flying SAFETY

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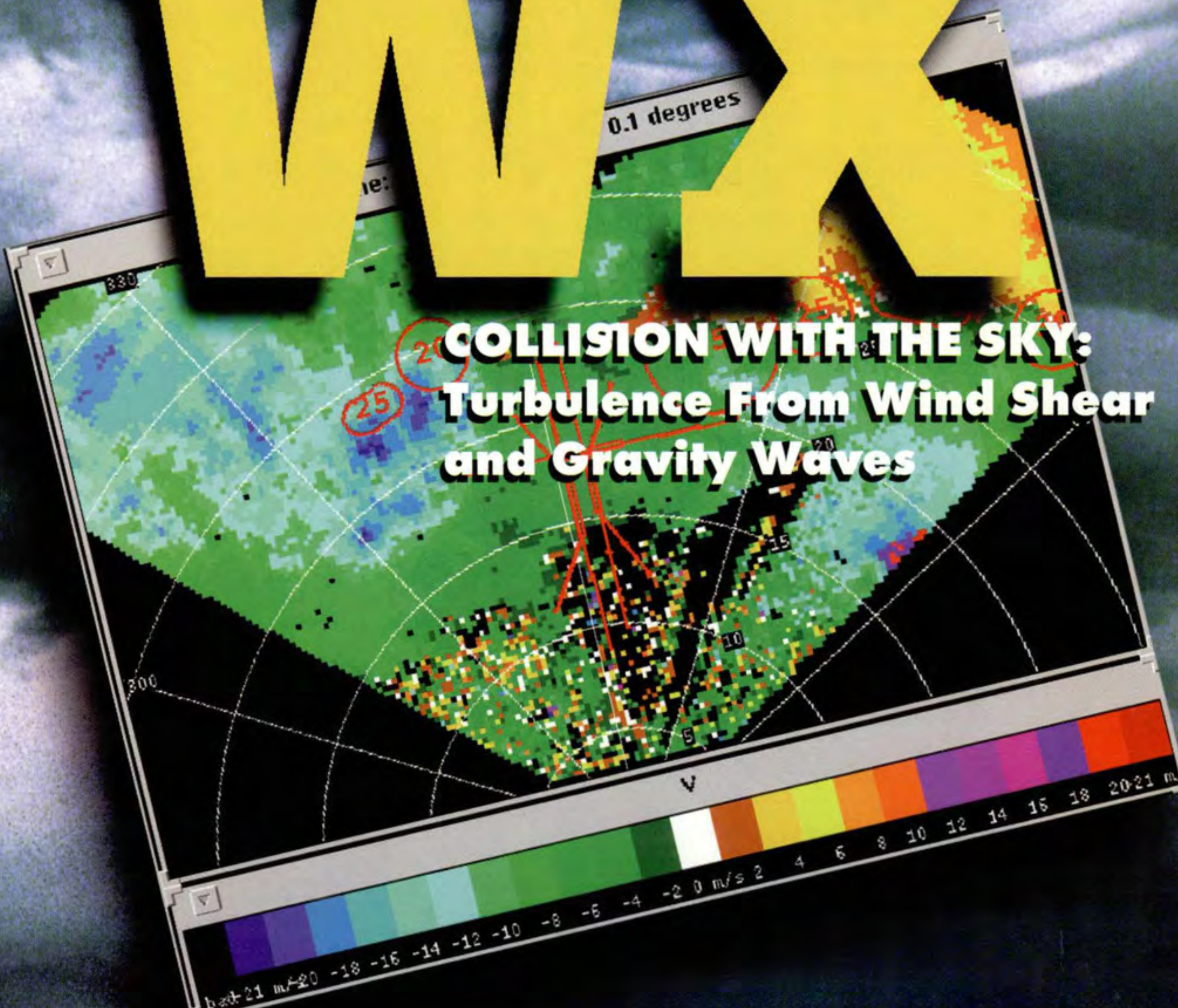


COLLISION WITH THE SKY: Turbulence From Wind Shear and Gravity Waves

RISK MANAGEMENT•

BALANCING RISK AND PAYOFF

There are risks associated with any operation, those you can control, and those you can't. As weapon systems and operations grow more complex and budgets and manpower billets decline, the need to successfully balance risk with gain takes on increased emphasis. Risk management identifies and quantifies possible risks, then identifies risk control methods.

Years past in the flying world, we thought the only way to prepare for the operational mission was to fly low and fast on every training mission. We later learned we exposed our pilots and airframes to more risk in training than required. Most operational missions require only minutes worth of low-level flying, as opposed to hours. This is a prime example of why I asked my commanders to balance risk against payoff as they execute the Air Force Space Command missions.

The command has a helicopter flying mission in support of the Intercontinental Ballistic Missile forces. Risk management is part of day-to-day mission planning, whether providing aerial security for nuclear weapons transport or conducting routine training missions. Through the formal risk management process, our aircrews and commanders continually weigh risk against payoff and make decisions. They may decide not to launch in marginal weather to accomplish emergency procedure training, since the risk is too high for the payoff, and training can be conducted another time. However, they may launch under the same conditions for a real-world medical evacuation, because the payoff is worth the risk.

Air Force Space Command is employing risk management in all our mission areas, to include spacelift. Launch operations are high risk, given that some of the boosters contain over a million and a half pounds of explosive propellant. Risk management and all our other safety procedures minimize the potential for loss of life and collateral damage. We conduct in-depth hazard identification and analysis throughout booster and payload buildup activity and continue right up until ignition and liftoff. Hazards are identified and controlled to protect personnel and property. Risk management ensures risks and payoffs are continuously evaluated and reevaluated. It's easy to become complacent in the face of repetitive success. Spacelift operations pay enormous dividends in the form of operational satellites placed on orbit, increasing our national capability in communications, navigation, weather, ballistic missile warning, and theater missile defense.

You may have seen CNN's coverage of the recent Delta II launch mishap at Cape Canaveral Air Station. What you didn't see amid the flames of the explosion were the control measures we established well before the launch that prevented injuries and minimized collateral damage. These control measures include wind analysis for debris dispersal, booster burn exhaust, well-defined clear zones, and a reliable, redundant flight termination system. Any launch can be stopped by a number of people if their analysis indicates the risks are too high, much like a modern car assembly line can be stopped by any worker on the line.

Reviewing operations and balancing the risk-payoff ratio is the bottom line to any successful program. We must continue to do high-risk high-payoff events because they are essential to our getting business done, but we must eliminate high-risk low-payoff activities that put our resources at risk for little or no return. If you're not sure how to balance risk against payoff, have someone trained in risk management help you. By employing risk management, we can reduce hardware loss and save our most precious resource—people. ✈

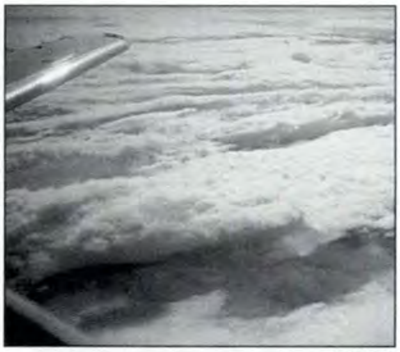
GENERAL HOWELL M. ESTES III
Commander, Air Force Space Command

UNITED STATES AIR FORCE

AIR FORCE RECURRING PUBLICATION 91-1

Flying Safety

JUNE 1997
VOLUME 53, NUMBER 6



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Cover K-H cloud photograph by
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SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS
Contributions are welcome as are comments and criticism. No payments can be made for manuscripts submitted for publication. Call the Editor at DSN 246-0936 or send correspondence to Editor, *Flying Safety* Magazine, HQ AFSC/PA, 9700 G Ave., S.E., Ste 282, Kirtland Air Force Base, New Mexico 87117-5670. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning.

NUGGETS OVE

LT ROBERT JONES
Courtesy *Approach*, Sep-Oct 95

My RIO and I were first-cruise nuggets in the Arabian Gulf on the first deployment of the F-14D. As a section leader under training, I was enthusiastic about leading a 2 v 2 AIC hop even if it was a moonless night. The forecast called for 100 SCT 200 BKN 7 for our recovery.

The mission went well, and as our thoughts turned toward heading back, we noticed some cells building up in mother's general direction. The first real sign of things to come, however, was my CO calling us from his turning jet back on deck. The chuckles, the "You guys are gonna love this," and the scrubbed launch all clued us in to the fact that we were going to have a bit of weather for our recovery.

We closed on mom's position and had to penetrate a solid overcast from 40,000 feet to marshal altitude, dodging several imbedded cells on the way. Since my wingman's radar was a little shaky, I decided to keep him with me to help him avoid the cells. During the idle descent, I began to feel a little impressed! I had never seen two 60,000-pound airplanes get tossed so violently. My RIO calmly directed us around the worst of the cells, all the while reassuring marshal that we didn't care if we violated some little rock's 12-mile standoff. My wingman was doing a great job of hanging on, but I was glad to finally drop him off at marshal.

Marshal had given us four or five push times and expected final bearings, so we waited for them to figure out which ones were correct. We heard a senior aviator report the position of the largest cell in the area to mom. He indicated she was steaming right for it. "Stand by" was the only response he received.

As we pushed from the top of the stack, it appeared that the ship had executed a couple of displacement rolls and was not vectoring aircraft for a right downwind recovery. Our controller was falling behind since every aircraft was on a vector and mother kept fishing for winds. He seemed to be hanging in there until we heard, "Power! Power! Power! Bolter! Bolter!" from an LSO. This had the surprising effect of driving our controller's voice up an octave.

As we broke out at 2,000 feet, still 10 nm upwind, I thought that finally we were going to earn a little of our flight pay. I have always believed naval aviators generally have one thing in common: We like to be personally challenged in our aircraft. That's as close to a rationalization of the whole night-trap thing as I can get. At any rate, the lightning and turbulence at 1,200 feet, combined with the increasingly panicky controller and talkative

R ARABIA

LSO, motivated my RIO and me to really nail this pass.

The lightning was the most impressive I had ever seen, constant and in all quadrants. I noticed we were on a vector that would have us cross the bow at about 5 miles, and we began trying to get a word in edgewise. Our controller was falling further behind as the now-excited LSO was calling, "Paddles contact," for each aircraft at 2 miles and directing all the way down. The result was that we crossed the bow not knowing if the controller still had us or not. Other aircraft were beginning to have similar problems, and I began to look at our situation with an even more critical eye. We were "loaded for bear" in an F-14D, which is 2,000 pounds heavier than an F-14A to start. Max trap gave us two looks at the deck before being below tank state. I asked my RIO to carefully calculate our exact bingo to our possible diverts, although I had no desire to see the camels in Saudi Arabia.

As we slowed to approach speed abeam the ship, we were blinded by two quick lightning strikes that surrounded us. I was certain we had been struck since I could not see any instrument lighting or my HUD. I flipped on the T-storm lights and realized the jet was fine except for the radar and my night vision, both of which were gone.

About the time I got the scan going again, we hit some sharp bumps that drew some comments from the backseat. I noticed we accelerated from 150 to 180 knots without touching the power. I have to admit I was never a big believer in microbursts, so I immediately thought we were nose low and accelerating.

About the time I convinced myself that was not the culprit, I told my RIO I suspected we were entering microburst activity and to really hawk the instruments. He looked at airspeed just in time to watch us go from 175 to 125 knots like the gauge was broken. Fortunately, our mighty GE F-110s kept us above 900 feet. I was definitely wide awake!

Approach managed to call our turn to final, and I told them our approach speed would be a little higher than normal. My RIO and I were not pumped for our approach. We were going to nail this pass. Not only did we want out of this weather, but we wanted to also demonstrate to the air wing they could count on our squadron to do it right every time, no matter how junior the crew.

At 4 miles on final, we hit the worst of the cells. We were thrown down with such force that I heard my RIO's PCL hit the top of the canopy. I selected full power and rotated to just over 20-degrees nose high, and I still had a 2,000-fpm descent rate for several seconds.

As we flew through the burst, we shot to almost 2,000 feet before I could stabilize and continue the approach. The LSO decided to help me down and called, "Paddles contact, at 3 miles. You're high." I wonder why.

By 2 miles, we were on glidepath, on course, and just waiting for another burst. Then, Approach said something I could not believe: "205, discontinue approach, climb to 2,000 feet and tank." I was looking at a clear deck, on and on at 2 miles, with plenty of gas! I thought Approach was confused since there had already been some bolters in front of us. They repeated the command, so I figured they meant us.

As I added power and started to clean up, I met the tanker right over the ship, flying up the final bearing. My RIO mentioned something about how spectacular a midair would be right over mom, and I began to suspect that no one in the

continued on next page

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POSTAL INFORMATION — *Flying Safety* (ISSN 00279-9308) is published monthly by HQ AFSC/PA, 9700 "G" Avenue, S.E., Kirtland AFB NM 87117-5670. Periodicals postage paid at Albuquerque NM and additional mailing offices. **POSTMASTER:** Send address changes to *Flying Safety*, 9700 "G" Avenue, S.E., Kirtland AFB NM 87117-5670.

ship was very concerned about us.

Based on the verbal picture, there were now two Tomcats, a Hornet, and an Intruder trying to find a tanker at 2,000 feet overhead the ship. We were all in instrument conditions, and our jet had no radar. We still had 4.3 on the gas, and we figured 3.6 was as low as we could get and still make our divert. So, being the motivated, can-do JOs that we were, we would just get a vector to the tanker, get plugged during a smooth spot, and return to mom. After all, diverting from the carrier in the Arabian Gulf is like removing a gun from a battleship. Besides, it would be admitting defeat.

Unfortunately, Departure made the last critical mistake of the evening. When we asked for a vector, we got a quick "On your nose for five." The vector was away from the ship and right into the heart of a bad area of lightning. We pressed out that way for a minute and then asked for another vector. Again, we got, "On your nose," but the range had increased. We continued into the worst area of lightning and asked one more time. We got the same call, again with greater range.

My RIO, who had been displaying infinite patience, figured out that the calls were from the tanker to us. We turned around, but since we didn't know the tanker's heading, the "on your nose" calls were useless. We did our best to stay VMC in a thunderstorm, but after a minute or two, we had to tell Departure that we were IMC and needed a vector from 205 to the tanker. This time we got, "205 is at your three o'clock for four." Again, no help.

Checking our fuel, I could not stare at the gauge hard enough to get any more than 3.6 out of it. I told my RO to try one more time and make it clear we were leaving if they didn't answer us. His extremely calm, clear request for a vector resulted in a "Stand by." Departure sounded shocked when we told him we were "passing 10,000 feet, switching Dharan Approach."

I was disgusted with myself. We had not met the challenge. I was sure the other aircraft still airborne were going to get their gas and get aboard. That would leave the nugget-nugget crew as the ones who couldn't make it. But as we broke out on top, I began to feel a little better. Looking behind us, I could see the tops of that storm going up to the high 40s. No wimpy storm there.

I remembered the aviator who called the storm's position 30 minutes before the ship entered it. I wondered if the ship could have avoided it. I thought about the fact that through the saturated controllers, comm jamming, lightning, and microbursts, we had made it to final. Steaming under that cell put the wind over the deck out of limits and canceled our only look at trapping.

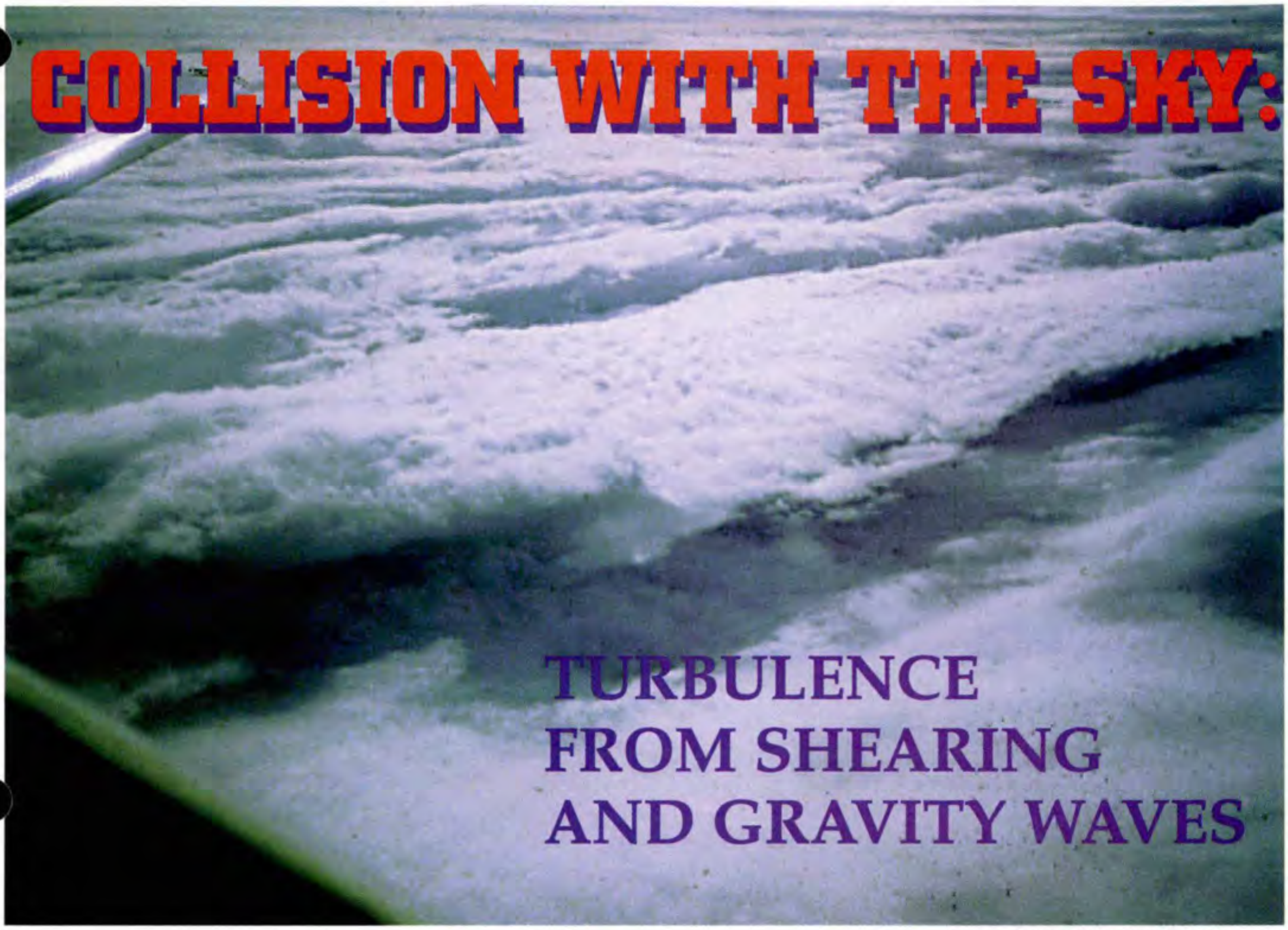
Then I thought of the circling aircraft, co-altitude over the ship, in and out of clouds and lightning, at night, with frazzled controllers. That couldn't be right. Things started falling apart as we left. Requests for divert states and "pigeons" from the remaining aircraft resulted in "Stand by" or briefs on barricade fuel states. Finally, all remaining aircraft were directed to divert. In all, five aircraft diverted that night with the only damage being some delamination of an A-6 intake from a lightning strike.

I'm glad I didn't allow the disgust I felt for diverting prevent me from doing the right thing. I looked at that fuel gauge a long time, trying to find some excuse to stay around and keep playing. I'm also thankful I had such an outstanding RIO that night. I can't overemphasize the value of staying calm on the radio, even if stuff is bouncing off your head and everyone else is screaming.

Most importantly, I'm glad my nugget bud and I got the opportunity to experience the night, thunderstorm, no gas, foreign land, and challenge to our airmanship and judgment. We both learned a lot more than if we had the decisions made for us. ✈

COLLISION WITH THE SKY:

TURBULENCE FROM SHEARING AND GRAVITY WAVES



Photos by Dr. Thomas Carney, Purdue Univ. via the author

MAJ TIMOTHY H. MINER
Headquarters Air Weather Service
Scott AFB, Illinois

In the summer of 1996, a commercial airliner rotated for takeoff at a major airport in the southwestern United States. Once airborne, the aircraft experienced a rapid rolling motion that could not be stopped by the pilots until the jet rolled about 90 degrees to the ground. While this left passengers on one side of the plane with a wonderful view of the ground at a very low altitude, nobody on the aircraft enjoyed the scene. The pilots returned to level flight soon after the rolling stopped. There were no thunderstorms in the terminal area at the time. Scientists called the phenomena a gravity wave. The pilot called it a collision with the sky.

The atmosphere can actually throw "obstacles" in front of aircraft by the way it moves—we perceive such motion as turbulence. Aviation safety is directly impacted by the ways aviators prepare and respond to turbulent skies.

With more aircraft flying, the aviation community is increasingly affected by the impact of turbulence. Turbulence forecasts directly impact military missions daily. More people are injured by turbulence in commercial aviation every year—over 500 flight attendants are injured annually. Maybe we need to take a quick review of what we know about turbulence and peek at potential operational changes ahead as more emphasis is placed on turbulence research.

The Nature of Turbulence

Turbulence is actually part of the natural state of the atmosphere. It is like a stream, a fluid in motion. It has eddies and countercurrents, bubbles and smoother spots. As aviators, we tend to think of turbulence as an unexpected motion of the air in a violent pattern that causes our aircraft to depart its intended flightpath or airspeed.

Our current definitions of turbulence are based on how we, as pilots, perceive the changing motion of the aircraft or its controllability. But turbulence doesn't have to be violent. In fact, it may not even be perceived by the pilot. In 1995, a large commercial airliner in cruise had the flight deck crew and front flight attendants experience a brief lightness on the feet but no adverse reaction.

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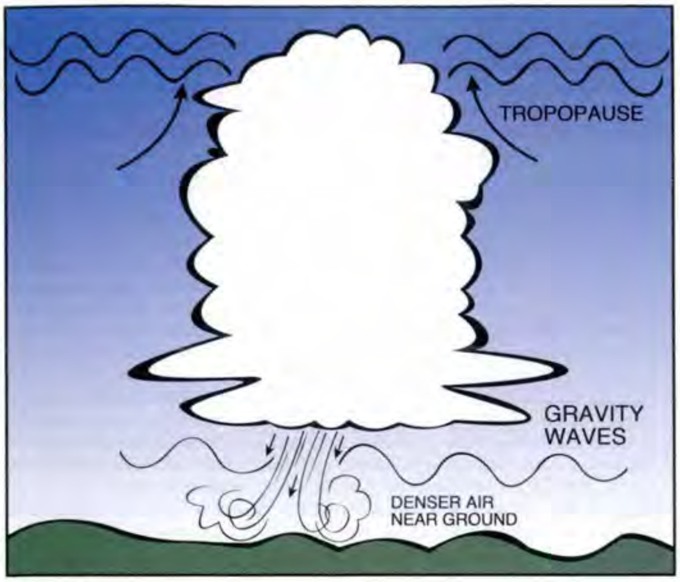
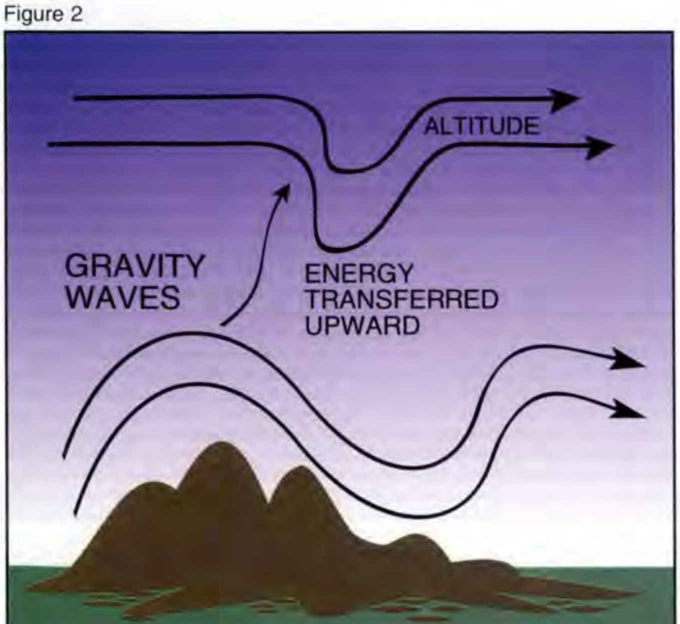


Figure 1

There was no change in the aircraft's speed or altitude. However, in the back of the aircraft, three flight attendants and six passengers were thrown about enough to break bones.

According to studies done by the National Center for Atmospheric Research in Boulder, Colorado, it is the size of the eddy in the flowing stream of air that determines the impact to an aircraft. When an eddy is larger than 6 kilometers, there is no effect. When there is an eddy between 2 and 6 kilometers in size, it is not usually felt unless there is a wind shear associated with it equal to or greater than 15 knots, and then there will be only a noticeable change in airspeed. There is no real impact when the eddy is less than 50 meters in size. The optimum size for eddies to impact an aircraft is between 50 meters and 2 kilometers.

Figure 2



Turbulent flow in the atmosphere comes from many different sources. Such flow is always assumed whenever convective activity is forecasted. The turbulence comes not only from the up-and-down drafts within the convective storm, but also from the disrupted airflow around the cumulus clouds. In the boundary layer—the lowest 1km of the atmosphere—the air above heated ground rises, creating turbulent eddies. Terrain creates many different "mechanical" turbulent flow patterns such as mountain wave activity, rotor clouds, and flow through canyons and gaps. Finally, there is turbulence from horizontal shearing—changes in wind speed and/or direction within a short distance, such as near a strong jet stream. Each of these processes is explained well in the written material most aviators have on weather.

Shearing and Gravity Waves

What isn't explained so well is the impact vertical shearing has on turbulence. An analogy of shearing can help. Imagine a calm lake with a smooth surface. The lake is filled with a very moist fluid with a very weak current. Over the top of the water is a dryer fluid (air) moving with a stronger current. This creates a vertically sheared situation. As the velocity of the air increases relative to the water, waves begin to form on the water's surface. The waves are the turbulent "eddies."

This turbulent flow also develops between dryer air flowing faster over denser air in the atmosphere. It can happen in the boundary layer and at altitude. At altitude where the shearing can be very large, Kelvin-Helmholtz clouds are produced. The K-H cloud looks like a cresting wave at a favorite surfing beach. The vertical motions of the air around these clouds and the waves on the surfing beach are not too dissimilar. This type of turbulence is also possible close to the ground where moist air along the surface has a dryer and faster airflow on top.

A final process that produces turbulent flow of the air is the gravity wave. This is the turbulent flow that sent the commercial airliner rolling in the opening story example. If we go back to our calm lake image again, we can see gravity waves working like they would in the atmosphere. Throw a rock into the calm lake, and waves ripple out in all directions away from where the water was disturbed. The lake's ripples are gravity waves. Gravity waves form close to the Earth or at altitude. When a denser air mass near the surface of the Earth is "punched down" from a microburst or downdraft, waves in the denser air travel away from the disturbance like the ripples on the surface of the lake. When a thunderstorm punches up through the tropopause, waves ripple away from that disturbance. The result here is turbulence at the higher altitudes. (See figure 1.)

Meteorologists are seeing these gravity waves travel very long distances away from the initial event that set up these vertical motions in the atmosphere. The gravity waves in the opening of this article traveled dozens of miles away from a thunderstorm to catch the crew unprepared at a low altitude. But gravity waves don't need a thunderstorm to form. Terrain-induced mountain waves can force the air above it to be displaced. As the energy from this updraft travels higher, a gravity wave is produced. (See figure 2.) The unsuspecting pilot flying through it files another report of turbulence.

How Can You Avoid Turbulence From Shearing and Gravity Waves?

To keep from filing those turbulence reports, keep aware. There are lots of published ways to key you into the potential for turbulent flows in the atmosphere. When it comes to shearing turbulence and gravity waves, you might want to add a few more tricks to your bag of savvy weather wisdom.

During the weather briefing, be aware of the wind speeds and directions above and below your filed altitude. If there are significant differences, you might ask about reports of turbulence. Also, know the tropopause height, especially around thunderstorms that could be high enough to disrupt the flow of air or punch through to create gravity waves. Of course, when airborne, watch out for K-H clouds as well as lenticular-shaped clouds in your flightpath. Listen to other aircraft in the area on the ATC radio. Be sure to help other aircraft by reporting turbulence wherever and whenever you encounter it.

New Ways to Describe Turbulence Coming in the Future

Right now, researchers are working with ICAO and the aviation industry to develop new tools to help aviators and planners work in the turbulent skies. The National Aeronautics and Space Administration is developing new techniques to sense turbulent flow in the air around an aircraft in flight. An airborne sensor could be available soon.

Commercial aircraft in the United States are automatically data-linking weather information, including turbulence data. This program, called MDCRS for the Meteorological Data Collection and Reporting System, records wind, temperature, and location information along with (currently) g-meter readings every 7 minutes in cruise. Over 30,000 observations come from aircraft daily in the U.S. By this summer, a new value, called the eddy dissipation rate, will be sensed by some of the aircraft. This program is the first step to create a new OBJECTIVE scale to measure the motions of the atmosphere.

The current way of SUBJECTIVELY describing turbulence (light, moderate, severe, chop, continuous, intermittent) is considered by most inadequate for modeling forecasts and for communicating the impact of the atmosphere to every aircraft flying in the airspace. Although it is years away, a new objective scale for turbulence is being created as you read this. The scale will be independent of the type of aircraft. It could be displayed in the flight deck for the pilot to observe and report. Every aircraft would be certified by the manufacturer for operations at specific values of turbulence.

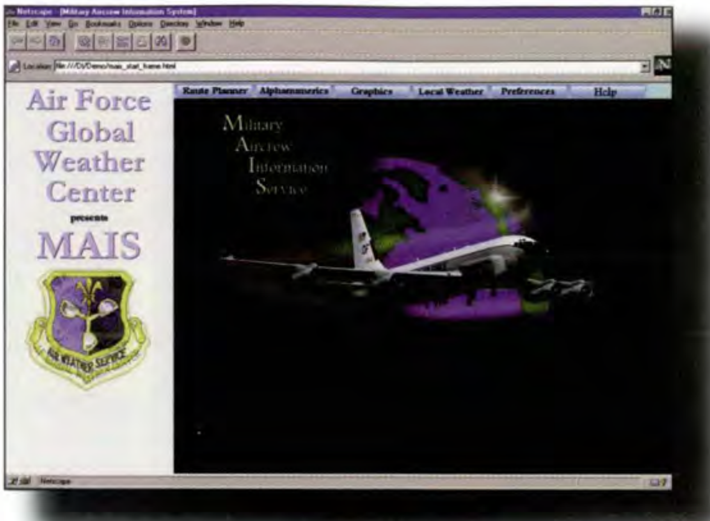
With the potential for sensing the turbulent motions of the atmosphere and an objective aircraft-independent scale for communicating the realistic motions of the atmosphere, aviators will have better chances to avoid turbulence and to receive better modeled weather information.

Conclusion

There are many ways to produce the natural turbulent motions of the atmosphere. Most processes are well documented in our weather guidance.

However, meteorologists are only now beginning to understand the phenomena of shearing turbulence and gravity waves. Until new technology allows the aviator to sense and avoid these turbulence-producing phenomena, each aviator will have to depend on being aware from the clues available during the weather briefings and the signs of potential turbulence while airborne. The goal is a safe and successful mission each and every time a plane takes to the air. One way to be safe is to avoid the collision with the sky. ✈

At altitude where the shearing can be very large, Kelvin-Helmholtz clouds are produced. The K-H cloud looks like a cresting wave at a favorite surfing beach. The vertical motions of the air around these clouds and the waves on the surfing beach are not too dissimilar. This type of turbulence is also possible close to the ground where moist air along the surface has a dryer and faster airflow on top.



Give MA

Starting with initial operational capability targeted for July 1997, HQ USAF/XOW (Air Force Weather), in cooperation with HQ USAF/XOO and the Guard and Reserve operational communities, will unveil the Military Aircrew Information Service (MAIS).

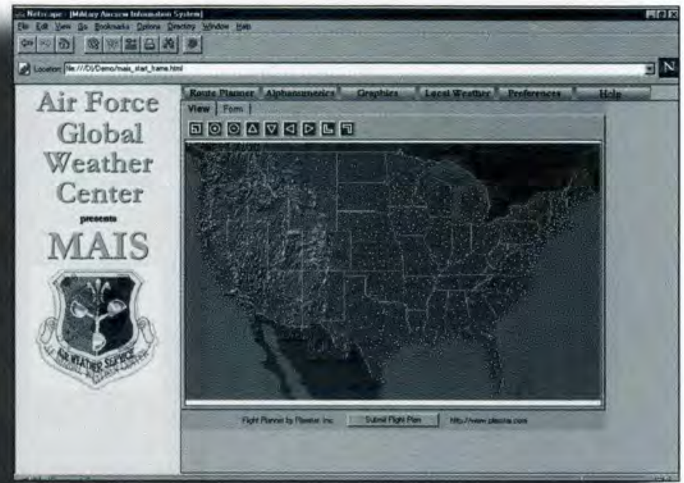
LT COL AL BELCHER
Air Force Global Weather Center
Offutt AFB, Nebraska

Ever had trouble getting the required preflight weather briefing? Lines too long, phones busy at the base weather station? TDY to who-knows-where and not a weatherman in sight for your required 175-1 brief? Well, we've come up with a new solution to bring you the most current and accurate weather information available anywhere from a myriad of military and civilian weather data providers with the most user-friendly interface designs available.

Starting with initial operational capability targeted for July 1997, HQ USAF/XOW (Air Force Weather), in cooperation with HQ USAF/XOO and the Guard and Reserve operational communities, will unveil the Military Aircrew Information Service (MAIS). This product, designed in concert with line fliers, will walk you through a basic flight-planning process via point- and-click maps or alphanumeric input (those details you would normally enter on a DD 175/1801) to identify the locations where you want/need weather information.

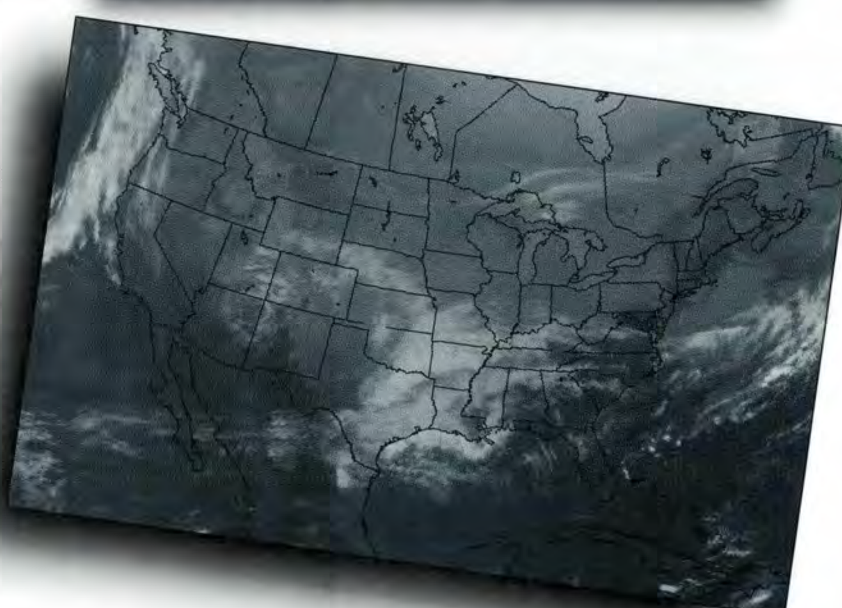
This is far more than just an automated Dash One briefing system. MAIS will select information such as terminal area forecasts, current observations, NOTAMs, flight hazards, radar/satellite loops, and other relevant information to display on map backgrounds

IS a try!



you use for flight (JNCs, ONCs, etc.), in simple, user-friendly formats and provide hard copy of DD 175-1-type information to quickly allow self-briefing of the weather information required before flight. The July release of MAIS will focus primarily on Guard and Reserve customers at CONUS locations, but we will soon begin efforts to expand the system to the active duty and expand to worldwide coverage.

The system is designed to know, via the user details you provide, what type of weather information is significant/important for your aircraft or mission. Products will include alphanumeric (when applicable), GIF-formatted visualizations, and GRIB format (which allows for multiple overlays of information you designate, e.g., radar and satellite data on the same map background). MAIS will be available over the Internet with the use of Netscape or Internet Explorer browsers or via a direct dial modem connection. This access should make mission weather easily available to you at work, home, or on the road.



MAIS is designed to be an ever-evolving system, so as your mission needs change or enhanced weather technologies become available, MAIS will be able to secure and display the new products required by you, our customer.

For SOFs or commanders who want to keep on top of the latest local area situation, the system has areas specifically designed to keep you automatically updated on the latest local area weather situation as well as inform you of any weather warnings affecting your installation. More information will be forthcoming through ops and weather channels as we get closer to the July release date.

Give MAIS a try. You might actually like it. If you don't, let us know what we can change to make MAIS your supplier of choice for weather information.

For the latest on MAIS development efforts, contact myself, Lt Col Al Belcher at DSN 271-7378 or Lt Col Barney Knauss at DSN 271-5520. ✈

HEAT STRESS •

Courtesy *Spotlight Special*
Operations in Tropical Mountainous Areas
Third Edition, Feb 97
Directorate of Flying Safety, RAAF

It is impossible, sitting in an air-conditioned office, to fully appreciate the debilitating effects of heat on aircrew who must work outdoors. But make no mistake, heat can kill. It can kill directly through its cumulative effects upon the human body, or it can kill indirectly through its debilitating effects on aircrew performance and subsequent loss of an aircraft.

One of the first casualties of operating in a hot environment is a sharp degradation in mental performance. Even simple tasks are often associated with a high percentage of careless errors. You're just not as sharp as you were in a more temperate climate. This decline in performance can occur without your being aware that the heat is in any way affecting you.

In flight operations, this degradation in mental capacity is often exhibited by missed checklist items, faulty flight planning, hitting the wrong switch, or seemingly intentional violation of basic rules and regulations. It can affect an entire crew so that no one acts as a safety valve to "knock it off" when things are obviously becoming unsafe. An example is a USAF transport crew which, in their determination to leave a hot desert ramp, departed with an unserviceable inertial navigation system and a blocked fuel filter on one engine. Only after the crew got airborne and cooled off did the seriousness of their actions become apparent. Although the crew admitted to being uncomfortably hot prior to departure, none were aware that their mental capacities had been so severely degraded by the heat.

Minor discomforts, confusion, disorientation, memory loss, etc., which occur to you, that you observe in fellow aircrew members or that supervisors see must not be overlooked. They may be the earliest signs that heat is beginning to cause serious problems. Be aware that even relatively mild heat stress can impair aircrew performance enough to tip the balance toward failure.

An often unrecognized effect of heat is a marked reduction in G-tolerance. As the body's core temperature rises, the G-tolerance falls precipitously. It is important to realize that it is the core temperature which determines the body's response to heat—not the subjective "comfort" temperature of the skin. The skin temperature responds rapidly to environmental cooling such as air conditioning or a cool shower. But the body's core temperature requires at least 30 minutes to stabilize to a cooler temperature. Thus, even though you may feel cooler once you get your aircraft into the air, your body may still be operating under the debilitating effects of an elevated core temperature for at least 30 minutes into the mission.

Another aircrew-specific effect of heat is a marked increase in the susceptibility to decompression sickness due to dehydration.

Your body can lose up to 1.5 liters of sweat per hour doing work in heat. In hot, dry climates, the sweat may evaporate so fast that you are unaware of the extent of fluid loss. At the end of the first hour, there may be no sensation of thirst even though you have already lost 1.5 liters. By the end of the second hour (3 liters lost), you may feel thirsty, weary, irritable, sleepy, and suffer loss of appetite. There is a definite performance decrement. By the end of the third hour, if no fluids have been taken, you may well become a heat casualty.

Lack of thirst does not mean you are well hydrated.

To understand how to prevent heat casualties, one must first understand some of the basic physiological facts about how heat affects the human body. Heat accumulation in the body depends upon the climatic conditions (temperature, humidity, sunny versus shade, wind, etc.), physical workload, and clothing.

As the temperature rises and equals or exceeds body temperature (37°C), the only mechanism for the body to dissipate heat is through the evaporation of sweat. Thus, anything that interferes with the body's ability to sweat or the evaporative process will accentuate the body's accumulation of heat.

One of the main factors which determines how quickly the body responds to heat through the production of sweat is the degree to which one is acclimatized to the heat. Acclimatization is the process by which the body adapts itself to heat. It takes time (about 7-10 days), depending on the degree of exposure, work performed, and individual physical fitness (the more fit you are the quicker you acclimatize).

A common misconception is that someone who is heat-acclimatized sweats less than someone who is not. On the contrary, if you're heat acclimatized, you begin sweating earlier and sweat more profusely than someone who is not. Remember, it's the evaporation of sweat from the body which gives the maximum protection from the effects of heat accumulation.

To gain the maximum benefits from acclimatization, you must remain well hydrated. Dehydration reduces sweating, limits your body's ability to regulate its temperature, and predisposes it to heat injury. Voluntary dehydration increases with air temperature, work rate, effort required to get a drink, and palatability of the water provided. Female personnel will often voluntarily dehydrate themselves if toilet facilities are felt to be unfit or do not provide adequate privacy.

Heat exposure and the resulting dehydration can have a dramatically detrimental effect on aircrew readiness and mission success. Command supervision must ensure that all personnel are educated with respect to the DOs and DON'Ts of preventing heat injury. Commanders must institute measures which promote constant monitoring of personnel performance and adoption of the preventative guidelines listed below:

♦ Adequate, timely, and recurrent water and food intake by all personnel.

♦ Air and ground crews must have water available to them at their work and rest sites.

♦ All personnel should pre-hydrate with 1-2 liters of water before prolonged activity.

♦ Midday urine checks (urine should be no darker than dilute lemonade) to enhance individual awareness and responsibility for avoiding voluntary dehydration.

♦ Careful management of work assignments and recovery periods.

♦ Ensure outdoor activities are adjusted to allow for prevailing conditions.

♦ Personnel acquire and maintain appropriate levels of physical fitness and heat acclimation.

The effects of heat and heat-related casualties are preventable, but it requires the combined efforts of personnel and their supervisors to achieve the goal. ✈

Adapted for the RAAF by Lt Col Michael R. Mork, USAF/RAAF Exchange Program, from Preventing Heat Casualties During Operations From Desert Air Bases, USAF School of Aerospace Medicine

ALCOHOL AND FLYING

EXCESSIVE consumption of alcohol is another sure way of doing a real good job of dehydrating the body. Now, before you shut this magazine and toss it in the corner of your office or in the "out" tray, just read on a few lines more—it might just save your life one day.

Stop and think about the times you've flown the day after a heavy night of bending the elbow. Never? What about flying after a dining-in night; or Boggies' Bash; or probably more likely, you're on your first trip away for a while; overseas perhaps, or just far enough away to get out of the local training environment.

How many times have you gone for the traditional first night overspeed, still having to be at the aircraft at 0700 for an 0800 departure? I would think that most aircrew (90 percent?) would have either been in this situation or flown with someone who was.

The other 10 percent of aircrew are probably kidding themselves.

The Effects of Booze

Of course, everyone knows the effects of a wild night at the bar. Alcohol depresses brain activity, making concentration hard and can induce short-term memory loss. It slows the thinking processes and clouds judgment. Whilst flying, it may affect your decision-making capabilities (to overshoot or not to overshoot?) and make remembering ATC clearances all the more difficult.

Yes, booze affects the central nervous system, suppressing normal responses. Alcohol also exaggerates self-confidence, making you feel you are flying accurately when, in fact, you're not.

Alcohol also makes you hypoxic! Absorbed alcohol blocks the passage of oxygen across membranes surrounding tissue cells, resulting in a lack of oxygen at tissue level. It is toxic hypoxia, and no amount of 100 percent oxygen will help.

You Can't Hide a Hangover

That's okay, you say. The rest of the crew will cover for you. But, what if the rest of the crew were with you the night before? Worse still, you're an instructor with a low-hours student, or your aircraft has only one seat! So, the onus is up to you to make sure your blood alcohol level is zero.

Let's not forget about the other side of the coin—the effects of being hung over are just as bad. Your head's throbbing, your tongue's dry, and your stomach is trying to decide whether or not to reject the breakfast you've just eaten. You are fatigued, and there is no way you are going to perform at your best.

Avoiding the Hangover

So how do you get over the effects of alcohol? Black coffee? Running? A sauna? Drinking a liter of water while standing on your head? 'Fraid not, sunshine. TIME is the cold, hard reality, and there is no way around it.

Well, how can you avoid an embarrassing situation popping up through flying with a hangover or otherwise suffering from the effects of alcohol? Well, it's easy really—just observe the following guidelines:

▸ Think about the next day's tasking. Have you got a 10-hour day ahead of you?

▸ Don't feel obliged or be pressured to drink.

▸ Don't drink on an empty stomach.

▸ Drink, don't gulp (i.e., avoid "boat races").

▸ Limit yourself to a definite time or number of drinks.

▸ If you're not feeling 100 percent fit, have enough pride to admit it, and cancel or delay the sortie.

Microbursts and Wind

LT COL R. E. JOSLIN, USMC
Courtesy *Approach*, Mar-Apr 97

During night ASW operations, the collective, with barometric-altitude hold engaged, rose to its upper limit with VSI indicating approximately 2,000 fpm descent, which could not be arrested as the aircraft descended into the water. Class A mishap: The accepted causal factor for this continuing mission in deteriorating weather.

Some people in the rotary-wing community think they are immune from the catastrophic effects of microbursts and wind shear. In fact, the effects can be quite hazardous, especially in the low-level environment.

The three basic regions of wet or dry microbursts are a headwind, downflow, and a tailwind zone. When we get into the headwind region, our groundspeed decreases, even though our indicated airspeed increases, and the aircraft balloons. Thus, a pilot's natural reaction may be to reduce the collective to maintain altitude or glide slope. At this point, no harm has been done, but if we head into the downflow region, we may have just set ourselves up for disaster.

You can best avoid microbursts and wind shear—usually associated with areas of significant convective activity—through early recognition.

In the downflow region, we can easily have a 20- to 40-knot downflow of air hitting the fuselage, which pushes us toward the ground or water and increases our descent rate. This downflow does not sound like much until you convert it to feet per minute, which then transforms these numbers into approximately 2,000 to 4,000 fpm! Now, we are falling out of the sky, which probably is more than we can stop with the power we have available (a.k.a. settling with power). We may even droop main-rotor rpm as we add collective to slow our descent rate.

Compounding the problem is that once we establish this high-sink rate, we may settle into our own rotor downwash (a.k.a. vortex-ring state power settling) and really aggravate things.

During a mountain landing that ended in a Class B mishap, a high-sink rate developed, full collective applied, Nr began drooping, and aircraft made a hard landing in the trees short of the site.

If you make it through the downflow region and into the tailwind region, you may still have serious problems. If you have a 50-knot tailwind and are only moving across the ground at 50 knots, you are essentially in an unanticipated out-of-ground-effect (OGE) hover and you need high power to keep from descending. This tailwind also increases your groundspeed and can cause a "speed rush," which can be especially disorienting at night or in water spray, rain, dust, or snow.

You can best avoid microbursts and wind shear—usually associated with areas of significant convective activity—through early recognition.

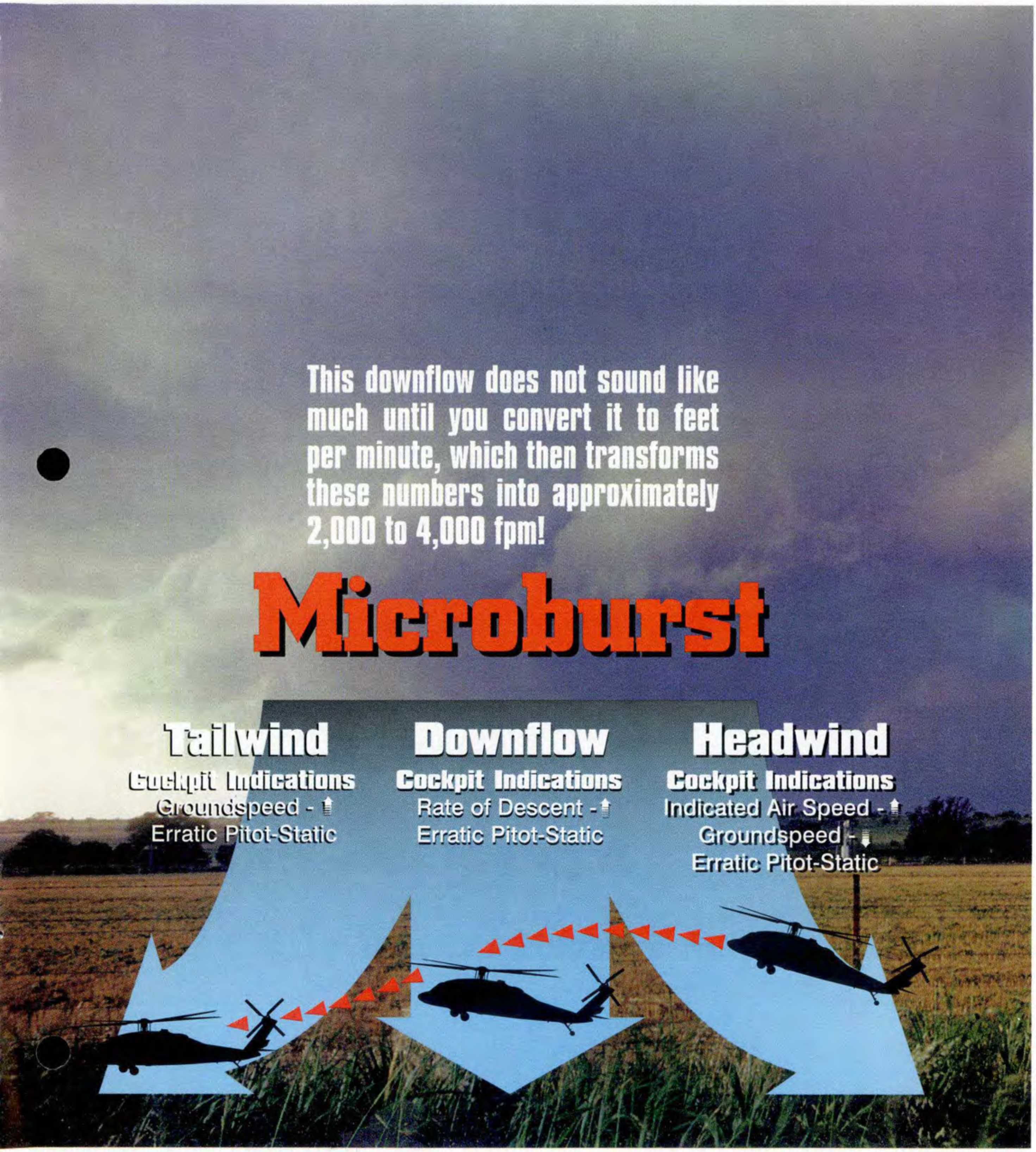
Thunderstorms, which have lots of convective activity, are normally forecast and easily seen and avoided. Dry microbursts are a little harder to detect but have characteristics that may provide some warning such as rapidly shifting surface winds, dust devils, and erratic pitot-static instrument indications (VSI, airspeed, barometric altimeter). In all cases, any barometric altitude and airspeed-hold features should be immediately turned off when you suspect a microburst is near.

Unfortunately, most microbursts are not forecast and generally appear without much notice. Therefore, aircrew must learn to recognize and avoid this hazard, using their own observation skills. Weather and other acts of God cannot be considered mishap causal factors. However, not conducting proper weather preflight planning, or not recognizing and avoiding hazardous weather conditions, can be. ✈

Lt Col Joslin is the operations officer at the Naval Test Pilot School.

Shear for Helo Pilots

This downflow does not sound like much until you convert it to feet per minute, which then transforms these numbers into approximately 2,000 to 4,000 fpm!



FORMATION AIR R

MAJ ELDON A. WOODIE
Joint Action Officer
Air Land Sea Application Center

"WARNING: Receivers will ensure a safe clearance from the tanker(s) as they proceed on their assigned mission."

"...flying two aircraft in close vertical proximity is not safe."

Duh, why does the obvious usually wind up as a warning or caution in a flying regulation? I still recall my T-37 instructor pilot's words when he taught me basic formation flying: "Don't hit the other jet. Don't let the other jet hit you. If you lose sight, know lost wingman procedures cold, and get on the radio. Woodman (that's what he liked to call me), always remember altitude separation is your friend."

I love "war stories," especially now that I'm a staff officer. My fellow staff officers often share their past exploits. None of us wants to tell a war story about a computer locking up or a paper cut, so we dredge up stories real and imagined from our glorious flying past. Next to the combat stories, those that come across as causing the most severe emotional trauma are the tales of formation refueling in the weather.

"Tanker One, this is Bomber Three. We need to come left 40 degrees for weather." I made that call one night in the weather. I was the new aircraft commander of the No. 3 bomber in a flight of three, refueling with two tankers. Tanker One and Bomber One were refueling at FL 200. Bomber Two was refueling with Tanker Two at FL 210. We (Bomber Three) were flying right echelon off Tanker Two.

Tanker One commenced a left turn and announced the turn after established. After the turn was announced, the whole formation started turning. "Murphy" takes over, and into the weather we go.

Tanker One rolled out wings level after 20 degrees of turn and failed to inform the flight. Tanker Two, with Bomber Two in tow, overshot Tanker One before recognizing lead had rolled out. Recognizing the overshoot, Tanker Two started back to a right echelon position from Tanker One. Sometime during this fine performance, the situation awareness (SA) on Bomber Three took a short break, long enough for us to start flying a right echelon position off Tanker One.

Within a breath of simultaneously, Bomber One completed the onload and announced a move out to a left echelon position from Tanker One, and Bomber Two terminated refueling for icing conditions. In short, a giant gaggle! We announced a descent to the bottom of the block. A quick risk management discussion among the crew of Bomber Three yielded the decision not to further pursue air refueling that night.

The prescription for my mess was simple and classic:

EFUELING

USAF Photo by SSgt Andrew N. Dunaway, II

no prior coordination between the bombers and tankers, poor formation briefing, no plan for the briefed poor weather conditions, and almost zero consideration for wingmen. We were able to sort it out that night, but there is a limit to the protective powers of the "big sky theory." Our Air Force has suffered several mishaps related to air refueling, and although this article provides tips focused at planning, briefing, and executing B-1 formation refueling with a formation of tankers, most of the information is generally applicable to all weapon systems.

Planning

Planning a three-on-two refueling may start with, but should not end with asking a senior aviator, "How would you do it?" After getting the old-head information, refer to the appropriate portions of the air refueling manual. Check with your wingmen to see if there are any priorities in the flight for air refueling; i.e., No. 2 aircraft commander is not current and flying with an instructor to regain currency, or No. 3 needs a certain onload to be able to complete the scheduled mission. Armed with the old-head tips, regulation guidance, and the mission requirements, you are ready to coordinate with the tanker lead. If you are unable to reach any of the tanker crews, confirm mission information with their scheduler and pass any special mission requirements.

Briefing

My experience tells me there is a direct link between the quality of the formation brief and later in-flight performance. It pays to use briefing guides, squadron standards, communication cards, and pictures to clearly communicate the planned course of action. Mission, weather, and maintenance changes may limit the time available for the brief.

If you are in charge, take charge! Prepare and distribute a hard copy communication plan to all participants. It is a great SA enhancer for keeping everyone on the same sheet of music. All good aviators like pictures. Using slides to depict airplane positions and altitudes improves the flight's understanding of lead's plan for accomplishing the mission.

A long brief is not the goal. The goal is for every member of the flight to clearly understand the plan for accomplishing mission objectives. All procedures should be in accordance with applicable regulations. (The most notable B-1 air refueling mishap involved nonstandard formation procedures.) If you feel deviations to standard formation procedures or to the air refueling manual are warranted, they must be specifically authorized by command headquarters.

Execution

Execution is simple. Join up with the tanker flight, get the gas, and go your separate ways. What could possibly go wrong? Too long a list comes to mind, so I will concentrate on ways to handle the inevitable in-flight challenges.

Back up lead on the radio. Emission control (EMCON) procedures are not intended to preclude calls for safety-of-flight situations or to ensure mission success. It is better to be embarrassed during the debrief for excessive chatter than hesitating on a safety-of-flight call. Machismo aside, a good lead likes to be properly backed up by wingmen (i.e., altitude conflicts or thunderstorm avoidance).

We don't crash by compartments. Teamwork in every jet is critical. Night and adverse weather compound the requirement for solid teamwork. Coordination between the offensive systems operator and the pilot flying will be intense. The defensive systems operator and the pilot not flying must keep their SA high by monitoring radios, altitude, aircraft performance, and cross-checking the radar or visual references as applicable. Pay particular attention to maintaining position during turns and clo-

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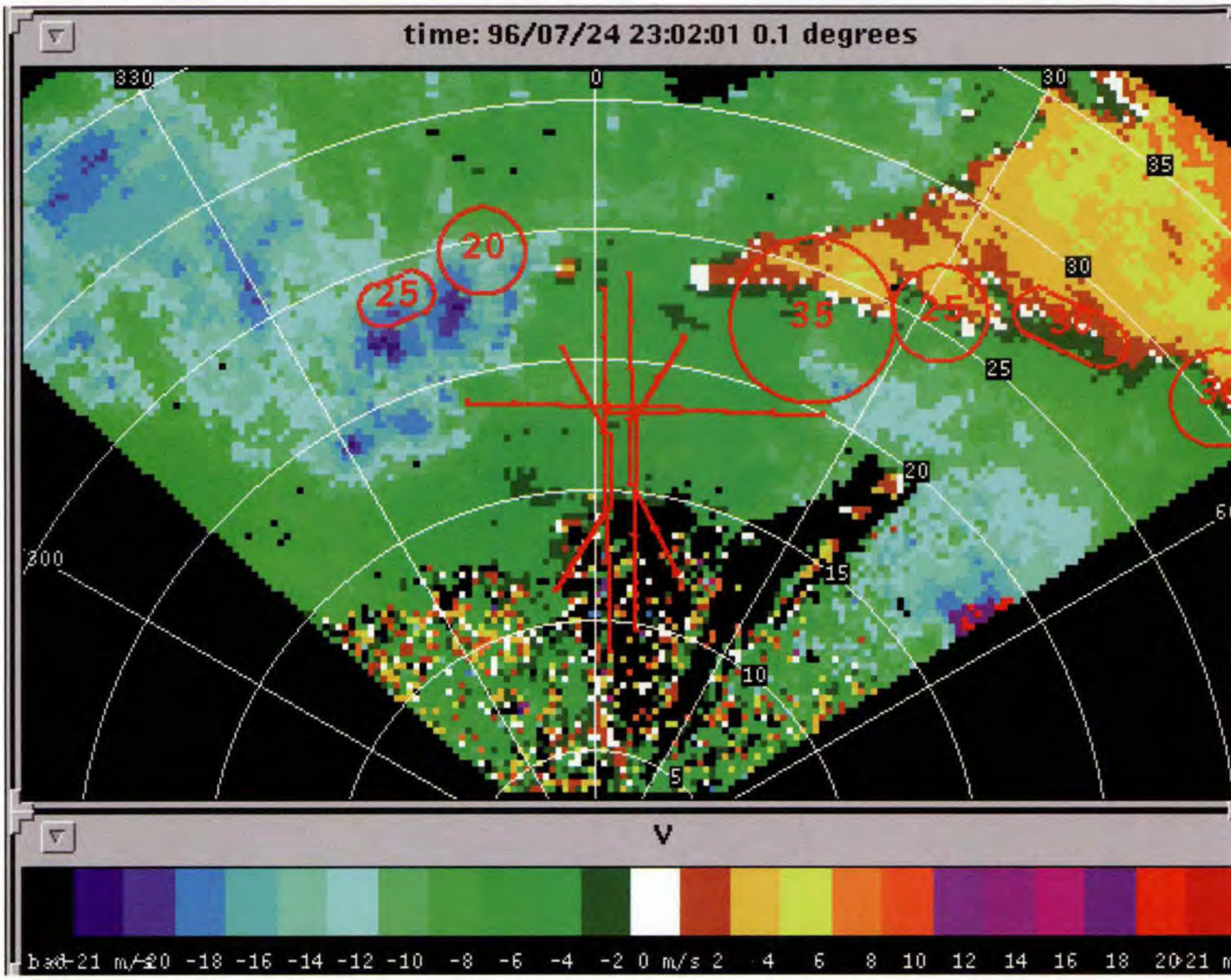
Judgment and Wind Shear



The photo above is raw information the radar is processing to create the picture. This is the product the meteorologist will use.

MAJ TIMOTHY H. MINER
HQ AWS/Directorate of Plans and Operations

For the next few pages, we will critically analyze an epic poem about a young flier by the name of Lt Judgment who had an eventful encounter with wind shear. Like all ballads, this one is also loosely based on fact. Like many ballads, this one has a lesson for all to learn.

Judgment and Wind Shear

The sky was getting darker,
The time was getting late,
When Lt Judgment called
"Yo, RAPCON," at the arrival gate.

The hands of this steely flier
Held power galore and, so,
Not a care would mark the face
When the ATIS said "wind shear" below.

Wind shear! Now that's a subject we all need to look at again. It is the No. 1 weather killer in aviation. In the last 20 years, over 650 deaths were caused by wind shear in just commercial aviation alone.

We all know from weather training material that wind shear is a rapid change in wind speed and/or direction in either the horizontal or vertical direction. We know that wind shear can cause significant turbulence. But low to the ground, wind shear can be a killer. Studies on wind shear accidents have shown that pilots have only 5 to 15 seconds to react and react correctly, in order to safely negotiate the rapidly changing headwinds and tailwinds, strong side gusts, and variable lift on the wings induced by wind shear.

The causes of wind shear are very well known. Convective weather with gust fronts, down drafts, microbursts, and gravity waves (see article on gravity waves in this issue of Flying Safety) are the most significant forms of wind shear. Terrain features like mountains, canyons, gullies, and rivers cause wind flow to change over short distances. Man-made obstacles (like that large hangar beside the runway) also create changes in the wind pattern. Fronts and storms can create vertical shearing in the atmosphere close to the ground.

But, just as important as knowing the weather behind the phenomena is knowing how the hazard can be avoided.

The runway came into view.
To hold speed, extra power was a must.
Though the cumulus were only miles away,
Below, the flier noticed blowing sand and dust.

Then tower called up to the pilot,
"We just wanted to give a warning, boss,
For a C-5 reported wind shear there,
From right to left, with a 30-knot loss."

Wind Shear Warnings

So how do you know there is a wind shear in your immediate future?

Lt J could have received a warning from the weather briefing. Recent changes to AFM 15-124 ask weather forecasters to add specific detail on wind shear. In the past, a TAF would include a remark such as "LLWS." This changed to allow forecasters to put specific values of winds at the heights forecasted. An example would be a possible remark of wind at 1500 AGL at 36045KT. While the briefing would alert our aviator, the best wind information is that gathered in real-time.

Lt J had clues from the aircraft. The power setting was higher than normal. The pilot saw blowing sand and dust. Maybe the navigation system's wind reading was significantly different than the winds reported on the ground. All of these clues should have pointed to wind shear already mentioned on the ATIS.

There are other ways to get a heads-up about wind shear. At Air Force bases, there are three primary warning systems. The first

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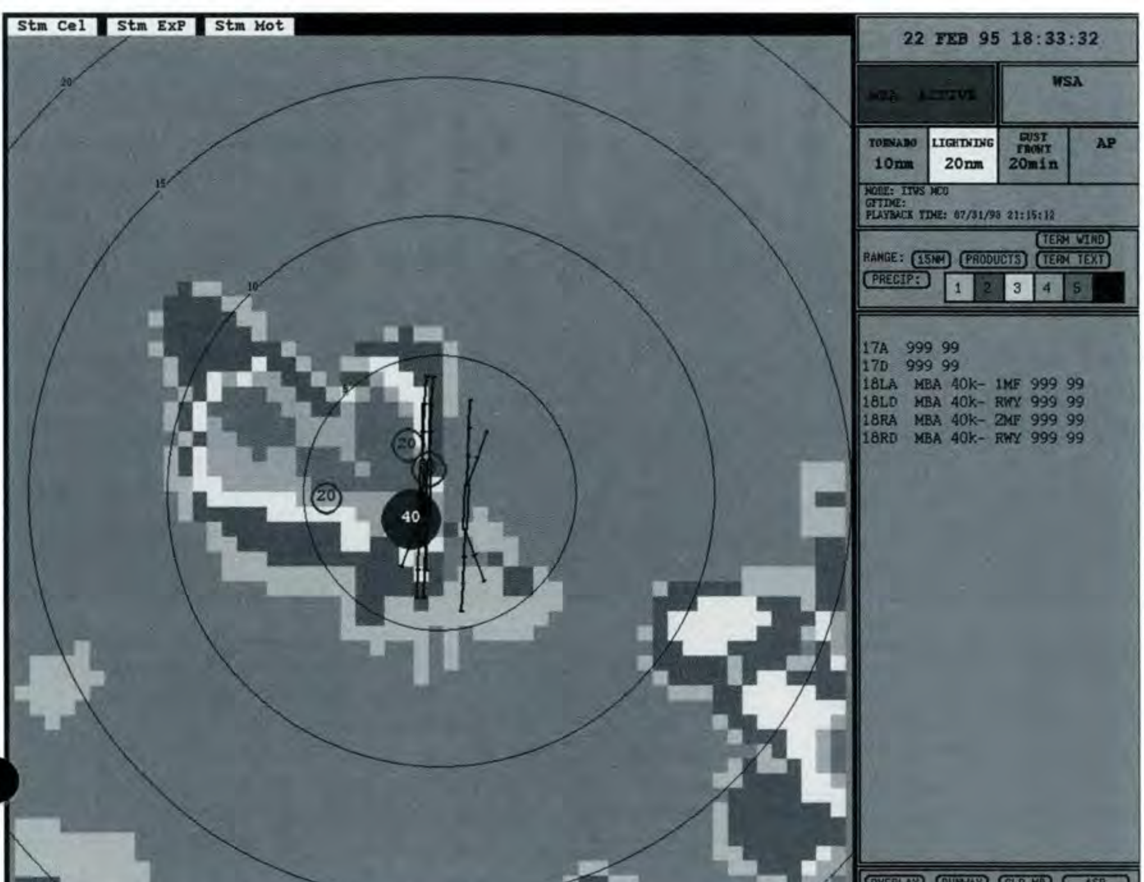


This is a display of the terminal doppler radar products as displayed in the air traffic control tower. The 40-knot circle indicates a microburst of a 40-knot loss of air speed. This is the product the air traffic controller will use.

The Air Force uses and shares Doppler radars (NEXRAD) with the National Weather Service. All bases in the United States have this coverage, as well as bases in Hawaii, Puerto Rico, Okinawa, and Korea. Most bases in Alaska have the coverage too.

is the Doppler radar found near the local Air Force base. Some bases now have "wind profilers" that sample the atmosphere overhead. Finally, there is the sensor, the pilot, in the aircraft ahead. Pilots flying into major joint-use airports also have the luxury of more sensor systems available to scan for wind shear activity. But the presence of these systems cannot be taken for granted, and there are limitations.

The Air Force uses and shares Doppler radars (NEXRAD) with the National Weather Service. All bases in the United States have this coverage, as well as bases in Hawaii, Puerto Rico, Okinawa, and Korea. Most bases in Alaska have the coverage too.

When radar operators look at the Doppler screen, they can see reflections of water droplets just like an aircraft's radar. But a different presentation shows the movement and speed of the air toward or away from the radar site. By studying this presentation, the radar operator can see areas of wind shear in the atmosphere around the base. The radar can show gust fronts, microbursts forming, the beginning rotation of a funnel cloud, and other areas where the wind changes quickly.

But some bases are limited by the location of the radar which prevents them from sensing the atmosphere below 2,000 feet AGL. This negates the radar's ability to sense wind shear where the situation is most critical. However, when a shear is sensed, Base Weather will notify tower personnel who, in turn, can warn aircrews.

A second sensor system, called a wind profiler, is available at some CONUS bases. This device looks overhead every minute to identify levels of the atmosphere where winds change direction and speed. Again, Base Weather must notify the tower when wind shear is detected.

However, the most important sensor for wind shear at a base is the pilot that flew in the area before you. PIREPs are the largest source of wind shear information in the Air Force. PIREPs can not only create a low-level wind shear warning, but a negative PIREP can cancel the warning as well.

Once the tower gets a PIREP or other warning of wind shear, ATC becomes the primary method for getting the information to the flight deck. AFM 7110.65 gives the controller guidance on handling wind shear information. The tower will advise every aircraft approaching an airfield with a verbal warning until the information is placed on the ATIS. The terminology from the controller will be, "...wind shear alert...center field wind from right to left at 35 knots...20 knot decrease reported on a half-mile final by a T-38 at 1530..." The ATIS terminology is that a "low-level wind shear advisory is in effect." This means that a wind shear was reported within the last 20 minutes.

Civil airports have four different terminal wind shear warning systems and even the ability to deliver the information directly to the flight deck.

Technology and Wind Shear

The first technology breakthrough in wind shear sensing occurred in the 1970s with the Low-Level Wind Shear Alerting System (LLWAS). This system of anemometers is placed around the airport with a computer comparing the wind speed and direction of all the anemometers every second. When different values of direction or speed are sensed, the tower is notified automatically for voice dissemination to aircrews. The first generation of LLWAS had six sensors, but that was found to be inadequate since microbursts slipped in between the wind gauges. The next two generations increased the number of sensors and their location. The latest version has

up to 16 wind sensors at the airports. Forty-one airports in the CONUS use this system including COS, OMA, SHV, and other joint-use fields.

At another 33 airports, local ATC radars have been fitted with a computer system to capture weather information and analyze it to show the wind shear information. The ASR-Weather System Processor is used in LAX, HNL, SYR, and BDL, for example.

The FAA's Terminal Doppler Weather Radar is a smaller version of the Doppler weather radar available for national coverage. The TDWR again uses computer decision-making to locate and display wind shear information to the ATC personnel. This system is available in MKE, MSP, PIT, PHX, and in 33 other major airports around the country.

The latest evolution is the Integrated Terminal Weather System (ITWS) which is available at eight airports. This system uses the TDWR and the latest version of the LLWAS working together to provide automatic alerts to ATC.

The tower is still the primary means of communicating wind shear warnings at civilian airports. The terminology is the same as that mentioned for the military airfield. Controllers have a display in the tower which shows the wind shear and microburst warnings for specific runways. The warnings are generated automatically.

If there is a limitation to these systems, it is that the tower controller is the only relayer of the information to the pilot. Terminal controllers do not have access to the information, unlike the military RAPCON which does. For the last 3 years, airlines have been using a VHF data linking program to have text and graphic information of the terminal area broadcast directly from the TDWR and ITWS systems to the flight deck. The textual description of the weather within 15 NM of the airport is automatically updated every minute. The radar produces a graphic (using letters and numbers) every 5 minutes. Direct interface between the sensors and the flight deck looks to be the future when it comes to sensing wind shear.

Other new technologies may soon be available to fliers. NASA has been working on forward-looking sensors (LIDAR) which will warn the pilot. Many airlines now have "reactive systems" that monitor airspeed changes and automatically alert the pilot to the fact that the aircraft is experiencing wind shear.

Other new technologies may soon be available to fliers. NASA has been working on forward-looking sensors (LIDAR) which will warn the pilot. Many airlines now have "reactive systems" that monitor airspeed changes and automatically alert the pilot to the fact that the aircraft is experiencing wind shear.

In our poem, Lt J has received many different inputs. It is now time for a decision.

Then the Lieutenant thought of the TDY,
How all had wished that it was through.
The pilot nudged ahead the throttles,
Thinking of the waiting mate who was new.

Making Decisions About Wind Shear

So how will Lt Judgment, like every other professional aviator, make a weather-related decision? Every day the environment can put the aviator in a situation that calls for a weather-related judgment call. How the decision is made will determine the outcome.

To make the weather decision, there are three different types of information that Lt J, just like every aviator, will use. The first type of information is the weather theory that all aviators learn as part of the initial training process. We can see that level of information when we answer the question "What is a microburst?"

The second type of weather knowledge includes the facts and forecasts about the current state of the atmosphere. This type of weather knowledge answers the question "Are weather conditions right for a microburst when and where I fly today?"

Finally, every aviator comes to a weather

continued on next page

decision point with the judgment skills necessary for flying through the weather. We can see this level of training by answering the question "How will my aircraft behave in a microburst, and do I want to get near one?"

Obviously, the more weather theory the pilot knows, the more up-to-date weather information the pilot has available, and the more experience and understanding the aviator has of weather's impacts on the aircraft, the safer the decision will be. But weather theory, weather information, and judgment skills alone will not explain some accidents related to weather. Something must be influencing how these levels of knowledge are applied.

There are two different "filters" that determine the application of weather information. The first is the aviator's perception of the technology at his/her command. If a pilot feels the aircraft is capable of handling anything Mother Nature throws at it, then weather knowledge will not be as important.

If avoidance fails, it is still critical every flier have an escape maneuver available. Maintain extra energy when approaching an airfield where the potential is high for wind shear. Don't be shy about aggressively escaping the weather conditions and avoid reconfiguring the aircraft. Pitch is the key to successfully escaping strong wind shears like microbursts. Effective crew coordination is a key ingredient for successful wind shear recognition and recovery. Every weapon system should have its own plan, and every pilot should know it by heart.

The second filter is the perception of the mission to be flown. As a personality trait, most pilots tend to be mission oriented. If a pilot believes the mission is "more important" than the chances of a possible weather outcome, then again, the knowledge will have less of an impact in the decision process. The two filters—technology perception and mission-importance perception—limit or magnify the importance of the weather knowledge that each aviator has to bring to the decision point.

In our poem, Lt Judgment is seeing the weather colored by both filters. The pilot has "get-home-itis" after a long TDY. We've seen the lieutenant also "feeling the throttles," believing in the superiority of the technology. These filters color the significance of the pilot's knowledge of wind shear, the fact that clues are pointing towards the occurrence of wind shear, and the knowledge that the aircraft probably doesn't perform well in a wind shear.

So what happens to Lt Judgment?

In safety meetings until forever,
Weather officers will stand up and say,
That no one has seen a wind shear,
Like the one that struck the field that day.

And pilots will silently shake their heads,
And pronounce the judgment sound,
For on that day Julie Judgment
Smartly said she "would take it around."

So Lt Julie Judgment survived to fly again. At the last minute, she decided to make a missed approach and take the aircraft around the pattern again and possibly divert if necessary. She recognized the filters of "get-home-itis" and "technology complacency" were influencing her weather decision process, and she reached back to her knowledge of wind shear to make the sound and safe decision.

So all you fellow pilots,
Take heed from the message here.
When all is said and all is done,
Judgment avoids low-level wind shear.

Maj Miner

If Avoidance Fails...

Avoiding wind shear is the ballad's primary lesson and an important key to successful aviation.

Wind shear is difficult to detect without vigilance. Pilots can recognize wind shear through visual cues like blowing dust, virga, lightning, and heavy precipitation. Fliers can use radar and other sensing systems to help avoid the hazard. Aviators can listen for PIREPs from other aircraft. All these clues will help avoid wind shear encounters.

But if avoidance fails, it is still critical every flier have an escape maneuver available. Maintain extra energy when approaching an airfield where the potential is high for wind shear. Don't be shy about aggressively escaping the weather conditions and avoid reconfiguring the aircraft. Pitch is the key to successfully escaping strong wind shears like microbursts. Effective crew coordination is a key ingredient for successful wind shear recognition and recovery. Every weapon system should have its own plan, and every pilot should know it by heart.

Wind shear has killed in the past. It may kill again. But if every planner, operator, and supporter works together to sense, communicate, and avoid, then wind shear will not be responsible for another ballad again. ✈

The Treaty on Open Skies

MSGT GEORGE INGRAM
HQ AFFSA/XATP
Chief, FAA/Military ATC Procedures

Open Skies—a treaty designed to promote openness of military activities through unarmed aerial observation flights.

On 3 December 1993, the United States Congress ratified the Treaty on Open Skies, with implementation in force by September 1996. The On-Site Inspection Agency (OSIA) is a joint service Department of Defense organization responsible for implementing and monitoring the treaty provisions for the State Department. Although the treaty was not ratified by all 27 signatories, flights under the direction of the OSIA are occurring.

Open Skies treaty aircraft are equipped with up to three different types of sensors. They are optical panoramic and framing cameras, infra-red line scanning devices and synthetic aperture radar. Each sensor requires specific altitudes to meet the pictures resolution standards allowed by the treaty.

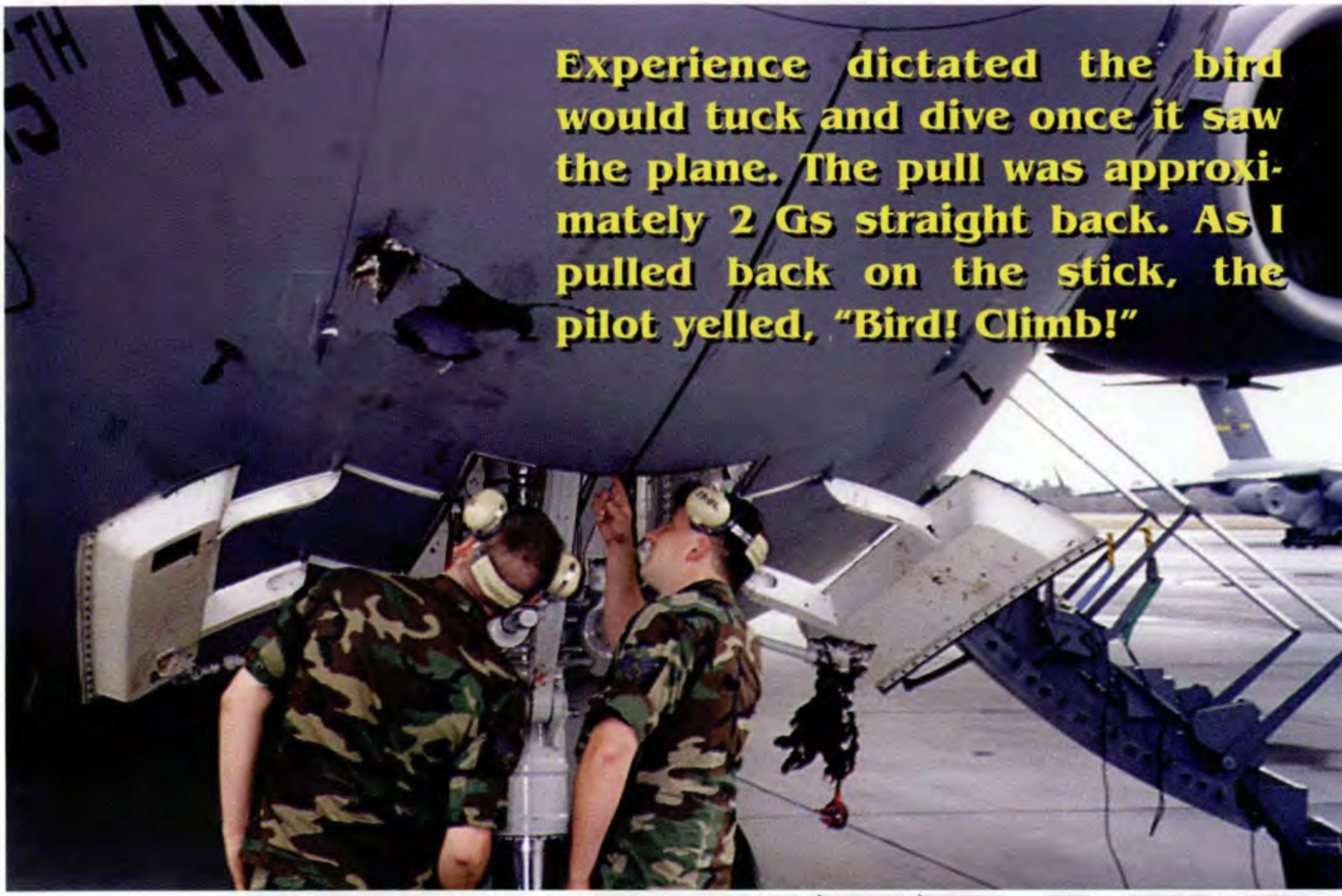
What does this mean to the air traffic control system? Air traffic controllers are required to provide priority handling to Open Skies treaty flights, with suffixes of "O" for observation and "D" for demonstration. THESE FLIGHTS, AS STATED IN THE TREATY, HAVE PRIORITY OVER ALL REGULAR TRAFFIC, FALLING ONLY BEHIND EMERGENCIES, FORCES, OR ACTIVITIES ENGAGED IN COMBAT AND PRESIDENTIAL-DIRECTED FLIGHTS. (Presidential-directed flights are those flights which directly support presidential movement.) Open Skies flights with the suffix of "T" for transit do not require priority handling. OSY (Open Skies) was issued as the identifier for these flights. The call sign will be followed by two numbers and a suffix identifier dependent upon what type of mission the aircraft is flying (for example, OSY 12D). While an Open Skies aircraft must comply with all FARs, they will have waivers to transit all Prohibited Areas and to fly at speeds in excess of 250 knots below 10,000 feet.

The Open Skies mission flight plan is similar to an Altitude Reservation (ALTRV) in that the routing and altitude are approved on a national level. It is a direct point-to-point flight with fixed altitudes between segments. The difference is that Open Skies treaty aircraft may deviate from this routing with the concurrence of ATC.

Open Skies treaty aircraft might request to deviate to avoid weather conditions affecting flight safety, if the aircraft is experiencing technical difficulties, in the event of a medical emergency, or when circumstances are encountered which are "beyond a controller's control or direction" (for example, volcanic eruption, tornadoes, etc.). Deviations may also be requested if weather conditions prevent the use of optical sensors and line scanning devices. The request should be handled like any other request—coordinate as necessary, then approve as soon as practical. Priority handling is required, but safety, as always, is the first concern of ATC.

The following information is derived from HQ FAA ATO-130, Special Military Operations Branch: "Open Skies aircraft are permitted by treaty to overfly any area, including restricted and prohibited areas, without restrictions for national security. The Department of Defense policy is to return all Special Use Airspace (SUA) to the FAA for the Open Skies flight. The flight cannot enter SUA until the using agency has released the area and has confirmed that all operations in the airspace have ceased. The SUA must be returned to the using agency, if appropriate, within 15 minutes after the Open Skies aircraft clears the area."

The Air Traffic Control System Command Center (ATCSCC), Herndon, Virginia, is the focal point for coordination of Open Skies information. Any problems or incidents dealing with an Open Skies flight should be forwarded to the ATCSCC. Changes to FAA Orders 7110.65, 7610.4, and 7210.3 regarding the handling of these flights are forthcoming. ✈



MR. BUZZARD

CAPT BRIAN DOYLE
17th Airlift Squadron
Charleston AFB, South Carolina

The bird's dive, coupled with the plane's rotation, allowed the bird to miss the window, but it impacted just above the nose gear wheel well.

The mission was an off-station trainer. We had 4,000 pounds of cargo (basically empty) on the flight to Roosevelt Roads, Puerto Rico. The point was to get additional flying hours—the C-17 community had been on the low side for several months—and to complete quarterly and semiannual requirements.

On the return leg, the one Guantanamo Bay certified crewmember was going to certify the rest of the crew at Gitmo. In order to meet the requirements for a Tactical Proficiency Sortie (TPS), a pilot needs to fly, among other things, a low-level route.

The crew consisted of six pilots, and we planned on flying two low-level routes through Florida and the Keys on our way to Puerto Rico. The preflight and cruise down to Florida were uneventful. The pilot was a new aircraft commander with less than 100 hours in command, and I was flying in the right seat, a copilot with 500 total hours (300 in the C-17).

No crewmember had flown the route before. However, a thorough route study had been completed the morning of the flight, and all crewmembers were relatively familiar with the route. I planned to fly through Point C and then take over map-reading duties while the pilot flew. Additional crewmembers (ACM) were seated behind both pilots.

Miami Center kept us at 2,000 MSL until entering the route. Hence, we weren't actually flying "low-level" until halfway (5 miles) to Point B. I had the autothrottles keeping the jet at 300 knots while I hand-flew at 500 feet AGL.

The terrain was almost flat, and the weather was great. Because no radio changes were required and terrain was minimal, everyone on the flightdeck was looking outside. We saw a few birds between Points A and B, but they were avoided with minimal maneuvering. Most of the birds were of the soaring raptor variety.

Approaching Point C, there was a depicted tower, a "CHUMmed" tower to the left of course, and an exclusion area right of course. After maneuvering around the tower near centerline, I was essentially on centerline coming into Point C.

I saw a buzzard gliding directly in front of the plane at approximately eye level. I immediately initiated a climb above the bird. Experience dictated the bird would tuck and dive once it saw the plane. The pull was approximately 2 Gs straight back. As I pulled back on the stick, the pilot yelled, "Bird! Climb!"

Discussing the flight later, one of the ACMs had also seen the bird but did not have time to say anything. The plane may have climbed slightly, but the effect of my stick input was mostly to rotate the plane nose up. The bird began its dive about 30 feet from the plane, just below my windscreen. (I was close enough to recognize a very scared bird!)

The bird's dive, coupled with the plane's rotation, allowed the bird to miss the window, but it impacted just above the nose gear wheel well. Every crewmember heard a loud "thud" as the bird impacted the plane. I continued the climb to 1,000 feet AGL and leveled there as the loadmaster checked for damage.

"I've got a lot of feathers and blood in the nose gear well," the loadmaster reported. "And I can see light coming through from the outside. We have a hole down here."

Hearing this, I continued the climb to 3,000 MSL (top of the block) while the pilot began to coordinate with Miami Center for an altitude and routing back to Charleston. The engines and flight controls were all operating normally, and there appeared to be no other damage than to the front of the plane. The pilot requested and received an altitude of 9,000 feet for the 1-hour flight home. The altitude was chosen in case of any pressurization problems. (There were none.)

The remainder of the flight was normal. The pilot flew the localizer approach into Charleston. We didn't know if the bird was still in the gear well and were not sure if anything would drop out when the gear was lowered. To avoid potentially raining a bird and parts of the aircraft on downtown, the pilot flew a low approach and lowered the gear over the airport (just prior to the runway). The gear extended normally and was visually confirmed in place. Nothing fell out of the gear well, and the pilot circled for a normal landing.

After taxiing to parking, the plane was shut down normally. The bird, a 10-pound turkey buzzard, was still wrapped around the strut of the nose wheel. It had entered the plane about 15 feet directly below the copilot's window. Blood and feathers were indeed splattered all over the interior of the nose gear well. The impact caused $107,000 of damage to the plane. Maintenance later figured, had the bird hit the windscreen, it would have gone straight through.

What did I learn? Always have at least one pilot looking out of the plane at all times. This is especially important on a low-level. In the C-17, it is sometimes difficult to resist the temptation to help the other pilot with a mission computer problem. Resist! Also, the pilot flying needs to be actively looking in front of the aircraft. Often, ACMs will call out towers well to the left and right of the flightpath. This is a good practice as it precludes the PF from turning into those towers, but the PF cannot become fixated on those obstacles. I had a "decluttered" HUD at the time of the bird strike, and the intensity of the HUD was low. This may have been the difference between seeing the bird in time and taking one in the face. ✈

After taxiing to parking, the plane was shut down normally. The bird, a 10-pound turkey buzzard, was still wrapped around the strut of the nose wheel. It had entered the plane about 15 feet directly below the copilot's window.

THE AFFSA Weather Quiz

CAPT STEVE DICKEY
Chief, Flight Weather Programs
HQ AFFSA/XOF

Benjamin Franklin once remarked: "Some people are weatherwise but most are otherwise." Mr. Franklin was a smart man who obviously knew a lot about many topics, including weather. You should know about it too. As an aviator, you can't afford to be "otherwise." You must understand weather and be prepared to deal with Mother Nature's potentially deadly forces. The more you know and understand about our atmosphere and its effects on your aircraft, the safer you will be.

Here's a short quiz to help you assess your current knowledge of weather and how it can affect you. Hopefully, you'll do well. For additional information or to sharpen your already "crisp" knowledge of a variety of important weather topics, I encourage you to take a look at the new AFH 11-203, Vol I, *Weather for Aircrews*. And hopefully, this latest revision, dated 1 March 1997, is on the streets by now—or will be very soon. Good luck on the quiz!

1. You are planning a flight from Vance AFB to Laughlin AFB. During your weather briefing, the forecaster says you'll be flying through an area of isolated thunderstorms with tops to 50,000 feet. While en route at flight level 290, you encounter these storms. In order to avoid them, you should:

A. Descend and fly directly beneath the storm cells since the terrain is relatively flat.

B. Place the aircraft in a max climb, and attempt to fly over the top since most aircraft can outclimb a building thunderstorm.

C. Fly around the storm cells, and since storms typically move from southwest to northeast in the northern hemisphere, give especially wide berth if passing north of the cell.

D. Fly directly through the storm cell since at flight level 290 you'll be well above the most dangerous portion of the storm.

2. Being aware of the basic conditions necessary for the development of thunderstorms can help you anticipate when and where they may form. What are the three primary factors necessary for thunderstorm development?

A. Thrust, lift, and a stable atmosphere.

B. Moisture, unstable air, and some type of lifting action.

C. Intense sunshine, light winds above the freezing level, and low pressure.

D. Strong low-level winds, an unstable atmosphere, and a high pressure system.

3. At 500 feet AGL during final approach to Little Rock AFB, you are experiencing a direct headwind of 40 knots. Almost instantly, the winds shift, and you now have a tailwind component of nearly 40 knots. This equates to a net loss in airspeed of nearly 80 knots—an extremely dangerous situation. The weather feature most likely causing this condition is:

A. A warm front.

B. A cold front.

C. A microburst.

D. A sea breeze.

4. While flying just east of Denver, Colorado, en route to Boise, Idaho, you look to the west and notice some interesting cloud formations. These clouds are fairly flat and shaped like lenses or almonds. One of your passengers says they are called "standing lenticular clouds." Based on your extensive knowledge of weather hazards, you conclude that these neat-looking clouds are indicating possible mountain wave turbulence. You should:

A. Avoid the lenticular clouds since they may contain severe to extreme turbulence.

B. At a minimum, fly at a level at least 50 percent higher than the mountain range.

C. If possible, approach the mountain range at a 45-degree angle so that a quick turn can be made from the ridge if a severe downdraft is encountered.

D. All of the above.

E. Both **A** and **C** are correct.

5. Every aircraft in flight generates a pair of counter-rotating vortices trailing from its wingtips. These vortices produce wake turbulence. Many large jets generate vortices exceeding the roll capability of smaller aircraft, making this wake turbulence a potentially deadly event. When following a larger aircraft, you should:

A. Fly at or above the preceding aircraft's flightpath since these vortices have a sink rate of 400 to 500 feet per minute.

B. Fly just below the lead aircraft's flightpath because the vortices actually rise at a rate of 400 to 500 feet per minute.

C. Increase your speed to reduce the distance between you and the lead aircraft. This will allow you to utilize his draft for a smooth, fuel-efficient ride.

D. Radio the lead aircraft to request that he turn off his vortex generator and stop producing these nasty spinners.

6. Aircraft structural icing consists of three basic types: clear, rime, and frost. The type most hazardous to aircraft is ________ because ____________

A. Frost; it can cover the windshield or canopy, restricting the pilot's view.

B. Rime; it builds up fast, is heavy, and very difficult to remove.

C. Clear; it is hard, heavy, and adheres firmly to aircraft surfaces.

D. None of these types of icing are a factor for today's modern deicing equipment.

7. During your descent into Andrews AFB, while passing through 15,000 feet, you notice ice beginning to form on your T-38's wings. Based on your extensive study of weather, you remember that icing can seriously affect your aircraft's performance because it:

A. Results in loss of lift, increased drag, and a higher-than-normal stall speed.

B. Adds so much weight to the aircraft that you essentially become an airborne brick.

C. Restricts your visibility with a layer of frost over the canopy.

D. Creates precipitation static throughout the aircraft's electrical system.

8. During today's mission you encountered some pretty bad turbulence at flight level 330. Your description of this turbulence goes something like this: "It caused large, abrupt changes in my altitude and my indicated airspeed. The aircraft was very difficult to control." Drawing on your extensive knowledge of turbulence and its effects on aircraft, what intensity category have you most likely just encountered?

A. Light.
B. Moderate.
C. Severe.
D. Extreme.
E. Rougher than a Cob (RTAC).

9. Low-level jet streams can develop due to the formation of a radiation inversion. Winds near the top of the inversion decouple from the surface winds allowing them to be much faster than the isobar spacing on a weather map would indicate. Low-level jet streams can easily exceed 60 knots at 700 to 2,000 feet above the ground while the surface winds may be only a few knots. You know this can create a dangerous low-level wind shear situation. At what time of the day would you normally find this low-level jet stream to be its strongest?

A. Just after sunset when daytime heating begins to diminish.

B. Just before sunrise when radiational cooling is greatest.

C. During mid-afternoon when solar heating is greatest.

D. There is no favored time for the low-level jet to be at its maximum speed.

10. It's late at night and you, the AC of your trusty C-5 Galaxy, are happily flying along at flight level 350 on your way to Elmendorf AFB, Alaska. Suddenly you notice an odor similar to electrical smoke and see what appears to be dust in the cockpit. A few minutes pass, and you now notice a bright orange-colored glow in your engine inlets and the EGT on all engines is on the rise. You appear to be passing through some sort of cloud layer. You turn on your landing lights and notice they cast a very distinct shadow on this layer. What is most likely happening, and what should you do?

A. You have encountered the exhaust of another aircraft and should call ATC to re-confirm separation from this other traffic.

B. You are witnessing the aurora borealis (northern lights) and should just enjoy the light show.

C. You have encountered a volcanic ash cloud and should reduce thrust as much as possible and reverse course in order to escape the cloud.

D. You have encountered a volcanic ash cloud and should apply full power in an attempt to climb out of the cloud.

11. During your preflight planning, you access some military weather forecasts. You are reading the forecast for Tinker AFB, and you see "BECMG 1718." What does this mean?

A. Rain will be coming into the area at exactly 1718 zulu.

B. The forecast was issued at exactly 1718 local standard time.

C. This is a change group indicating that at 1718 zulu a new weather condition will exist.

D. This is a change group indicating that a change in weather conditions will begin occurring at 1700 zulu and be complete by 1880Z.

12. You are reading the forecast for Vandenberg AFB and

continued on next page

you see this: "VV005." What in the world does this mean?

A. Winds are forecast to be variable at 5 knots.

B. The forecast is calling for a completely obscured sky with a vertical visibility of 500 feet.

C. The prevailing visibility is expected to be 5 miles today.

D. There is a 5-degree vertical vector being added to all cloud heights in this forecast.

Refer to the following line from a Scott AFB forecast to answer questions 13 to 15.
KBLV TAF 151616 34015G30KT 9999 SCT005 BKN010 0VC100 550006 QNH2994INS

13. The valid period of this forecast is from:

A. 1516 zulu today until 1500 zulu tomorrow.

B. 1500 zulu today until 1600 zulu tomorrow.

C. The 15th at 1600 zulu until the 16th at 1600 zulu.

D. Cannot determine valid period from information given.

14. Is a cloud ceiling being forecast, and if so, at what height?

A. Yes, a scattered ceiling at 500 feet.

B. Yes, a broken ceiling at 1,000 feet.

C. Yes, an overcast ceiling at 1,000 feet.

D. No ceiling is being forecast.

15. What does "550006" indicate?

A. Means no hazardous weather is expected.

B. Indicates contrails are expected at 50,000 feet.

C. Indicates moderate turbulence is expected from surface to 6,000 feet.

D. Indicates moderate icing is expected from 5,000 to 11,000 feet.

Answers

(Questions 1 through 10 are referenced from AFH 11-203, Vol I, 1 March 1997.)

1. C. (para 13.7.7)
2. B. (para 13.2)
3. C. (para 10.5)
4. D. (para 9.5.6)
5. A. (para 9.9.2)
6. C. (para 11.3.1.1)
7. A. (para 11.5.1)
8. C. (para 9.2.2)
9. B. (para 9.4.7)
10. C. (para 16.3)
11. D. (FLIP, General Planning, pg 8-4)
12. B. (FLIP, GP, Pg 8-4)
13. C. (FLIP, GP, pg 8-3)
14. B. (FLIP, GP, pg 8-4)
15. C. (FLIP, GP, pg 8-4)

Hope you enjoyed the quiz. These questions were not meant to test your knowledge of the science of meteorology, but rather to refresh your understanding of how weather can affect you and your aircraft, plus a little on weather codes. If you have questions or comments, please call me at DSN 858-5267 or commercial (301) 981-5267. ✈

Formation Air Refueling concluded

sure rates to the tanker.

Unless real-world EMCON procedures prohibit it, common sense dictates that tanker lead should call all turns in the weather or at night when conducting multiple aircraft refueling. Depending on the number and size of aircraft, the formation may stretch 5 miles laterally. Tanker station keeping is key. If the No. 2 tanker is making heading changes of more than 5 degrees, they should be called out at night or in the weather to assist the receivers. After refueling, keep the cell breakup plan simple and emphasize vertical separation.

Fly your plan and make all briefed altitude/position calls. Here is an example for three bombers refueling with two tankers at night. Bomber One completes refueling, moves to a left echelon 2 miles from Tanker One and 2,000 feet below Tanker One's refueling altitude. Bomber Two completes refueling, moves to a left echelon 1 mile from Tanker One and 1,500 feet below Tanker One's refueling altitude. Bomber Three becomes lead of the bomber formation. Bomber Three completes refueling, descends 1,000 feet below Tanker One's refueling altitude and leads the bomber flight during the breakup with the tanker flight.

Style points are not earned with air traffic control (ATC) centers by executing a starburst at the end air refueling point. If mission requirements force the bomber flight to break up after air refueling, it is generally easier to accomplish after tanker and bomber flights separate. If the bomber flight does plan to break up at the end air refueling point, give tanker lead advance notice. The tanker lead can then start early coordination with ATC. One last pointer on the breakup: Guard against the natural letdown that occurs after a demanding formation refueling. Stay ahead of the jet.

Once the mission is over, don't forget to thoroughly debrief with your crew, wingmen, and the tanker crew. Failing to debrief the activities that went poorly doesn't mean they didn't happen, but it just about assures they will be repeated. The tanker crews see more receivers than the bombers see tankers and can often provide excellent critiques. Formation refueling is an integral part of Power Projection. Quality planning, briefing, and execution are our best antidote against weather, malfunctions, and fatigue.

P.S. If you earn a good "war story," pass it along. ✈

THE INSTRUMENT REFRESHER COURSE: WHAT YOU SHOULD KNOW

MAJ KEVIN JONES
HQ AFFSA/XOFD

Unfortunately, it's that time again—time for the old instrument check. As you look down your list of prerequisites, there's one which everyone has on their list—the Instrument Refresher Course (IRC). Although everyone must accomplish IRC prior to taking their instrument evaluation, the content and quality of the IRC varies greatly across the Air Force. Being good instrument pilots is essential to our ability to perform our mission anywhere and anytime. In this article, I'll tell you what you should be seeing in your local IRC as well as describe some of the recent changes to the IRC program.

I know many of you may be wondering why I'm writing this article in the first place. Doesn't everyone know about IRC and how it is supposed to be conducted? Evidently not. Following the CT-43 mishap at Dubrovnik in April 1996, CSAF asked the Air Force Inspector General (IG) to conduct a Special Management Review (SMR) of the IRC. The IG completed its review in the fall of 1996, and one of their findings was that only 13 percent of the units visited complied with the minimum requirements found in AFMAN 11-210. Rather than believe the IRC is purposely being ignored, I prefer to believe not everyone is aware of the Air Force's policy regarding IRC.

First of all, where's the guidance regarding the Instrument Refresher Course? AFI 11-401, Flight Management, requires completion of the IRC as a prerequisite to the instrument evaluation. AFMAN 11-210, Instrument Refresher Course (IRC) Program, 1 Nov 96, describes how the IRC will be conducted. Here are some of the highlights of AFMAN 11-210's guidance:

• Who must attend IRC? All pilots on active flying status must complete the IRC during the eligibility period for their instrument evaluation.

• Course length and content. The IRC must be 6 hours in length and cover the following areas: New and revised regulations, weather, flight planning, instrument procedures, spatial disorientation, and HUDs (if applicable).

• Method of instruction. The IRC will be taught in a classroom format by a qualified IRC instructor. No other form of instruction (computer-based training, self-study, etc.) is authorized.

• Instructor qualification. The IRC instructor must be a graduate of the Air Force Advanced Instrument School (AFAIS). Additionally, IRC instructors must be instructor pilots (IP) or have been previously qualified as an IP. Contract instructors are authorized; however, they must meet the same qualification.

As the OPR for IRC, HQ AFFSA has started several programs to assist units in improving the quality of their IRC programs. Here are a few of the latest developments:

* IRC Roadshow. HQ AFFSA created an "IRC Roadshow" in the fall of 1995. Since then, AFFSA has taught IRC to about 20 units throughout the Air Force. If your unit can provide a good-sized crowd, AFFSA will send instructors to your unit to teach the IRC. AFAIS also provides a similar service.

• Home Page. HQ AFFSA has established an "IRC Home Page" on the Internet (http://www.aon.af.mil/affsa/irc.htm). On the IRC Home Page, you'll find a variety of information: the latest version of the instrument examination test bank, briefings on various topics, and links to AF flight directives such as AFI 11-206 and AFMAN 11-217.

• Core IRC. In January 1997, HQ AFFSA and AFAIS began developing a briefing we call the "Core IRC." It's difficult to create an IRC which will fit all of the Air Force's aircraft and mission. However, there are some things which all Air Force pilots need to know—we've attempted to capture those common items and present them in the Core IRC presentation. You can download the Core IRC from the IRC Home Page.

• Instrument Review. By the time this article is published, an Air Force-wide review of instrument training will be well under way. The review will be comprehensive. It will cover instrument training conducted at pilot training, follow-on training conducted at the schoolhouses, and unit-level continuation training. The study will be completed by the end of August 1997.

Hopefully, this article has given you some insight on how the IRC should be conducted. It's an important part of our continuing education. It is important to make sure the time spent in IRC training is time well spent, because the old saying, "What you don't know will kill you" is especially true in aviation. If you have questions or comments, e-mail me at jonesk@emh.aon.af.mil. Fly safe! ✈

FSO's CORNER

Reducing the Risk of ORM

MAJ DALE T. PIERCE
HQ AFRES/SES

With all the activity surrounding operational risk management (ORM), it can be difficult to see the risks through all the rising dust. If we become so focused on the risk-reduction process that we fail to see the risks, we will only work at ORM and never really achieve it.

Take chemical warfare (CW) training, for example. Most organizations schedule CW training during the "cool" months to reduce the number of people who succumb to heat injury during CW training. That's a plan. It reduces the physiological risk associated with required CW training.

But what will happen when your people are tasked during wartime to perform during "warm" months in CW gear? By training only during "cool" months and not during the "warm" months representing a likely operational environment, what effect will you have on your mission risk? After all, isn't the purpose of ORM to ensure mission readiness?

If your people don't learn to manage risk in the intended operational environment, you've missed the point of ORM. You see, ORM is about mission accomplishment. It is not about promoting safety at the expense of mission accomplishment.

So how might you reduce both your safety risk and your mission risk? Using the CW example to manage the risk associated with working during "warm" months in CW gear, you must examine the risks related to that environment, identify ways of minimizing or eliminating those risks, modify the related process to make it permanent, and train your people to perform using the modified process. (Gee, that sounds like quality stuff.)

The risks associated with CW training are many. They include heat stress, dehydration, reduced visual acuity, reduced balance, reduced depth perception, reduced digital articulation, reduced speech and hearing, and the list goes on. For this discussion I'll use heat stress.

Some ways of minimizing or eliminating heat stress risk in a "warm" environment include using mission-oriented protective posture (MOPP) levels, using work-rest cycles, and training people in heat injury response. All these are skills applicable to wartime mission activity.

Most Air Force people are familiar with MOPP levels. The higher the level, the more protection (uncomfortable) you get. MOPP levels are used to reduce heat stress levels when exposure to that risk can be reduced without losing mission capability. In this case, you identified the risk, chose a risk reduction measure, modified the process to include it, and trained your people to use the new process. For the very same reason, most Air Force people are also familiar with work-rest cycles.

These familiar risk-reduction strategies are intended to enable mission accomplishment without exposing people to unnecessary risk. The same applies to heat-injury response. However, few nonmedical Air Force people are trained in this area. The fact we still have Air Force people succumb to heat-related injury every year during CW training suggests a need for this training. Unit-level training and application are viable risk-reduction options.

What would this training include? How about something as simple as symptoms and first aid? (No, these aren't covered in your local buddy-care training.) Training in this area should cover heat stress, heat cramps, heat exhaustion, and heat stroke. Some organizations do provide this training annually; a few provide the information on wallet cards for individual review; other units may not provide any training in this area at all.

After you've done all you can think of, what next? One of the best ways to identify risks in your area of responsibility is to talk to someone in another area, unit, or base who does something similar to what you do. There is a world of ideas out there. It's amazing what you can learn with a couple of telephone calls to ask for help from people you don't know. (What are they going to do, tell you they're busy and hang up? It's never happened to me, and I've been doing it for years.)

The point is that when we get together as a team, even across telephone lines, we can identify many risks and risk-reduction ideas that can be applied without sacrificing mission capability. Remember, ORM is about accomplishing the mission with all known risks eliminated, reduced, or managed. It's not about canceling the mission.

ORM—it's how we do the mission.

P.S. If you want a copy of the 919 SOW Guide to Heat Injury wallet card, send your complete military address via e-mail to pierced@wg53.eglin.af.mil. ✈

☆ U.S. GOVERNMENT PRINTING OFFICE 1997-573-322/43024

LT GEN GORDON A. BLAKE

AIRCRAFT SAVE AWARD

MSGT GEORGE INGRAM
HQ AFFSA/XATP
Save Program Manager

The Lt Gen Gordon A. Blake Aircraft Save Board convened during the fourth quarter of CY96 and awarded four aircraft saves. The save board would like to extend congratulations to these latest recipients:

Mr. Geoffrey Schrink (Approach/Departure) and Mr. Brian Scarbrough (Radar Final Control), Selfridge ANGB. These controllers far exceeded normal duty performance while providing guidance to a very nervous and disoriented VFR only qualified pilot. Result: A safe landing during severe IFR weather conditions.

A1C Gregg Potter (Approach Control), McGuire AFB. The pilot of an IFR aircraft en route to Brookhaven, New York, encountered severe IFR weather and began to experience electrical failure. Being unfamiliar with the New Jersey area and not having approach plates available, the pilot became nervous and began to panic. A1C Potter confidently issued timely and accurate instructions which encouraged the pilot to remain calm and complete a safe landing.

SSgt Todd Vangen (Approach and Departure Control), Grand Forks AFB. When a student solo pilot declared an in-flight emergency with approach control stating "her engine had quit." SSgt Vangen, while working the approach assist position, took the initiative (based on combined controller and general aviation pilot experience) to assume the approach control position. He immediately began providing assistance, talking the student pilot through checklist items while helping her to remain calm and complete a safe landing.

These controllers have upheld the highest standards of professionalism and dedication to flight safety. Their actions directly contributed to the saving of lives and preventing damage to these aircraft. Keep up the good work!!! ✈

At the outset
it is important to accept
the inevitability of human error.
No person,
whether designer,
engineer, manager
or pilot,
will perform perfectly
at all times.

But we must keep trying anyway!

More on
Human Factors
forthcoming
in our July issue