or just let them dry naturally. Do not add anything like fabric softener, hand creams, or other coatings to keep the leather supple.

■ If there is a hole in your gloves, turn them in. End of discussion.

■ If you wear a watch, consider wearing it on the outside or use that clock on the instrument panel that is specifically designed for your needs while in the air.

■ Wear your gloves tucked inside your flight suit sleeve.

Remember the bottom line: ***Wear It Right and Keep It Tight!*** ♦

—For more information contact LTC Adams, CW4 Bergstrazer, or Mr. Licina at the Aviation Life Support Retrieval Program, USAARL, Fort Rucker, AL. All can be contacted by calling DSN 558-6893/6815 (334-255-6893/6815) or e-mail Joe.Licina@se.amedd.army.mil.

Figure 1.
Flight glove with holes and POL staining.

Figure 2.
Fire-damaged glove.

Display Fixation

CW4 (Ret) Sean Morrill
Fort Hood, TX

Cockpits today are more modernized than ever, and technology continues to enhance the amount and quality of information displayed. However, I've experienced display fixation in flight—and I'm sure I'm not alone—caused by these new gadgets. I found that I'm most vulnerable at night, and especially so under night vision goggles (NVGs) when I'm the pilot not flying. Over the years I've had to remind myself constantly to keep scanning outside to assist the other pilot.

Today's glass cockpit demands total focus in working multi-function displays to manage multiple software pages effectively. Programming weapons systems, radios, and navigation data in flight consumes a lot of time and attention. I hate to admit it, but sometimes assisting the pilot on the controls with obstacle avoidance unintentionally goes on the back burner for me.

This phenomenon is not new, however. I've experienced these challenges in aircraft with analog "steam gauges" too. I found out early in my career that focusing too long on anything, inside or out, is not good. I can vividly remember the time when the pilot on the controls and I both fixated on an inoperative landing gear light in an RC-12. That mistake almost caused a re-enactment of a well-known airliner crash in the Everglades!

Maintaining situational awareness is a constant challenge, especially as cockpits and aircraft improve. As an instructor pilot, unit trainer, and aviation safety officer in both fixed- and rotary-wing aircraft, I've come up with a few personal rules that help keep me from fixating inside the cockpit.

Know your software (or displays). The better you know the display pages, the less time you spend fumbling around inside for the buttons. When I transitioned to a new aircraft, I learned as much about the aircraft as fast as I could. I found that even going out and practicing during some downtime with a ground power unit was time well spent that paid off in flight. The better you know your systems, the less likelihood of the pilot on the controls having to come inside to help you. Two pilots looking inside is never good for long.

Program the aircraft system as much as possible on the ground before flight. Use the Aviation Mission Planning System (AMPS) and program your data cartridge, then load and <u>verify</u> your data before flight—especially at night! RC-12s have a finicky, DOS-based AMPS, but I always made a point to use it. This practice helped us immensely during Operations Enduring Freedom and Iraqi Freedom and enabled us to focus on the myriad of other things our flights demanded.

Study software regularly. Most pilots are good about staying in chapters "5 and 9" of the operators manual, but software pages are not something I like to study. I made it a point to try and look at some of them in the –10 whenever I was studying something else. I tried to learn quickly, but that doesn't mean I would always remember it. Staying proficient through regular use and regular study of software is a necessity for me.

Learn to recognize when you become fixated. Know when and where you're more likely to become fixated during a mission profile (e.g., weapons engagements under NVGs) and talk about it during the crew brief before flight. Keep this thought in the back of your mind and make it a point to increase your outside scan rate. Also learn to say something when the other pilot is inside looking at the displays with you, especially if they're on the controls. It's very easy to get lured in while you're the one flying, and even more so if you're instructing.

These few simple, personal rules helped me over the years, and though they aren't a total answer, I hope they assist you in developing your own. It's good for all of us to be focused on the mission—just don't let all the focus be "inside." The aircraft still must be flown, whether we want to look outside or not. ♦

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2004 AAAA
Award Winners

Paula Allman
Managing Editor

The Army Aviation Association of America (AAAA) recently presented the annual aviation awards honoring achievements of individuals and aviation units throughout the Army during 2004. The award recipients are as follows:

■ **Army Avn. Trainer of the Year: CW3 David A. Fallon, A Co., 2nd Bn., 160th Special Operations Avn. Regt., Fort Campbell, KY.** *CW3 Fallon was recognized for creating an MH-47E instructor pilot course.*

■ **Army Avn. Medicine: LTC John A. Smyrski III, MD, HHC 25th Avn. Bde., Joint Task Force (JTF) Wings, APO AE 09354.** *LTC Smyrski distinguished himself as the JTF Wings Flight Surgeon of Combined/JTF 76 in support of OIF-5.*

■ **Outstanding USMA Avn. Cadet of the Year: 2LT Michael A. Powell.**

■ **Outstanding ROTC Avn. Cadet of the Year: 2LT Julie A. Perry.**

■ **Army Avn. Fixed-Wing Unit of the Year: CPT Mark Johnson, I Co., 185th Avn. Regt., Gulfport, MS.** *I Co. was the first C-23 Sherpa unit to be deployed to OIF and was the first Army fixed-wing cargo plane to be utilized in a combat zone. While in theater, I Co. transported over 1,420,000 pounds of cargo, 3,120 passengers, and accumulated over 2,500 combat flight hours without major incident or injury.*

■ **Army Avn. Air/Sea Rescue: Crew of Dustoff 56, 68th Med. Co. (Air Ambulance), Bagram, Afghanistan (MAJ David Spero, 1SG Louis Gholston, CW2 Jason Rayburn, SSG Robert Ramirez, and SSG David Hernandez).** *The crew of Dustoff 56 performed a lifesaving mission in hostile territory near the Pakistani border in northeastern Afghanistan. The 6-hour mission involved several hoist operations due to steep, rugged mountainous terrain and necessitated multiple trips to the pick-up site and were performed under day, night, and NVG conditions at over 5,000 feet in elevation.*

■ **Army Avn. Air Traffic Control (ATC) Co. of the Year: C Co., 1st Bn., 58th Avn. Regt., Fort Campbell, KY.** *The Soldiers of C Co. have proven themselves worthy of recognition, providing air traffic services in some of the most remote and barren locations while operating under hostile and austere conditions in the unforgiving Iraqi desert.*

■ **Army Avn. ATC Facility of the Year: B Co., 1st Bn., 58th Avn. Regt., The All-American Tower, Simmons Army Airfield, Fort Bragg, NC.** *The Soldiers of B Co., 1-58th, consistently displayed expertise, professionalism, personal pride and skill during their combat tour of duty in support of Task Force Pegasus during OIF-1.*

■ **Army Avn. ATC Maintenance Technician of the Year: SGT Curt P. Krenning, A Co., 3rd Bn., 58th Avn. Regt., APO AE 09165.** *While deployed to OIF, SGT Krenning was the primary electrician for A Co., 3-58th, TOC and life support area. He was also the maintainer of the only FAA IFR-certified ground controlled approach radar in Iraq, two AN/TSW-7A tactical towers, two AN/TSC-198 tactical towers, and one AN/TRN-30V1 beacon at Balad Army Airfield tower.*

■ **Army Avn. ATC Manager of the Year: SFC William A. Wrancher, B Co., 1st Bn., 58th Avn. Regt., (82nd Airborne), Fort Bragg, NC.** *SFC Wrancher displayed extraordinary drive as the senior ATC tower manager, tactical airspace integration system specialist, and served as one of two fully-qualified ATC examiners within the entire 82nd Airborne Div. While operating in the most hazardous airspace in Iraq, he was directly responsible for responding to five of the first nine aircraft shot down during the war. His outstanding leadership and direction directly aided in saving more than 20 Soldiers while playing a pivotal role in the rescue coordination of a CH-47 shootdown near Fallujah.*

■ **Army Avn. ATC of the Year: SGT Terry M. Horner, B Co., 3rd Bn., 58th Avn. Regt., APO AE 09250.** *SGT Horner was instrumental in assisting his unit in accomplishing their missions while deployed in Germany, Kosovo, and in the joint USA-USAF Balad tower. SGT Horner holds a rating on the AN-TSQ 198, the AN-TSW 7A ATC central, and facility ratings at Steel Tower, Camp Bondsteel, Kosovo, and was the first controller in B Co. to achieve a facility rating in Balad Tower.*

—You may contact the author at DSN 558-9855 (334-255-9855) or e-mail paula.allman@safetycenter.army.mil.

Accident Briefs

Information based on preliminary reports of aircraft accidents

AH-64

A Model

■ **Class C**: While conducting NVG/NVS training, the crew heard a loud roar from the rear of the aircraft. During the approach, the shaft driven compressor caution light illuminated. The crew performed an emergency landing and an emergency engine shutdown and eggressed the aircraft. Inspection of the transmission area revealed the auxiliary power unit (APU) shaft had severed at the APU connection and became disconnected from the accessory gear box. *This report was received late*.

■ **Class C:** Aircraft was started with rotor brake activated. Upon noting burning smell and an orange glow from the transmission deck area, the crew initiated fire extinguisher system and shut down and evacuated the aircraft. The main transmission and all rotor brake components sustained damage and required replacement.

D Model

■ **Class A (Fatality)**: Aircraft impacted the ground during gunnery training. Both crewmembers sustained injuries, one fatal. The aircraft was destroyed.

■ **Class A (Damage):** The aircrew was conducting a two-ship mission traveling at 200 foot AGL and 100 knots, and heard a loud bang followed by severe vibrations. The crew attempted to conduct an emergency landing to a field. During landing, as power was applied, the crew reported an uncontrolled yaw. The aircraft landed in a ditch and the aircraft rolled on its right side. There were no injuries to either crewmember.

■ **Class C**: Crew reported N_p overspeed of the No. 1 engine (130 percent for 4 seconds, peaking at 136 percent) during flight.

CH-47

D Model

■ **Class B:** On approach to an unimproved landing strip, aircraft landed hard. Damage to front left landing gear and sheet metal under nose. ECOD: $200,000.

■ **Class C:** Aircraft was ground-taxiing into parking when it experienced failure of right rear landing gear strut during a right turn. This was the second reported right rear strut failure for this aircraft. Unit has been instructed to submit a QDR.

■ **Class C:** Aircraft experienced separation of the right rear landing gear when it contacted a snow-covered rock during approach to land. ECOD: $20,000.

HH-60

■ **Class C:** A MEDEVAC aircraft attempted to park between two parked aircraft in a confined area. One of the parked aircraft was parked with engines shut down, but the rotors were still slowly turning. While taxiing, the MEDEVAC aircraft main rotor blades meshed with the parked aircraft main rotor blades. This resulted in main rotor blade tip cap damage to both aircraft.

OH-58

D Model

OH-58D(R)

■ **Class A:** While conducting a mission, an OH-58DR struck wires, went inverted, crashed and burned. Sister aircraft did not report any hostile fire/activity associated with event. Both crewmembers were fatally injured.

■ **Class C:** During termination of a standard auto rotation, excessive main rotor flapping resulted in two main rotor blades contacting the tail boom causing extensive damage to two main rotor blades, tail rotor drive shaft, tail boom, driveshaft cover, GPS mount and GPS antenna.

OH58D(I)

■ **Class C:** During termination of a standard auto rotation, the crew heard a slapping noise outside the aircraft. Ground personnel saw the M/R blades contact the fuselage and signaled the crew to shut down the aircraft. Postflight inspection revealed damage to two main rotor blades, tail rotor driveshaft, driveshaft cover, GPS mount and GPS antenna.

UH-60

A Model

■ **Class B:** An aircraft sustained main rotor blade damage during flight while transporting a main rotor blade as an internal load. The blade container had been secured crosswise inside the aircraft with cargo straps. Shortly after takeoff, both ends of the container lid came loose and bent upward, contacting the main rotor blades. The crew landed the aircraft immediately without further incident. Postflight inspection revealed damage to all four main rotor blades, both engine cowlings, and the APU door.

■ **Class C:** A MEDEVAC aircraft attempted to park between two parked aircraft in a confined area. One of the parked aircraft was parked with engines shut down, but the rotors were still slowly turning. While taxiing, the MEDEVAC aircraft main rotor blades meshed with the parked aircraft main rotor blades. This resulted in main rotor blade tip cap damage to both aircraft.

■ **Class C**: Aircraft stabilator contacted the ground during approach to land at a helipad, damaging the tail wheel lock pin as well as the trailing edge of the stabilator.

■ **Class C**: Aircraft stabilator contacted the ground during approach, damage incurred by tail wheel lock pin, as well as trailing edge of the stabilator.

■ **Class C**: While ground taxiing from their parking pad, the blades of one Black Hawk contacted the blades of another that was parked in its assigned parking pad. After blade contact, the crew repositioned the aircraft onto the shoulder of the taxiway and performed an emergency engine shutdown. Inspection revealed that one aircraft sustained damage to one blade and three tip caps and the other aircraft sustained damage to one blade.

■ **Class C:** Aircraft stabilator contacted the ground during terrain flight.

■ **Class E:** While passing through 15,000 feet MSL on climbout to 3,000 feet MSL, the stabilator failed in the AUTO mode. Subsequent reset resulted in another failure. The aircrew performed the appropriate emergency procedure, asked ATC for a clearance to return to base, and performed an IFR approach back to the airfield.

L Model

■ **Class E:** After takeoff, the CHIP INT XMSN segment light and MASTER CAUTION lights illuminated. The aircraft was immediately returned for landing and the engines shut down. Maintenance determined that the intermediate gear box was unserviceable and replaced the unit.

■ **Class E:** Before second leg of mission, the No. 2 engine failed to reach operating Ng, and TGT reached abort limits causing the crew to abort the start. Another start sequence was attempted after one minute with the same results. The No. 2 engine HMU was replaced.

C-12

D Model

■ **Class B:** Landing gear failed to extend. Crew initiated emergency landing procedures. Minimal damage to engines reported, but props were destroyed.

C-26

B Model

■ **Class E:** On takeoff roll, prior to Vr, N2 engine speed decreased from 100 percent to 98 percent. Takeoff aborted.

CAS-212

■ **Class B:** During climbout, left engine torque climbed from 100 psi to 115 psi. Power was immediately reduced and the aircraft was landed.

RQ-7

Shadow Model

■ **Class B (Total Loss):** Air vehicle experienced an auto-pilot failure during transition operations from the forward site back to the launch/recovery site. Air vehicle entered uncontrolled flight, crashed, and was totally destroyed.

■ **Class B (Total Loss):** Air vehicle was being flown for a training mission when the controller reported a spike in the aircraft's RPM, followed by an auto-pilot failure. Ground control station's primary and secondary control links were lost as well. Air vehicle and mission package were destroyed.

■ **Class C:** Air vehicle experienced generator failure during flight, followed by engine failure. The air vehicle was commanded to an FOB and became inverted prior to ground contact.

■ **Class C:** Air vehicle experienced engine failure during climbout. Engine-out procedures were executed and the air vehicle landed hard.

■ **Class C:** Air vehicle experienced engine failure and began losing altitude. Approximately 4.6 hours into flight, the aerial vehicle operator (AVO) noticed an engine failure warning. Within seconds, the air vehicle's engine stopped and the voltage reading dropped to 18, which is the lowest voltage for a parachute to deploy. The parachute deployed at 2,200 feet. Air vehicle was recovered and handed over to the BCT who secured it and moved it back to the launch and recovery site. The air vehicle appeared to have minimal damage.

■ **Class C:** While in cruise flight at 9,000 feet AGL and 93 knots, the air vehicle experienced an engine failure. The air vehicle was remotely turned back towards the originating airfield and the parachute recovery system was deployed. Postflight inspection revealed substantial damage to the nose area, fuselage, payload, and the left wing tip.

■ **Class C:** Air vehicle was launched for a reconnaissance mission. Approximately 3.5 hours into the mission, the rotor air temperature rose dramatically. The aircraft was turned back to base to be recovered. Minutes later the RPM fell from 5,750 to 4,250 and the AVO tried to level the aircraft off to cool the engine and regain RPM. The aircraft continued to descend and the RPM would not respond. The parachute deployed successfully at 1,000 feet and the air vehicle was recovered with minimal damage.

■ **Class C:** Air vehicle experienced engine failure during climbout. Engine-out procedures were executed by the AVO and the recovery chute deployed, and the aircraft landed hard.

RQ-5

Hunter Model

■ **Class C:** Air vehicle was returning to station when a dual engine failure occurred approximately 40 kilometers north of airfield. The recovery chute deployed and the crash plan was activated. Air vehicle came to rest in a remote area. Front engine experienced a 1,000 to 2,000 RPM fluctuation and the aircraft was low on fuel at the time of dual engine failure.

Editor's note: Information published in this section is based on preliminary mishap reports submitted by units and is subject to change. For more information on selected accident briefs, call DSN 558-9552 (334-255-9552) or DSN 558-3410 (334-255-3410).

When in Doubt, turn about!

• The safest course is away from the thunderstorm area. Go a few miles out of your way or land and wait it out if the shortest and most direct route is through the storm area.

• Lowering ceiling and rain showers may indicate thunderstorm activity.

• Don't be fooled by gentle winds and rain; you could be flying into the teeth of a thunderstorm.

• Excessive radio static is a sure sign of a thunderstorm in the area.

• Don't land or take off in the face of an approaching thunderstorm. A sudden gust front and associated low-level turbulence and wind shear could cause loss of control.

• Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.

• Destructive hail can be tossed from thunderstorms into adjacent clear areas. Bear this in mind if you're ever tempted to sneak between thunderstorms.

• Don't trust appearance to be a reliable indicator of the degree of turbulence inside thunderstorm.

• Avoid by at least 20 miles any thunderstorm identified as severe.

Editor's note: The months having the highest frequency of storms—June, July, and August—will be here before we know it. So it's not too early to give summertime flying some thought and review what we know about thunderstorms.