
MARCH 1997
Flying
SAFETY
NEW TECHNOLOGIES
ISSUE
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50
1947 - 1997

UNITED STATES AIR FORCE

50 Years Strong

■ As we celebrate the Air Force's fiftieth anniversary year and reflect on our Air Force's proud past and ever-increasing contributions to America's security, it's easy to see a half-century of remarkable progress.

One noteworthy area is safety. If you want to talk about real progress, consider that during World War II, we lost over 50,000 aircraft to training mishaps—that's more than we lost in actual combat. In 1947, our first year as a separate service, we experienced 1,555 Class A flight mishaps for a mishap rate of 44 per 100,000 flying hours. As a matter of fact, for the period 1947-1957, we averaged over 1,700 Class A's per year with an average mishap rate of over 28 per 100,000 flying hours. Now, when you consider that in FY96 we had 27 Class A flight mishaps and a 1.26 mishap rate, it's clear that we've made truly incredible progress!

This progress is due in some measure to our advanced technologies and improved training programs. But it is also due to the creation of a different mindset, or a safety "culture," within our Air Force. Flying safety, while extremely important, is only one part of our safety equation. On-duty and off-duty ground safety, weapons safety, and overall safety awareness impact our people and our resources.

Increasingly, we have moved away from the attitude of "accomplish the mission at any cost" to one of weighing benefits versus risks, making risk management decisions, and "accomplishing the mission at reduced costs."

On 11 August 1995, I sent a message to all Air Force commanders on the role of leadership in safe operations. In that message, I emphasized that if your unit's operational tempo is creating unsafe conditions, the commander has the *responsibility* and *authority* to call "Knock it off." We must all recognize the telltale signs of an impending mishap and break that chain of events *before* we lose any of our people or destroy a valuable resource.

The high level of operational commitments I referred to in August 1995 is still with us today. And I am just as committed now as I was then to supporting commanders and supervisors who make that tough "Knock it off" call. This applies not only to the flight arena but to every facet of Air Force operations around the world.

GEN RONALD R. FOGLEMAN
Chief of Staff, USAF

Let's continue to build on the positive safety momentum we have generated and not allow complacency to seep in. For the past 6 months, you have seen a great deal of publicity on the Operational Risk Management (ORM) program. While many of you have utilized the basic principles of ORM for years, we have now formalized the program (AFI 91-213) and we're incorporating it into formal training programs — from basic training to professional military education (PME) throughout an individual's career.

I am confident that if we can get all Air Force personnel to incorporate ORM principles into their daily routine, both on and off duty, we will reduce mishap rates across the board even more dramatically than we did in FY96. With your help, we will ensure that the Air Force's boundless future will be a safe one...without compromising mission accomplishment. ✈

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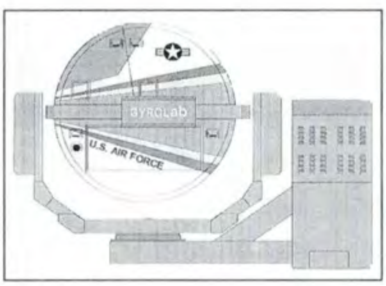

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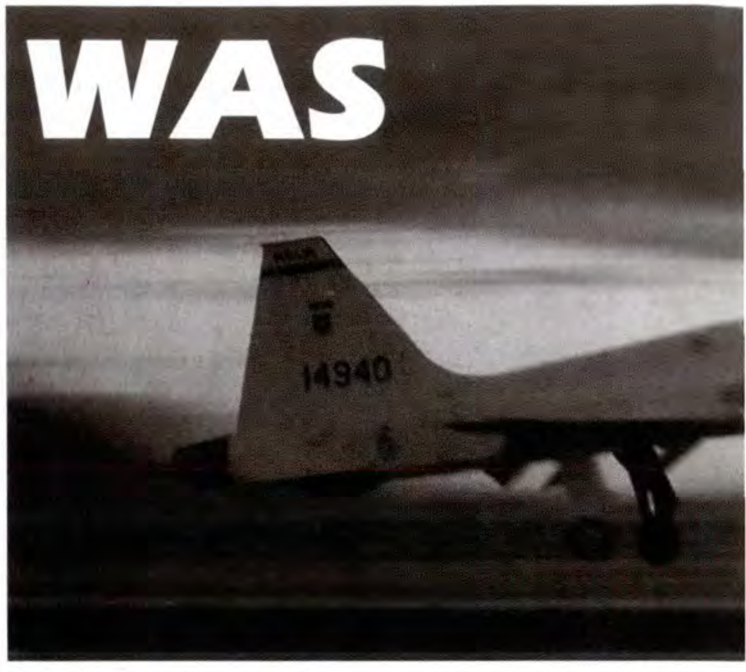
SPECIAL FEATURES

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.

THERE I WAS



There I was...finishing the T-38 phase of pilot training at Reese AFB, Texas. Although there was no official word of who was getting what assignments, I had done well throughout UPT, and "local intel rumors" had it that I was on my way to fly the jet of my dreams—the F-15 Eagle.

We were to the point of our weekend cross-country flights, and I had convinced my IP we would "achieve maximum training" if we went to Mather AFB, California. He knew I had a hidden agenda of visiting my fiancée while there but bought off on the plan anyway. Our first leg was planned to Davis-Monthan AFB, Arizona, followed by a night flight and RON at Norton AFB, California. Saturday morning we were to fly into Mather, another RON, then Sunday two-hop it back to Reese.

I was on top of the world. The weather was supposed to be perfect, winds were minimal, I was flying with my favorite IP, I was very comfortable flying the Talon, looking forward to a great assignment, and to top it all off, I was on my way to see my fiancée. To add to my confidence, I had entered UPT after 3 years as a navigator, and I knew most of the "short cuts" to flight planning.

The planning was straightforward and quickly accomplished. After all, it was just a navigation cross-country flight, and it was going to be great weather. As per the regs, I did prepare a VFR chart to cover the entire distance as well as terminal area charts. By *prepare,* I mean I cut the appropriate areas out of the large chart. Why go through all of the unnecessary trouble of plotting courses and performing a grueling VFR map study when I would be using the IFR charts, flying instrument approaches, and, to top it all off, the weather was going to be great! Of special *dis*interest to me was the local area VFR chart into Norton as that would be the night leg—and the weather was going to be great!

The first hop to DM went uneventfully. Navigation was as planned, followed by a near-perfect approach to an excellent touchdown, and, indeed, the weather was great. After getting gas and a quick bite, we began the night leg, at civil twilight, on our way to Norton. During the climbout, through a layer of low cumulos, I noticed that with the standard power setting and pitch angle my airspeed kept increasing. Only after I had pulled the power back to an obscenely low setting, accompanied by a decreasing wind-rush sound, did I finally get a clue and turn on the pitot heat (airspeed recovered at about 230 KIAS vs. the desired 300 KIAS). After kicking myself appropriately for the momentary lapse in checklist discipline, I soon settled back into my normal flying routine.

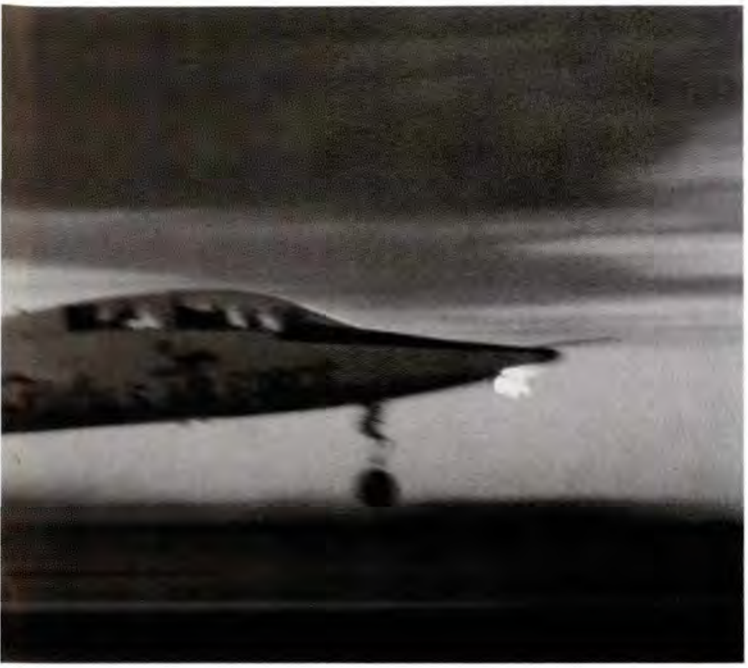
As full darkness fell upon us, I discovered there was no moon (Oops! I forgot to check that during planning). A quick call to a nearby PMSV revealed that the weather at Norton was VFR with only reduced visibility due to haze. Again, confidence came back up to near max, the weather was good, and my IP and I were enjoying the ground light show from the cities while night flying into the Southern California area.

Fuel checks revealed that one of the gauges had a burned-out light requiring the use of the peanut-light. Although I normally used that light for viewing my maps and approach plates, it took only a little effort in the benign cross-country environment to time-share the use of that light between my maps and the fuel gauges.

As we began our descent into the Norton area, the radio began to get quite busy, as anyone who has dealt with LA Center and Southern California approach controls knows (LA Center? Oh yeah, I forgot to take note of how busy the radio would be during flight planning). Although things were starting to "not feel quite right," warning bells were not going off—or I simply wasn't listening to them. I should have asked myself if I missed those couple of items during flight planning, what else did I miss, and just how complacent had I been? I didn't. At this point, I was intent on showing my IP just how well I could handle a busy environment and preparing myself for the radio-intensive environment I was entering.

We could see the strobe lights of what seemed like dozens of aircraft around us as the controller made her rounds on the radio to the aircraft under her control. I patiently awaited her call to me. Typical for that environment, the controller only had time to give directions with very little time to receive acknowledgments, let alone requests. Somehow I conveyed that I wished to perform an ILS, back to radar for a TACAN. It was obvious from her voice inflection I had just increased her task load by wanting practice approaches, but she began to provide the service as requested.

After checking the gas and resetting the peanut light on my approach plate, I was cleared for the ILS approach and was told to report when leaving the IAF. Up to this



point, I had taken little notice of the haze in the area since looking *through* it at the ground lights made it seem very thin. However, now that I had descended into it, it became apparent that visibility was significantly reduced from about 5,000 feet and below.

Due to radio congestion, I finally got out that I was inbound from the IAF (about 2nm inside the IAF). She acknowledged my call, "Reese 41 copy, after the approach execute published climbout. Break, break, 0816 heavy turn left heading.........." Published climbout? I'd assumed they'd provide climbout instruction like all of my other cross-country flights and didn't bother to look that up in the FIH during flight planning—oops!

Now embarrassed by my error, and faced with the realization there was no time to look up the climbout instructions, I was even more determined to complete the planned training items. I finally squeezed in, "Approach, Reese 41 unfamiliar, request climbout instructions." The reply, hurried and a little irritated, "Reese forty-one, climb on runway heading to one thousand feet, at (*hiss*)-ree DME turn right to 2-0-0, and contact me on this frequency."

Although hard to describe in writing, that hiss was very short, and it was obvious to me that it was "three." However, just to be sure, I queried my IP, and he confirmed that he also heard "three." By this time, I was executing the low approach; climbed to 1,000 feet; a quick rotation of the peanut light to check gas and calculate the airspeed for the next approach; oops, 310 KIAS, a little fast—back on the throttles; peanut light back to the approach plates; oops, climbing a little—level off; now approach 2 DME, things looking good and under control.

I had left the lights of the runway behind me, and with no communities in front, there was nothing but blackness off my nose. What I heard next is etched in my mind forever! In that controller voice of urgency that stops all other radio banter, and about one octave higher than before, the controller came on the radio: "Reese 41, Reese 41, turn right immediately! Reese 41, make an immediate hard right-hand turn! Climb to 3,000 feet! *Reese 41, make an immediate hard right turn! Climb to 3,000 feet! Acknowledge!"*

That was all I needed to hear! I simultaneously slammed the throttles to full AB, rolled to about 70 degrees of right bank, pulled on the pole with all that my Talon would give me, and quickly acknowledged with a "Reese forty-one." I was in the survival mode and would deal with spatial-D later. My IP was looking over the left canopy rail to try to see whoever, or whatever, it was that was about to hit us. For the next 3 to 5 seconds, although it seemed like eternity, the radios were absolutely silent as everyone on frequency waited. The next radio call was my own: "Reese 41, level 3,000, heading 2-0-0." To this day, I could swear I heard everyone on frequency exhale at the same time.

I had lost 100 KIAS during that turn and slowly let the speed build back to normal. The controller, now back to a normal voice pitch, asked for my intentions. I decided that I'd had enough training for one night and asked for vectors to the ILS, full stop (my IP concurred wholeheartedly!).

While checking into billeting, I asked my IP if he saw anything. All he saw was complete darkness, and even after rolling out, he couldn't see any conflict with the numerous strobe lights around us. It was late, so we went to our rooms, intent on solving the mystery the next day. As you can imagine, I didn't sleep quite as soundly as normal.

The next morning was a perfect Southern California morning, and I met my IP in front of our billeting rooms. We started walking towards the billeting office, the next building over, and began to recreate the previous night's event. As we walked around the corner of the building, we were able to catch a view of the flightline, and the whole picture suddenly became very clear to us as we picked up a spectacular view of the 5,000-foot mountains about 3 miles past the end of the runway.

As it turned out, we did correctly analyze the "-ree" as "three," but that small, insignificant hiss that preceded "-ree" that we *didn't* hear was the "point" as in, "point three DME"! It didn't even dawn on me that there would ever be such a clearance as "turn right at *point* three DME." We'd plotted out our flightpath on that local area map I had cut out (and hadn't used up to now), and our best estimates showed us missing that mountain by less than 500 feet.

Lessons learned: There is no flight worthy of a complacent attitude. Even on a "simple cross-country flight," you need to find out everything you can about the environment you will be flying into—weather, comm, nav, terrain, and local procedures, just to name a few.

And finally, when things are starting to feel "not quite right," they probably aren't. In the years since that event, I have never let myself fall into that complacent attitude that almost killed me and my IP. I have also learned to trust that itch that appears from time to time telling me "things aren't quite right" which has saved my hide on more than one occasion—but that's another story...

Intro to DIGITAL COMMUNICATIONS-102

Part 1

(What you won't hear anymore!)

MAJ BEN RICH
Air Force Reserve

This is the second in a series of articles examining aviation advances which can impact our future operations as Air Force crewmembers. The first, Intro to TCAS-101, Flying Safety *magazine, July 1996, looked at airborne enhancements deployed in the civilian community several years ago and now appearing on a few of our aircraft. This article will examine communications advances which make information readily available to the crewmember while avoiding the degradation of safety seen in some of our current communications methods.* ***A special acknowledgment is due to Aeronautical Radio, INC (ARINC) of Annapolis, Maryland, without whose assistance this article would not have been possible!***

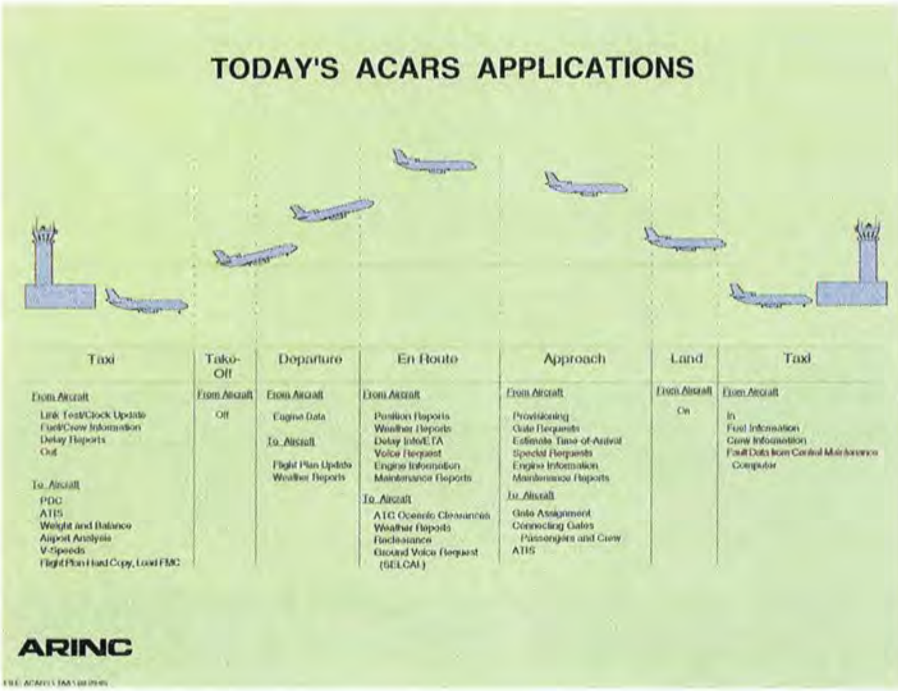
Arrive at the aircraft!
Complete the exterior inspection!
Check the ATIS and weather and runway in use!
Get the enroute ATC clearance!
Coordinate all of the information above and check performance requirements...

Does this scenario sound familiar? These activities occur hundreds of times on a daily basis in Air Force aircraft ranging in size from Cessna T-37s to Lockheed C-5s. Fortunately, *times are a changing*, and thanks to a desire to increase safety and efficiency within the civilian community, we are seeing communications advances which make the aviator's job **safer and more efficient!** The key to open the lock lies in **ACARS**, or Aircraft (original ARINC) Communications Addressing and Reporting System. (See the sidebar, "Just What Is an *ARINC*?")

ACARS was originally developed in response to a requirement from Piedmont Airlines to find a better way to measure flightcrew duty times. ARINC was given this requirement by their Board of Directors in 1975 (ARINC is owned by the airlines and the BOARD consists of vice presidents of the airlines). ACARS was declared operational in 1978 with a few stations located generally in the southeast United States.

Today, there are over 420 communications stations in North America, South America, and Asia. The southernmost stations are in Columbia and Venezuela while the northernmost station is Iqalit, on Baffin Bay. Bermuda covers the eastern flank while the westernmost station is downline in the Aleutians. Asia has stations in China and Thailand. ACARS is a worldwide system with the French company, SITA, providing service to ARINC specifications in Europe and parts of Africa and the Middle East. ACARS is VHF in the AM band with transmission rates at 2400bps.

Simply stated, the subscriber connects to the ACARS system and through the system's data-link capability has direct communications to and from their aircraft. The ACARS system consists of a control head in



the aircraft with either data print or information screen capability. As said, communications can be originated from either source (aircraft or ground) automatically or manually, and we will discuss this later.

With a direct connection to the host company's computer system, the aircrew has direct and real-time access to an abundance of information available through a computer terminal, and which will make the flight safer, more labor efficient, and allow greater flexibility than ever available in the past. These enhancements are the purpose of this article.

As stated previously, one of the original purposes of ACARS was Piedmont's desire to track flightcrew duty times (and crew pay as crews are literally paid by the minute for their services). As the system matured, organizations found other time-sensitive information could be transmitted and received through the ACARS system, and the expansion was underway. Did you know that it's through the ACARS data link that the TV screens in the airline terminals are automatically updated? (See the chart above.)

When an "Out" time is recorded and transmitted (the time the aircraft doors are closed and the parking break is released for taxi/pushback), the sequence is started. After the loads are entered into the computer (passengers, baggage, cargo, etc.), updated performance information (speeds, runway restrictions, climb restrictions, etc.) can be automatically sent to the crew for accurate departure planning. A last-minute change of runway is no problem as a complete departure plan can be uplinked in seconds at the push of a button (or two). Flight engineers will love this feature, and for you AMC folks, it makes FSAS look ancient at best!

The next normal event is the "Off" time which occurs when liftoff is sensed, and this is the second of the automatic updates. The dispatch computer already has a planned flight time, and when compared to the "Off" time, an accurate ETA is derived (and TV screens received their first update). At some subscribers, an enroute flightplan (fuel burns and ETAs for all navigation waypoints) and destination weather are automatically uplinked to the aircraft within minutes of liftoff.

When in-range of the arrival station, a changeover request is made approximately 20 to 30 minutes prior to landing by sending an estimated "On" time, and the aircraft will automatically receive certain valuable information including temperature, facility information, parking spot, and in some cases, connecting gates for enhanced passenger service. As the ATIS function comes on line, it, too, will be available in the manual and automatic function.

Finally, an "On" time is sent upon touchdown, and an "In" time is sent when the doors are opened upon arrival. All pertinent information is recorded, and the whole process is

continued on next page

	AGM
Msg for aircraft N001ZZ	AN N001ZZ/AP DFW
Reach 70029 from SKF-ADW	-/M70029 SKF-ADW
Msg sent through DFW @ 1625Z on the 23rd	DFW KADW 231625
Info avail at 1602Z on the 23rd	231602
The Andrews AFB 1553Z METAR observation shows gusty winds from 180 degrees, 10 miles vis, broken clouds at 2200 ft, temp of 27C etc	METAR KADW 231553Z 18016G24KT 10SM BKN022 27/22 A3001 RMK A02 SLP153 TO2670217
	END DATA

Figure 1
A typical ACARS weather message

ready to start again! What you have read is the superabbreviated version of ACARS use, and there are a few additional facets of the operation I want to cover.

Weather Information (Text) Availability

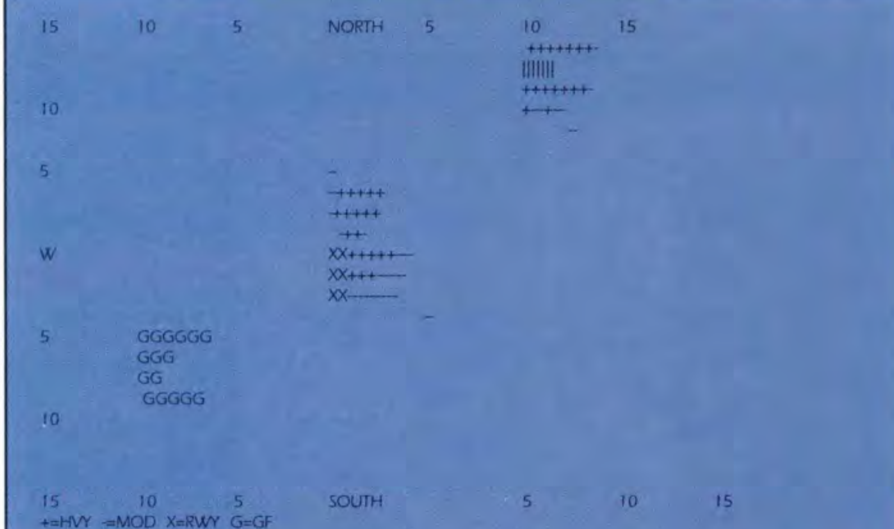
With the push of a few buttons, an aircrew has real-time availability to the reported and forecasted weather from any station in the world. This asset is invaluable when weather conditions are worse than forecasted at destination and the fuel seems to be going down as fast as the reported ceiling. For long trips, frequent updates of destination weather at the push of a button greatly decrease stress, allows for early planning for alternates if required, and eliminates painful, enroute HF radio weather updates. (See figure 1, page 7.)

Terminal Weather Information for Pilots (TWIP)

Another piece of the current ACARS puzzle involves TWIP, or Terminal Weather Information for Pilots. This feature provides ground-based terminal weather information to flightcrews on request via ACARS data link. This information, designed by active pilots, is specifically tailored for pilots to enhance situational awareness of terminal area weather such as microbursts, gust fronts, and heavy precipitation.

At selected airports, *text-only messages* and *character graphics maps* (Figure 2) are generated based on the Terminal Doppler Weather Radar or the Integrated Terminal Weather System. TWIP products include descriptions and depictions of the airport weather (microburst alerts, wind shear alerts, or significant precipitation), the present con-

With the push of a few buttons, an aircrew has real-time availability to the reported and forecasted weather from any station in the world.



This depiction shows a north/south runway (the Xs) with heavy to moderate showers east and north of the field (+s and -s) and a gust front 5-10 NM SSW of the field.

Figure 2

BENEFITS OF TWIP

Reduced Communication Congestion & Reduced Communications Errors
Better Routes and Altitudes—With more timely and complete information concerning weather conditions, pilots can better anticipate, plan, and request dynamic changes to the planned flight to optimize fuel burn and flight time.
Enhanced Situational Awareness and Safety
Increased Capacity and Reduced Delays—Alleviating requests for weather information from pilots allows for more even distribution of the air traffic controller's workload, especially during peak traffic conditions. More timely service to more aircraft.
Improved Cockpit Information Management
Increased Operations Opportunity—Many operations, especially general aviation, are canceled or unnecessarily altered because timely, reliable updates to the existing forecast weather are not available to pilots while enroute. TWIP continually generates revised weather products which provide pilots with better "Nowcast" assessments and increase the opportunity for safe utility in flight planning and enroute operations.

Figure 3.

vective activity within 15nm of the terminal area, and expected weather that will impact airport operations. In case of bad weather, TWIP products are updated and databased once each minute for text messages and once every 5 minutes for character graphic messages.

Trials of TWIP have been held each summer since 1993, supported by MIT Lincoln Lab, FAA, and ARINC. Successful trial results at the initial site (Orlando FL) encouraged the sponsors to expand the trials to Memphis TN, Dallas-Fort Worth TX, Chicago IL, Washington DC, and Atlanta GA. In 1995, the new FAA office for data link proclaimed TWIP a success and began coordinating the expansion of the system to 47 major airports by 1997. Seven passenger and freight services currently subscribe to TWIP. In 1996, Boston, Denver, and Charlotte were added. The figure lists some of the benefits of the TWIP feature. (See figure 3.)

Next month, we will cover predeparture clearances, digital automatic terminal information service, and digital delivery of taxi clearance. ✈

JUST WHAT IS AN ARINC?

TERRI ANTON
Program Director
Tower Data Link Services

In September 1929, the Federal Radio Commission (FRC) adopted "an aviation radio operating plan" which implied that the airline industry and civil aviation operators would band together and develop their own coordinated frequency requirements and licensing *through one central group*. The underlying philosophy was that it would be far more efficient to have a single agency provide the communications service for all airlines than to have each carrier supply its own services.

Aeronautical Radio, Inc. (ARINC) was organized on 2 December 1929 to function as the "single licensee and coordinator of aeronautical radio communications" outside the government. ARINC was established as a corporation rather than an association in order to provide a higher degree of independence.

ARINC's early service for the airlines was to license point-to-point and air-ground radio communication. The communication centers were operated by the airlines under ARINC supervision until 1948 when some came under direct operation by ARINC. The number of centers operated by ARINC has fluctuated from a high of 16 to the current 3.

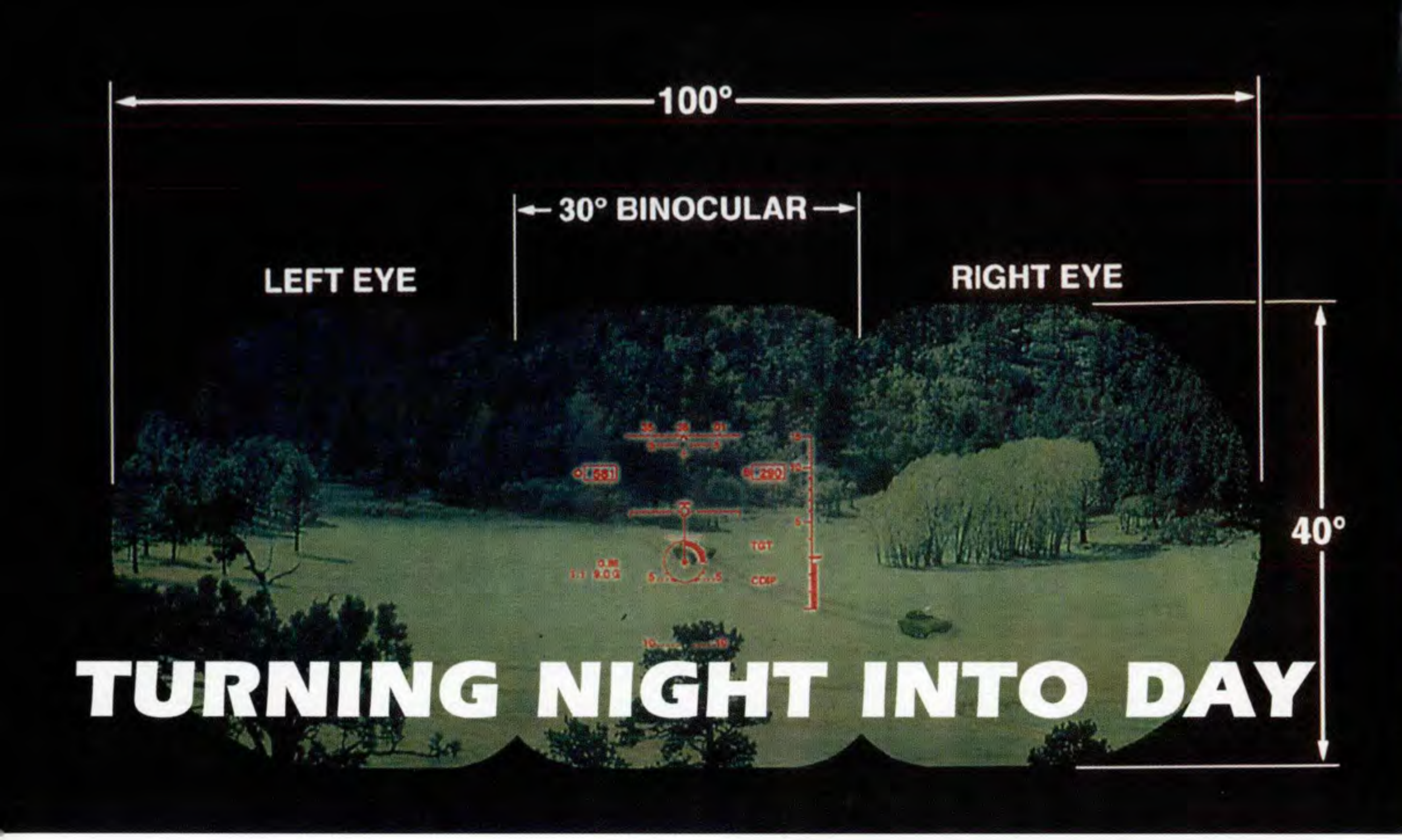
In 1946, ARINC undertook the task of improving the reliability of vacuum tubes used in airborne communications equipment. In 1951, a reliability research department was established to do similar work for the Department of Defense. The scope of the research work expanded until ARINC decided to reorganize the department as a separate corporation, called ARINC Research Corporation. This reorganization occurred in 1958.

ARINC's communication network continues to constitute the largest private communication system in existence. ARINC provides communications across the United States and over the oceans at gateway approaches, as well as high-frequency (HF) communications practically around the world. The number of employees in ARINC fluctuated from a low of two during World War II, when ARINC employees became military communicators, to approximately 2,000 people today.

While dedicated to serving the air transport industry, the company successfully functions as a corporation legally distinct from both its owners and users. The scheduled airlines of the United States continue to be the principal customers of the company, *as well as its principal stockholders*. However, the company's services, designed to assure safety, regularity, and economy of flight, *are extended to all aircraft operators, large or small, domestic or foreign, scheduled and supplemental, business, private, and government*.

Today, ARINC Incorporated is a $280 million company with a heritage of serving customers in aviation, government, and other industries for over 65 years. ARINC employs most of its 2,000 people at its headquarters in Annapolis, Maryland, and over 50 regional locations. It has international offices in London, Bangkok, Beijing, Seoul, and Taipei. The company is owned by United States and international airlines and aircraft operators.

ARINC continues to develop and operate communications and information processing systems and services essential to ensuring the efficient operation and performance of the aviation and travel industries. ARINC still supports the aviation industry with voice and data radio communications through the shared use of the assigned frequency spectrum and radio facilities, as well as satellites. ARINC also provides guidance for establishing avionics and other technical standards for the global air transportation industry. Customers benefit from ARINC's experience with communications, navigation, aircraft, satellite, airport, and air traffic management systems.



TURNING NIGHT INTO DAY

BOB VAN ELSBERG
Contributing Writer

The HH-60G hugged the ground as the crew sped to pick up the downed pilot, some 20 miles behind enemy lines.

Through the greenish light of his night vision goggles (NVG), the pilot struggled to spot threats—enemy troops who might open up with small arms fire or shoulder-fired missiles. As he banked hard left to fly around a ridgeline, a horrendous jolt shook the Pave Hawk, throwing the pilot hard against his shoulder straps. Before he could react, the helicopter yawed viciously to the right, then shuddered violently as the crew was thrown around inside the cabin. In horror, they heard the staccato cracking of the rotor blades snapping off. Tumbling out of control, the Pave Hawk rolled brutally to the left, then slammed into the ground. No one got out alive.

In this case, the "enemy" wasn't a shoulder-fired missile or a burst of antiaircraft fire—it was something much more innocuous. Unseen in the darkness, heavy power lines stretched from the top of the ridgeline to the valley at the bottom. Because the support poles were spaced far enough apart, the pilot never saw them in the 40-degree field of vision offered by his Aviator Night Vision Imaging System (ANVIS). Flying at more than 130 knots, the Pave Hawk ran into the power lines, destroying its rotor blades and sending the helicopter plunging to the ground. The pilot never had a chance to

Top photo - This image represents the view a pilot might see while looking through Armstrong Laboratory's revolutionary, new Panoramic Night Vision Goggles. The wide field of view represents an improvement of 160 degrees in what the warfighter sees during nighttime operations. The goggles also will feature an optical design capable of presenting internally integrated, heads-up display and flight symbology.

Lower photo - This image represents the view through the standard Aviator's Night Vision Imaging System or ANVIS goggles, which have been in use since the early 1980s. ANVIS goggles give military pilots a 40-degree field of view, long thought to be the maximum field of vision that night vision goggles could possess without sacrificing image resolution.

avoid the crash which killed himself and his crew.

But he might have had a chance if he'd been wearing the new Panoramic Night Vision Goggle (PNVG) being developed at Wright-Patterson AFB's Armstrong Laboratory. The goggles will give fliers a wider field of vision than they've ever had before in NVGs. And that could help aviators spot threats which now remain hidden in the darkness.

Jeff Craig is the night vision operations manager at the Armstrong Laboratory. Craig was involved with field testing the Night Operations Visual Aid, or NOVA-8 goggle system during 1995, which provides a 60-degree field of view. Studying the improvements offered by the NOVA-8 over the ANVIS, Craig believed an even better system could be developed; one that would give users a more natural 100-degree horizontal by 40-degree vertical range of view while still retaining high resolution; a goggle that would offer light weight and lower profile and center of gravity; a goggle which could even be worn during aircraft ejections.

"For years, it was thought that 40 degrees was the maximum field of vision night vision goggles could have without sacrificing resolution," he said. "Attempts to improve the system were focused on seeing better within that predetermined 40 degrees. Still, regardless of what improvements you make, it was like looking through a soda straw."

Armstrong Laboratory's Capt Robert T. MacMillan wears the prototype of the revolutionary Panoramic Night Vision Goggle that displays a 100-degree horizontal by 40-degree vertical, intensified, panoramic field-of-view, thereby increasing what the warfighter sees by 160 percent.

Craig's creation includes another significant improvement—a heads up display (HUD) that's projected on the inside of the goggles—not added on as an attachment. By designing the HUD "into" the goggle, Craig hopes to reduce the weight of his PNVG, a feature which will help reduce pilot fatigue on long missions.

One Air Force pilot who knows something about fatigue and "soda straw" field-of-view limitations of the current generation of NVGs is Capt Philip Mayfield, Chief of Weapons and Tactics for the 512th Special Operations Squadron at Kirtland AFB NM. His 1,500 flying hours in the HH-60G Pave Hawk include about 600 hours with the ANVIS and the improved AVS-4949 goggle with its 60-degree range of vision. And while, he pointed out, these goggles offer a tremendous advantage over flying at night with the unaided eye, their limited view imposes some serious challenges.

"When it gets extremely dark, you fly very close—pretty much what we refer to as a 'welded-wing,'" Mayfield said. Matching maneuver for maneuver, the pilot flies with his eyes fixed on the helicopter beside him. With only a one-rotor-disc separation between the aircraft, there's no room for error and no time to look away and watch anything else. Because the peripheral vision in the current goggles isn't wide enough to allow the pilot to see the flightpath ahead, some nasty surprises can come up quickly.

"We have what we call 'widow makers'—which are trees noticeably taller than the others," Mayfield said. Sometimes lacking leaves, they are hard to see and can stick up in the helicopter's flightpath like a telephone pole.

"If a widow maker comes up and you can't see it because of your limited field of view, you can quickly become history. There's an example of where an increased field of view would really help you."

And widow makers aren't the only threat PNVGs might help a pilot avoid. Power lines represent one of the greatest dangers in tactical flying. Because the lines cannot be seen, pilots must rely on spotting the poles from which they are suspended. But what if the pilot's looking in between them and the poles are far enough apart to be outside the pilot's range of vision with his NVGs? The result could be a fatal crash, just like the one described at the beginning of this article.

In the tactical environment, there can be much more sinister threats, Mayfield explained. A pilot focused on a landing zone (LZ) might not see enemy troops or weapons moving outside the peripheral view of his NVGs—especially if he's been too busy to scan away from the LZ. The cost could be a helicopter crew, their $20 million aircraft, and the mission, Mayfield said.

"We fly at night because it's harder to kill us at night in a combat scenario," he said. "However, while it's harder to kill us at night, it's also harder to fly at night. Our ultimate goal is to be able to fly at night—as if it were day—while it's dark for everyone else. The wider field of view offered by the PNVGs get us one step closer to that, one step closer to 'turning night into day.'" ✈

JUST A ROUTINE

I sit down to write this and think to myself, "-----, [name omitted to protect me, the guilty] how embarrassing!" Then I think, "How dumb, ----- [guilty name omitted again]!" Not a good way to reflect on "a routine training flight." Have you been there? Well, here's the background, so maybe you won't have to.

I'm a fully qualified aircraft commander, instructor pilot, and former flight examiner in a helicopter trainer, with over 2,300 hours of flight time, hundreds of hours of IP time, lots of sim instrument and simulator time, and untold numbers of instrument check rides successfully (whew!) logged in my career. I've done a tour or two in flight safety and have briefed all of the standard briefings on safety days. And I'm not a kid! In fact, I'm one of those guys politely known as a "graybeard." But this day got my attention like few others have.

I was scheduled to fly with one of the other pilots in my unit, a guy with even more flight time and qualifications than I have. Our trusty fling-wing-machine was uncooperative at first, but we eventually got maintenance to fix the glitches, and we proceeded to head for the "wild blue," which had moved yonder somewhere. Our high-scattered-clouds VFR forecast had deteriorated to observed IFR whilst we sat on the ground. No problem. We scratched the EP maneuvers we had briefed and picked up an IFR clearance to do pure in-the-weather instruments (yes, helicopters can fly in the clouds, too!).

We each briefed and flew a VOR back to home field, then a precision approach for each pilot. Unfortunately for me, my compatriot was flying great, and I was struggling with the leans each time we entered the 1,500-foot-thick cloud deck. My internal gyro caged each time we got VFR-on-top, but I was a little frustrated with myself and trying to figure out how to beat this problem.

End of the flying period was coming up fast, so my left-seater briefed one more approach to full-stop at home. He challenged himself with an NDB as I backed up his briefing and made appropriate calls from the right seat. Radar turned us dogleg to intercept final and called "Maintain 2,000 feet until final approach fix [the NDB] inbound, cleared NDB Approach, contact tower. Good day." We acknowledged, changed radios (but didn't talk to tower yet—too far out), and began the final approach course intercept.

We (crew aircraft, right?) captured the inbound, and then my copilot called "Starting down for MDA, 740 feet." I said, "Roger, MDA 740." We began a gradual descent, then leveled at 740, passed the NDB (which was the FAF), hacked the clock, and called tower "inbound." Tower rogered our call, then about 30 seconds later called us and said that Approach wanted us to "check our altitude." My left-seater and I looked at each other

Official USAF Photo

with the "duh" look as we confirmed we were level at the MDA of 740 feet. Then I replied to tower that we were "NDB final inbound." Tower came back about a minute later and said, "Approach advises 2,000 feet until on course past the NDB inbound." Suddenly, the clue light (or was it a bolt of lightning) illuminated over both of our heads at the same time.

We (still a crew aircraft, huh?) had begun our descent well outside the NDB/FAF and crossed the FAF already at the MDA. We had flown for several miles well below the TERPS vertical clearance for this approach, much of that time actually IMC! How could a crew with so much experience and flight time have done anything so dumb (is this beginning to sound like a mishap board report)?

Of course, the obvious answer was that my co had made a simple mistake—in this case, with some potentially deadly consequences—and I had not challenged him. We had flown two precision approaches before this one, and radar had turned us onto final very close to the glide slope descent point, so we might have "conditioned" ourselves to rolling onto final and quickly starting down.

But why didn't I catch this obvious error (especially since I have always prided myself on being a good copilot and, after all, I *was* the AC, responsible for the flight)? (1) I was still thinking about the leans I had experienced 10 minutes before rather than flying the approach with my copilot. (2) I had probably backed myself into my own "copilot syndrome" by trusting this more experienced flier who was demonstrating some great hands this day, and I had not properly backed him up. (3) I had become complacent (see also No. 2).

Again, fortunately, there were no tall towers, buildings, or mountains in our flightpath. We broke out and full-stopped. The debrief was pretty succinct as he apologized to me and I to him.

Having spent a few years in the helicopter safety business, I could just picture my buds at the Safety Center coming to investigate my Class A and writing the mishap report. How would it have read? "Cause. Human Factors, DO/Squadron/Person, Complacency." Not the way I would want to exit my career.

Lesson learned? You bet! By the grace of God, I am here to recall that experience alone is not a good substitute for planning, flying, and staying mentally with the aircraft. I lost situational awareness (yeah, us chopper guys are supposed to keep it, too), and it could have killed us. I am always on my toes with students. I was reminded with a 2-by-4 to be on my toes with experienced fliers as well. There is no such thing as "a routine training flight," especially one gone wrong. ✈

MUNITIONS *news*

ACMI Pods Dropped

So that a civilian contractor outfit could perform mod updates on fighters, they first had to remove and temporarily store the jets' ACMI pods. An agreement was made with the host base's munitions shop for the ACMI up/down loads of jets to be worked and the temporary storage facilities for the removed ACMI pods.

On one particular aircraft, the local munitions personnel helped one of the contractor's support people remove four ACMI pods and load them on the bed of a 1-ton truck. Unfortunately, and in violation of munitions handling directives, none of the pods had been placed in any kind of approved transportation rack, properly tied down, or secured on the truck bed. This would prove to be a costly trip to the storage facility for all concerned.

The civilian contractor's driver had to stop at the flightline entry point. As he was starting off again, two of the ACMIs fell out the back of the truck, and a third one's nose section hit the ground while hanging outside of the truck's bed. One could easily imagine this costly incident happening with the haphazard way the pods were handled by *both* the civilian contractor's support person and the local munitions shop. It was just a matter of chance and timing before a mishap struck, i.e., if this was their normal munitions ground handling behavior and routine.

Naturally, it's also pretty easy to point a finger at the civilian contractor, i.e., the mishap driver, because common sense would dictate at least some form of securing provisions would be necessary to keep the pods from falling out. We just shouldn't expect a directive or regulation of *any* sort to prod us into securing *anything* that's capable of rolling around in the back of a truck **with its tailgate removed!** C'mon now! Should we? We didn't think so either.

Unfortunately, the mishap unit felt the civilian contractor's lack of written guidance for its employees on the proper transportation of the ACMI pods led to this preventable incident. And there's some validity to that reasoning. However, in this blatant case of inattentiveness and carelessness on the part of the driver, maybe even written guidance wouldn't have helped.

But the goal of the USAF Mishap Prevention Program is the prevention of mishaps, i.e., the repeats, right? Well, in all fairness to the civilian contractors, they weren't the only ones contributing to this mishap.

If the host base munitions shop helped unload the ACMIs from the jet *and* also helped load the ACMIs onto the truck, then why would *they* allow such carelessness in the lack of proper securing and transportation of those ACMIs—no transportation racks, no securing provision, and no truck-bed tailgate? Surely the "blue suiters" should've known better and intervened. Instead, it was a concerted effort by all the participants that brought this mishap to fruition. Too bad it wasn't the other way around.

Air Launch Missile...Ground Launched?

No task supervisor, no checklists, no self- or team discipline, and not enough experience and proficiency—all combined—spell m-i-s-h-a-p.

A three-person weapons load team was tasked to perform a weapons download on an F-16. But before they could begin the download, their weapons team chief was called away to another location (he also happened to be performing weapons line expeditor duties). Before the team chief left, he instructed the two remaining team members (both 3-levels) to stay put and wait for his return.

However, the two industrious, young airmen decided to get a jump on things and start the weapons offload preparations *without* their team chief. So with no task supervision, not checklist qualified, no tech data available, and charged with a healthy dose of "can do attitude," off they both went.

They started by removing the fins on some AGM-88s, yet failed to install the tracking pins or install the caskets underneath the missiles as directed by tech data. When the two young, inexperienced "mach three-no heading" weapons loaders moved an AGM-88 missile forward, the tail-end of the missile came off its rail and dropped to the ground below. Over $70,000 worth of damages!

Of course, the two weapons team members shouldn't have ever started without their team chief. But, interestingly, why would they ever begin the task *without* tech data, i.e., when they both weren't proficient or experienced enough to perform the task safely? Their motivation and "leaning forward" attitude are understandable—not their lack of self- or team discipline.

As for the mishap unit's recommendations to preclude recurrences? Sadly, they decertified the two young, hapless, inexperienced, and certainly unproficient weapons loaders. But how can you decertify somebody who wasn't fully qualified to perform the task(s) in the first place? Could they have been following the past bad examples of their team chief and/or trainer?

Maybe the real cause of this mishap lies beyond the two airmen's performance. ✈

Spatial Disorientation Training

A Look Into the Future

Lt Col Sam Holoviak operates the new Advanced Spatial Disorientation Demonstrator (ASDD).

All visuals courtesy the author

LT COL SAM HOLOVIAK
ASDD Program Manager
USAFSAM/FP
Brooks AFB, Texas

"Gyro 11...winds 290 at 6, contact departure local channel 4, cleared for takeoff."

"Roger." I placed the throttles into full afterburner, felt the familiar lurch forward, and watched as the visual scene started to move past. I thought to myself, *Down the center of the runway, there goes the tower off the left side...Okay, there's the airspeed, rotate, the acceleration, the pitch-up sensation, the visual scene is just like in the airplane...This is great!*

Up into the dark night sky I climbed. "Very nice," came the voice over the intercom. "Now, do you think you could level off without looking at your ADI? Keep the throttles up and continue your departure, but just move the stick and make yourself feel like you have leveled off." *Sure...I can do that.* However, just to make sure I didn't sneak a peek at my ADI, the operator blanked it and the altimeter out for me.

"Okay, I feel like I'm level now," I said confidently...*This isn't so hard.* The console operator asked me, "What do you think your pitch attitude is now?" With a little confusion in my voice, I said, "Level, of course." Then my ADI and altimeter were given back to me. WOW! I was in a 20-degree dive, screaming toward the earth! "What's going on?" I asked.

The operator explained to me that I was feeling the erroneous pitch-up sensation caused by the normal takeoff acceleration—the sensation the inner ear gives all pilots when they accelerate down the runway. Some feel it to a greater degree than others. Everyone is a little different, but everyone feels it.

Then the operator said, "Okay, now level off on your ADI and tell me what you feel." "Hey! This is neat! I feel the same acceleration I felt on the takeoff!" "That's right," the operator said. "And the great thing about the

continued on next page


Cockpit with center and side stick

ASDD (Advanced Spatial Disorientation Demonstrator) is that we can put you in this situation, consistently, feeling that exact acceleration every time. Now, let's do the next profile."

This is just one of the many profiles being developed at the USAF School of Aerospace Medicine, Aerospace Physiology Department at Brooks AFB, Texas, for the Advanced Spatial Disorientation Demonstrator, or ASDD; the future in spatial disorientation (SD) training devices.

To all of you who went through aerospace physiology training (chamber training) and had a brief exposure to the old Vista Vertigon, the new ASDD will appear to be a quantum leap in design and use of state-of-the-art technologies in a single device.

These technologies include high resolution visual displays; high-speed, low-cost computer motion controls; and advanced programming languages that orchestrate a completely synchronized flight and motion simulation. Pilots will experience the sensations of disorientation by coupling these features with actually putting the man-in-the-loop by not just observing a demonstration but actually interacting with the device.

With a quick look at just a few of the capabilities of the ASDD, you will see the potential for sophisticated profiles that apply to all the USAF's pilots, fighters and heavy alike.

- 4 angular degrees of freedom: 360 degrees in pitch, roll, yaw, and planetary
- 2.2 Gs sustainable around an 8-foot planetary arm that can be rotated up to 28 rpm.
- Subthreshold motion. The electric motors are so smooth and quiet that the occupant does not sense the motion.
- Precision (± .01 degrees in motion or .01 seconds in time).
- Computer programmable profiles the exact position necessary to produce the illusion are simplified through user-friendly "profile utility" software. Simple profiles can be constructed in minutes.
- 150 millisecond response time. Gondola movements are nearly as quick as the actual aircraft, giving it a very realistic "feel."
- Man-in-the-loop or passive computer-driven motion. Such motion is totally operator selectable, allowing the occupant to interact with the profile, thus maximizing the experience.


Visual System


114° X 58° wide visual screen

- Seamless 114 degrees wide X 58 degrees high field-of-view. Utilizing a system of curved screens and mirrors, the pilot's view is not cluttered by any seams or monitor frames.
- Formation flight. Both fighter and tanker images flying their own independent paths allow for increasing the pilot's workload. Pilots can record their flight and then replay it while flying in formation with themselves in real time (single or two-ship formation images). The tanker has an independent programmable flightpath for realistic air-refueling anchors.

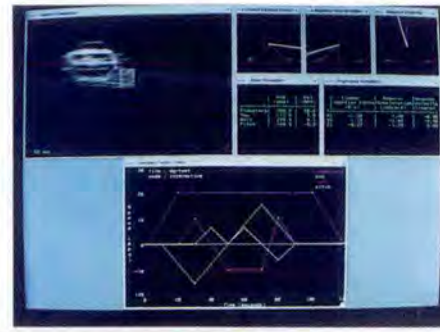
ASDD Motion

• Computer-generated images using Silicon Graphics computers. Visual scenes are programmable in the Silicon Graphics environment.

• Cockpit (T-38 layout). Medium fidelity cockpit with actual T-38 throttle quadrant and control stick.

• 4 Aeromodels (T-38, F-16, F-15, A-10). Source code for each aeromodel is programmable, and the site license is owned by the USAF.

• Computer-generated instruments and a virtual HUD are programmable, lending maximum flexibility for future modifications. Incorporation of an overlying metal bezel gives the instrument panel a realistic appearance.

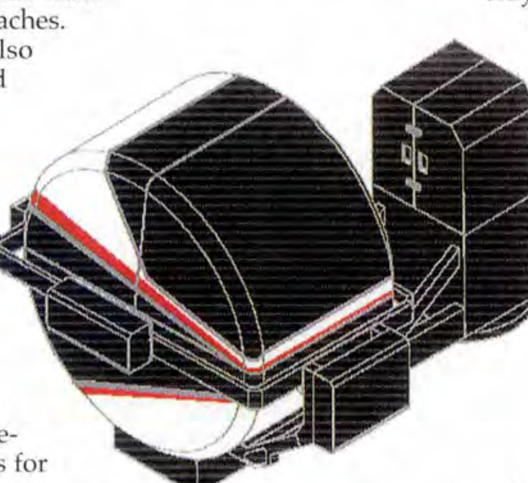



Computer and cockpit instrumentation

T-38 instrument panel, configurable

• Independent navigation monitoring screen. The ASDD operator can monitor the flightpath of not only the pilot but the independent tanker as well. Additionally, a simulated Instrument Landing System/Precision Approach Radar (ILS/PAR) monitoring screen allows for exact tracking of pilot progress on approaches. Approach trajectories are also recordable on laser printer hard copy.

• Flexible cockpit configuration. Two control sticks are permanently mounted in the gondola. The center stick is utilized by the T-38, F-15, and A-10 aeromodels. The side stick is utilized by the F-16 aeromodel. Neither conflicts with the other.



The ASDD is the only simulator that meets all five of the criteria set forth by the world experts for SD training.

- Enhanced Visual Displays
- Full Range of Motion
- Realistic Flight Instruments
- Man-in-the-Loop
- Variable Task Loading

The key to the ASDD's future is its software programming flexibility. Unlike most current simulators, visual scenes and motion directions can be changed in real time.

SD is not easily defined and is often misunderstood. By putting pilots into a situation where they actually experience specific SD illusions, they can improve their SD coping skills and gain a better understanding for the subtleties and dangers of SD. This way they know that if they put the airplane within certain parameters, they are setting themselves up for that illusion and can be better prepared to cope with it. The ASDD is a potential lifesaver. In the years to come, we envision future aviators will associate the ASDD with SD training as readily as they associate high-G centrifuges with GLOC training.

The success of the ASDD program is the direct result of a consolidated and cohesive team effort of not only the USAF Human Systems Center but also those line aviators who have contributed their time and expertise in guiding a realistic profile development.

In this age of high-cost modern weapon systems, it is critical that the ASDD, the only flight simulator able to address all of the pilot's senses of balance or "spatial orientation," be incorporated into the composite training program for our future pilots. The cost of SD-related mishaps is, on average, $80 million a year. There is no other program that seems to address this cost. The roughly $3 million ASDD price tag, however, has not enticed any MAJCOM commitment to put this unique training into the hands of the line pilot.

The ASDD rapidly gained international interest to the point where Germany and Japan have already purchased similar devices and are working feverishly to incorporate their unique features into their pilot training programs. ✈

"How Come They Never Mentioned This at CCTS?"

On our deployment flight, we were amazed at the open spaces in northwestern Canada and Alaska. Most folks in the lower forty-eight don't quite appreciate how far it is between suitable landing fields for a big airplane, such as our KC-135A, in our largest state.

Photos courtesy the author

CAPT STU MILLER
Altus AFB, Oklahoma

It was February in Alaska. I'd been an aircraft commander for 2 months, and the copilot and nav were stating (rather emphatically) that the fuel gauge was at bingo. In the meantime, the DO (now the OG/CC) was on the radio stating (just as emphatically) that we should try another approach. *How come they never mentioned this situation at CCTS (Combat Crew Training School)?*

How did we get here? I'd been back from the Azores about 2 weeks (where I had deployed with a more experienced crew) when the ops officer informed me I'd be getting a new crew and deploying in about 10 days to Eielson AFB for the Alaskan Tanker Task Force (ATTF). All of us rounded up as many warm clothes as we could find (you didn't need many at Carswell), mission planned, and headed north.

On our deployment flight, we were amazed at the open spaces in northwestern Canada and Alaska. Most folks in the lower forty-eight don't quite appreciate how far it is between suitable landing fields for a big airplane, such as our KC-135A, in our largest state. After landing, getting our arrival briefing, and hitting the sack for some much-needed rest, we found ourselves on our first sortie, a "Volant Boom" refueling of a C-141 near the western Aleutians.

Because the ATTF was short on instructor pilots, we flew with an instructor nav on this first sortie—an "over the shoulder/welcome to Alaska" ride. Although the takeoff roll was quite long—we broke ground after rolling for 12,000 feet ("R" models are great, aren't they?)—the takeoff and climbout to FL 310 was uneventful. Our flightpath out was a little bit different than on our way back home as we would drag our receiver to the northwest along our planned air refueling track on the western edge of our flight plan.

My copilot diligently checked our fuel quantity, and we realized we were behind the curve. We checked our onboard computer, and sure enough, the predicted headwinds were much stronger than forecast. The continuing fuel deficit made the otherwise scenic sojourn out to the western Aleutians seem somewhat longer than it actually was.

Once we'd hooked up with the -141, the boom asked if he'd be needing the entire offload. "Do you have any extra? We're a little low," was the response. Imagine that. The boom informed him we were in similar straits because of the winds. We offloaded the scheduled fuel load as quickly as possible and turned early for home.

The tailwind that should have been there on the way home wasn't. As we neared Eielson, we began checking the weather. As I mentioned, although the scenery up there is awesome, there's not a friendly weather shop on every corner.

It was my co's turn to do the approach and landing as I'd flown these on the deployment sortie. And, although the weather was quickly deteriorating, I figured this approach and landing would give him confidence in himself as well as showing him I trusted his ability. At about a 2-mile final, tower announced the visibility was now at 1/2 mile, which was well below my (and SAC's) Tier II aircraft commander mins of 300-1. The instructor nav in the jumpseat, who hadn't said much up to this point, quickly reiterated this fact to me several times in succession.

To be honest, the approach wasn't my co's best effort, so going missed approach wasn't all that bad of an idea. But as I looked at the fuel gauge on outside downwind and listened to the DO on the radio, we arrive at the beginning of my tale—*"How come they never mentioned this at CCTS?"*

Someone along the way had ingrained into my head that "bingo" did not mean just one more approach. So we informed the command post and the DO (who was less than overjoyed) that we'd be diverting to Elmendorf. It was at this point I experienced crew coordination and CRM at its best. The nav began to read the best range altitude and initial heading out of the in-flight guide. The co began to work the clearance with approach and set climb power. All I had to do was to fly the jet. The co worked out how much fuel we'd arrive with, and the nav came up with an exact heading as he punched Elmendorf's coordinates into the INS. We were on our way south as I silently thanked my ops officer for this crew.

Just as we lined up on final at Elmendorf, with the fuel gauge as low as I'd ever seen it, an F-15 took the barrier and crumped the runway. After I declined tower's offer and said it wouldn't be in our best interests to land on their other 5,000-foot runway, that same question came to mind—*"How come they never mentioned this at CCTS?"*

Again, the IN spoke up. "How 'bout Anchorage International?" Again, CRM kicked in. As I wondered whether the $50 I had in my wallet would cover the landing fee, my co started to work the clearance, and the nav mentioned where the upcoming approach was in the low book. Fortunately, while I was briefing the approach, the troops on the ground quickly removed the F-15 from the runway.

The landing at Elmendorf was uneventful. But as we taxied clear of the runway, command post informed us we were to refuel the jet and return to Eielson ASAP. We parked the -135, shut down the engines, then nearly had to do PLFs off the bottom rung of the crew entry ladder which was way above the ground due to our low fuel state.

When the gentlemen from transient alert reached the aircraft, they quickly informed us they had no idea how to refuel the -135. But after a series of errors which I don't care to mention, the boom suggested we consult the job guide, and things came together. When we'd finished refueling, we headed to base ops to file, check the weather, and scarf down some food.

In the old SAC days, crew duty day was hardly ever a factor on higher-headquarters-directed sorties, and this was the case here. The weather was not cooperating much, and conditions would continue to be near or below mins at Eielson as the evening progressed. As I discussed with my crew the decision to return, they clearly expressed they'd support any call I made. But the haggard-looking guy in the flight suit, who stared back at me from the mirror in the men's room, made the decision for me.

So I called the DO at Eielson, who was somewhat less enthusiastic about our decision to RON than I was, and we headed to billeting. We awoke refreshed the next day and flew in VFR conditions all the way to Eielson.

If you haven't guessed by now, there's three underlying themes in my story—know your limitations, CRM, and they can't teach everything at CCTS.

We were fortunate enough to make the right calls and stick to them. Even though this was one of the most disconcerting sorties I've ever flown, it was also the best example of crew coordination/CRM I've ever been a part of. Everyone on the crew contributed and did their job, mutually supporting the overall effort. By working together, we added synergy to our individual efforts and were able to work around several challenging obstacles.

And finally, although the training at CCTS is excellent, they can't cover every situation you might encounter. Your own knowledge of the aircraft, rules and regulations, coupled with what I just mentioned—good crew coordination and knowing your limitations—will help you overcome most obstacles.

But, to be honest, what caught us off guard the most on this TDY didn't occur until we'd arrived back at Carswell. A few days after our return, our ops officer handed us a letter from the DO at Eielson thanking us for outstanding efforts at the Alaskan Tanker Task Force. ✈

From left to right: SSgt Willie Coleman, Boom Operator; Capt Stu Miller, Aircraft Commander; Capt Willie Eaton, Navigator; 1Lt Karl Hjerpe, Copilot.

Training Pays Off

On 15 July 1996, I was flying my second ever T-37 solo sortie. I had a total of 35 hours in the aircraft when I experienced an engine malfunction on takeoff. This is my story.

LT KENT A. DUCKWALL*
Vance AFB, Oklahoma

On a recent July afternoon, I found myself preparing for my second area solo in the T-37. I felt confident about the mission ahead. As a UPT student with less than 2 months since my first flight, I probably should have been more concerned with not screwing up, but I was too busy enjoying the fact I had no IP next to me. Like any Air Force pilot who has had the pleasure of flying the T-37 during the summer months, I was also "enjoying" the terrible heat in the cockpit on the ground. Between the thrill of going solo and the distraction of the temperature, the only emergency I might have been thinking of was the daily standup. Now that was something which really could get my heart pounding!

"Scare 70, cleared for takeoff." Finally! "Scare 70," I responded. The canopy came down and I taxied out to the runway. I ran up the engines. As usual, everything looked good. I released the brakes and started rolling. Moments later, I was airborne. I raised the gear and flaps, switched to departure frequency, and checked in with them. The air-conditioning was really working now, and I began to feel comfortable once again.

That feeling vanished almost instantly when I heard several bangs from the right side of the plane and simultaneously felt the plane shudder slightly. In the T-37, bangs and pops from the engines are normal only after rapid throttle movements at higher altitudes. I was low and hadn't moved the throttles out of military since engine runup on the ground.

There weren't any warning lights in the cockpit, but my right engine instruments didn't look good. The RPM was jumping between about 90 to 100 percent. The EGT gauge was fluctuating a little more slowly, and the needle on the fuel flow gauge was all over the place. There was no smoke or other signs of a fire.

In this instance, the proper action is to reduce the power on the affected engine to idle and abort the mission. However, when I brought the throttle back, the RPM only came down to 70 percent, not 38 to 42 percent like it should have. I didn't remember ever seeing this type of emergency in the manuals, and I

USAF Photo by MSgt Fernando Serna

didn't know what to do. Ironically, just seconds after enjoying having the jet to myself, I was thinking how nice it would be to have an IP with me.

I rechecked the gauges. Aside from the strange RPM reading, they all looked normal. I had just made the decision to leave the engine running when smoke began to enter the cockpit. Although an engine fire is a bad thing in any plane, I was once again sure of what needed to be done. First I switched to 100 percent oxygen. In a flash, the bold face that had been forced down my throat for the past 2 months came back to me. **THROTTLE — RETARD. FUEL SHUTOFF T-HANDLE — PULL-OFF. THROTTLE — CUT-OFF.** Immediately, the engine shut down. All the gauges read normal on the other engine, and the smoke had vanished.

Unknown to me, a damaged part in the engine-driven fuel pump was forcing raw fuel into the right engine intake, and the engine was burning it, causing a high fire hazard. The smoke was probably a blessing because it convinced me to shut the engine off rather than leaving it running.

In the 10 to 15 seconds from the first bang to the time I shut down the engine, I went from confident to startled to confused to a state of disbelief. Rather than being scared (like in the morning standup), I couldn't believe this had really happened. However, it didn't take long for me to start worrying about my situation.

When I shut down the right engine, I was at 2200 AGL and 180 KIAS. However, I was now in a one-engine T-37 with a full load of fuel on a hot July afternoon in Oklahoma. I was still climbing, but my airspeed was now at 150 and slowing. I eased the nose down to maintain my airspeed, but it came at the cost of gaining any more altitude. Fortunately, I was still within a few miles of the base, and I started turning back.

"SCARE 70, EMERGENCY!" "I can't believe I'm saying this" I thought. This brought an immediate response from departure control. I explained my situation and intention to return to Vance and switched back to the RSU frequency and repeated the call with them. By descending to 1000 AGL (pattern altitude), I had been able to accelerate up to 200, and the one good engine was just enough to keep me there.

I was concerned about the heavy weight and high temperature outside. The combination of the two virtually guaranteed I wouldn't be able to execute a go-around if I had to. In addition, I still didn't know at this point what had caused the problem in the first place, and I was worried the same thing might happen to the other engine. I decided to play it safe when I reached the break point on initial. I pulled the throttle back slowly and not all the way back to idle before starting my turn. If the engine flamed out, I wanted to eject wings level and not in 60 degrees of bank. Fortunately, the engine worked fine, and I flew it in and landed. End of story.

I used to complain about how much I hated standup situations and how useless I thought they were. I know I'm not the only UPT student to have done this. Now that I've experienced a real emergency, I still hate them, and I'm just not very good at them. However, at least now I know they do build good habits, and good habits make good pilots. This may not be much comfort to you UPT students out there when you hear those terrible words "You have the aircraft" each morning. But take it from me, the habits those situations built got me through my problem, just as anyone with the same training would have been able to do. ✈

*Lt Kent A. Duckwall was awarded the 71st Fighter Training Wing Outstanding Safety Performer Award and the AETC Well Done Award for his actions.

NOISE! NOISE! NOISE! NOISE! noise! NOISE! NOISE NOISE! NOISE

WHAT YOU CAN'T HEAR CAN HURT YOU

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What Is Noise?

Noise is sometimes defined as "unwanted sound." But it's also "waste energy." The popular press often writes of noise as a "bad thing," ascribing to it unwanted fallout such as deafness, ulcers, and even insanity. So, let's bypass the insanity claim and limit this article to only the noise which causes deafness.

It's true that noise can be a distraction and an infernal nuisance, but does it cause physical harm? The answer is an unqualified yes, but it depends on lots of variables such as the energy, the frequency, the time to peak out, and the duration of exposure. There are, of course, people in this world called acoustic engineers who make a full-time living studying the impact of noise.

In the sense that noise is "waste energy," it can also be seen as increase in heat. And, yes, for those of you who are so inclined, it's possible to note a minute temperature rise when you are exposed to either a whisper or a sonic boom. These increases in energy can be measured in a unit called the decibel (abbreviated dB). The waste energy you receive from standing unprotected at 30 meters from a space shuttle launch is enough to knock you unconscious and liquefy your brain. (So don't try *that* at home, kids.)

So What's a Decibel?

Most folks have some notion that decibels have something to do with sound measurement. True, but that's only part of the story. Officially, a decibel is a logarithmic measurement of *anything* in relationship to a non-zero reference standard. This is a fancy way of saying it's just a unitless ratio. For example, you could measure your hair length, weight, heart rate, grip strength, or even your IQ (although it's hardly ever done) in dB. Electronics technicians often measure power losses in dB, but those kinds of dB mean something quite different from noise measurements.

Decibels go from minus to plus infinity, just like the Richter earthquake scale. If a dB reading goes below zero, it just means it's below the threshold level. When sound dBs go below zero, we usually say it's *too* spookily quiet, and we can hear our own breathing, swallowing, blood pulsing. Under laboratory quiet, the ear can even pick up Brownian motion sounds—the chain reaction of air molecules bumping into each other! In fact, most folks work better with some minor background noise present. Not all noise is bad.

Look at Table I. I've constructed some representative sounds and noises to demonstrate the vast life-and-death differences between seemingly small increases in dB. The perceived increase between, say, 60 to 70 dB may *sound* like the perceived increase from, say, 90 to 100 dB, but the actual sound pressure differences are 100 times as powerful at the higher end. It's at this high end of the dB continuum (100 dB and above) that people do themselves major-league hearing damage; and it's mostly because until we feel the pain (usually over 140 db), those noises just don't *seem* to be all that loud.

The Human Ear Is Pretuned to 3,000 Hz

Human hearing isn't equally sensitive at all frequencies. Most humans can't hear sounds above 20,000 Hz, although dogs and bats can hear these frequencies quite well. Human ears are most sensitive at ranges roughly between 2,000 to 4,000 Hz. Ever wonder why your digital watch alarm is so embarrassingly noticeable when it goes off at a concert or during an important staff meeting? That's because the beeper alarm is set at about 3,000 Hz, the frequency where you *will* notice it. (So, by the way, is a baby's cry—nature's way again of making us take notice.)

The bad side is that this 2-4 kHz range is also where hearing damage is most noticeably vulnerable. For instance, if we lose hearing in the low 20 to 1,000 Hz range, we lose the ability to recognize vowels. Huntington's chorea victims, indeed, lose hearing in this low range. But, alas, we usually don't recognize English words by their vowels, but by their consonants. The 2-4 kHz range is where most of the information content of the English language is carried. So, when we lose hearing in the 2-4 kHz range, we lose the ability to recognize consonants, and consonants are the great carriers of speech information.

I was told of a sweet old lady who couldn't hear the difference between "pot roast" and "cockroach." That hearing lapse is potentially embarrassing enough, but imagine the embarrassment of the pilot who can't hear the difference between the words "go" and "hold," "fly" and "try," "ascend" and "descend."

How to Lose Your Hearing

Hearing is a unique, special sense, totally mechanical in the early stages. Unlike your taste buds or smell receptors, these early mechanical stages lack the usual blood supply and, therefore, don't repair themselves. Most high frequency sounds are picked up mechanically by 24,000 tiny and delicate little hair cells, microns wide and tenths of millimeters long (see Figure 1). These hair cells are believed to reverberate like little piano strings or open harps. Frequent exposure to loud sounds at, say, 3 kHz will shear off or otherwise degenerate these hair cells tuned at 3 kHz. Since the sound pickup process is mechanical, when these hair cells are gone, they're gone. And they *don't* grow back. If you lose hearing to a really loud noise, it's a permanent thing. My own sorry youthful experience with firing a .38 caliber aircrew pistol on the range for only 2 hours without hearing protection has left me with a permanent 20 dB hearing loss in my right ear at, of course, 3,000 Hz.

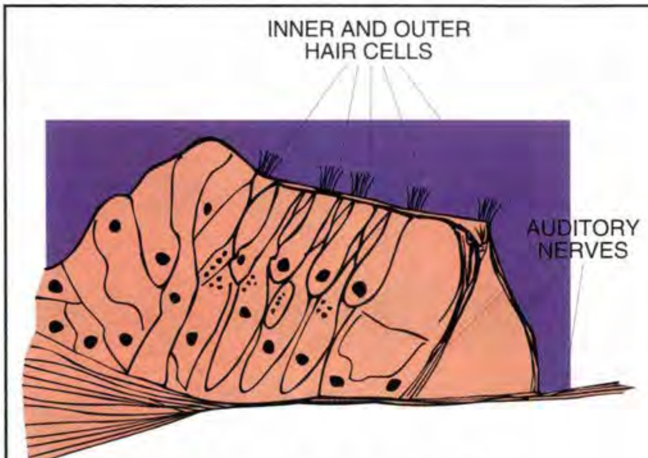

Figure 1. Side view of the inner ear's hair cells. Like fine tuned harp strings, when they break, they are gone forever. (After Longmans, 1919)

Table I

Sound Pressure Level (dB)	SOURCE
220	Inside detonating diesel cylinder
210	
200	300m from Space Shuttle launch
190	10m from detonating land mine
180	(probable eardrum rupture)
170	
160	Shotgun blast at muzzle
150	Jet takeoff at 10m (instant ear damage)
140	Jet takeoff at 30m (protected ear limit)
130	Pneumatic riveter (unprotected ear limit)
120	Rock concert 2m from amplifier (pain threshold)
110	Chainsaw at arm's length
100	Very noisy factory (cumulative ear damage)
90	Boiler room
80	Inside open sports car
70	Busy office/normal speech at 1m
60	Washing machine/clothes dryer
50	Light traffic
40	Quiet bedroom
30	Quiet countryside
20	Recording studio
10	Normal breathing
0	Threshold of hearing
-10	Too quiet

Sources: Sanders 7 McCormick (1993)
Kantowitz & Sorkin (1983)
Taylor (1970)

What Noises Are the Worst?

I can say without hesitation that loud impact sounds, like jackhammers, diesel engines, chain saws, and gunshots are the worst offenders. Impact sounds are defined as taking less than 10 milliseconds (that's 1/100 second; OSHA uses a more conservative value of 3.5/100 second) from onset to peak, and nearly all impact noises are man-made. (Yes, we've done it to ourselves again.)

Impact noise damage is found to be (thanks to an ingenious mathematical discovery called the Fourier transform) more likely to cause permanent hearing damage. For example, impact sounds like a diesel engine generate not only the fundamental frequency of, say, 33 Hz, but a whole additional infinite range of harmonics, many of which can and do promote hearing damage.

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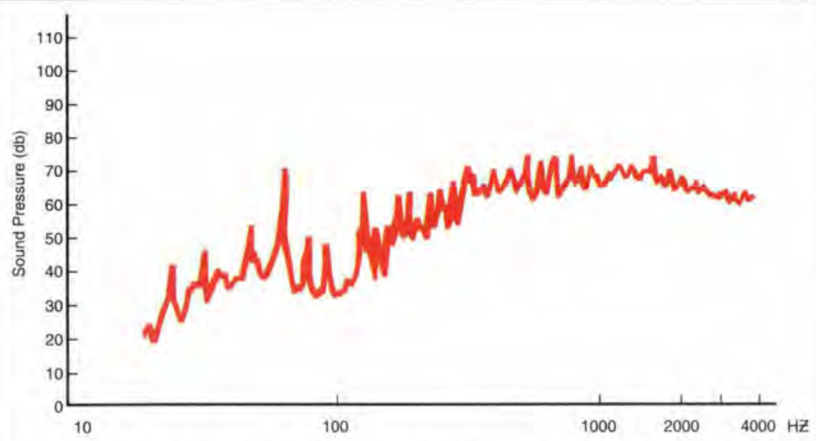

Figure 2. Noise spectra of a typical diesel engine (from Rupert Taylor, 1970)

Look at figure 2, showing the kazillion frequencies generated by a typical diesel engine (like a power cart) running at 2,000 rpm at full load. This engine actually resonates, reverberates, and amplifies sounds well into the 2-4 kHz range, with more than sufficient noise to cause hearing loss over a long period of time. This is a classic case of what you *can't* hear can hurt you.

The second-place taker for the worst noise offenders are jet engines. Contrary to what you might think, most jet noise is not generated by the fans, compressors, and turbines. The high-pitched noises which cause hearing losses are the noises caused by fast-moving air scraping and slamming into slow-moving air. Jets roar on takeoff because the exhaust air (sometimes at supersonic speed) is mixing violently with stationary air. Jets scream on landing because the noises of the compressors and turbines just aren't any longer covered up by noises of the violent air mixing. Fan jets are noticeably quieter because the bypass allows the exhaust air to mix more "gently" with ambient air. (See figure 3.) Referring again to Table I, you can see that the guy who stands next to a jet launching with afterburner lit (like on a Navy carrier) is begging for instant ear damage.

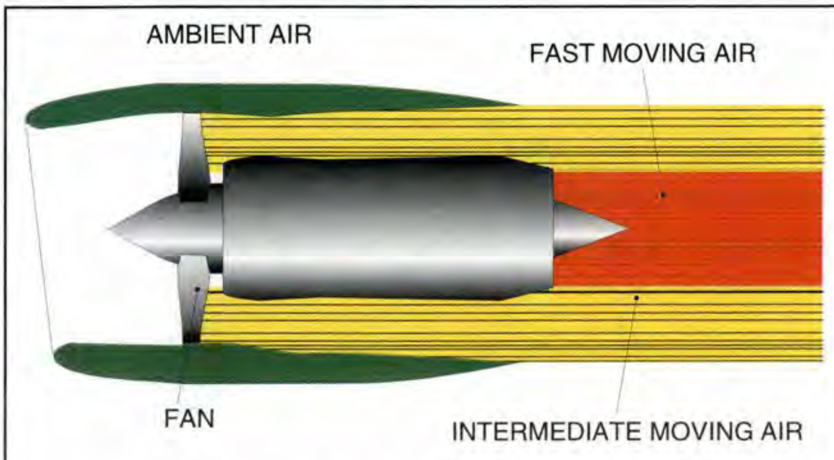

Figure 3. Why the fanjet is so quiet. The bypass allows more gradual mixing of fast moving and ambient air.

What Hearing Protection Works?

Allow me a minute to praise the noise-canceling headset. In 1992, David Tarullo and I presented a study to the Human Factors Society outlining personal preferences for the DCNC noise-canceling headset by private pilots. Our 11 pilots flew three separate missions in the Piper Comanche. Pilots flew the first mission with the DCNC, the second with a standard headset, and the third with no headset at all.

Results of this study overwhelmingly indicated that use of the DCNC headset significantly reduced pilot subjective physical fatigue, mental fatigue, and loss of proficiency during flight. That is, for all but three older pilots who did not normally use headsets anyway! Presumably, these old-timers had already acquired so much hearing loss they didn't either care or notice any noise-canceling advantage.

There is a misconception that people "adapt" to loud noise. Hogwash! They just get progressively deaf enough until they don't notice it.

However, there's no such thing as total soundproofing. Certain types of hearing protection can protect against certain frequencies, but there is no single system which protects against all noises. Therefore, it's a wise choice to use combinations of ear protection.

Earplugs (aka inserts) generally can attenuate high frequencies up to 40 dB. Earmuffs (aka external ear defenders, or "Mickey Mouse" ears) work well at the lower frequencies as well but are somewhat lacking at the higher end. The best combination is, of course, to use both plugs and muffs. Beware, though. No amount of head-worn ear protection works well above 150 dB. One shortcoming is that vibration and noise can shortcut directly through the skull and onto the inner ear. And, it's obvious that slipping eyeglasses between you and the muff cancels out some of the protective advantage. Use of ear protection is, of course, only the last resort when you can't control the source of the noise or put distance between you and the noise.

Treat Your Hearing With Great Respect

To avoid occupational deafness, avoid all loud noises if you can. If you can't, then cover your ears when you pass by jackhammers and jets, and, if possible, wear earplugs *and* muffs. This advice isn't anything different from what your mother would tell you. Occupational hearing damage doesn't repair itself. When it's gone, it's gone. ✈

What You Should Know About Wind and the AN/FMQ-13 Measuring Set

USAF Photos by MSgt Perry J. Heimer

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Why This Article?

We've been receiving some questions lately about the FMQ-13. It seems air traffic controllers and pilots alike are skeptical about the accuracy and validity of wind information provided by this state-of-the-art equipment. "Old-time" tower and RSU controllers were used to reading dials for the latest wind information. "Old-time" weather personnel were used to reading a wind recorder chart that provided a continuous trace of wind speed and direction. Pilots normally saw the dials; however, when visiting the weather station, they could also look at the chart. Those days are gone.

Digital Displays Are Here to Stay

As you know, we are rapidly moving to an all-digital world. Weather equipment is no exception. What you must realize is that in the digital era, a lot of smart processing goes on "behind the scenes" before the handy little numbers ever show up on the display. Once tested and proven reliable, this digital technology can make your job easier—but only if you let it.

The Basics

When attempting to measure the wind, we must keep a few important concepts in mind. First, always remember that our atmosphere is a fluid. It is a substance (much like liquid) capable of flowing and changing shape. Second, when it flows uniformly in direction and speed, it is relatively easy to measure. However, when it moves erratically, we must be careful how we measure the wind if we're to get a value that actually represents its true motion. Third, we can't place wind sensors precisely on the touchdown and takeoff areas of the runway or at any given point along an aircraft's flightpath. Therefore, our measurements are being made from a point other than where the aircraft will actually be. This distance may be small in some cases, but often it can be hundreds of yards. The point of all this is all these factors can render our wind measurements unrepresentative and less useful.

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Measuring the Wind

Wind information for use at airports can be considered representative only if it provides an optimal estimate of wind variations we can expect over the runway. The purpose of wind observations at an airport is to give suitable short-term wind forecasts to pilots engaged in takeoff and landing maneuvers. This information, even though considered an observation, is really a forecast. How can this be? Remember, when a controller relays the latest winds to a pilot, the pilot anticipates this value to represent winds they can expect upon arrival at the runway. Therefore, in a sense, it really is a forecast. When we determine this "short-term wind forecast," there are three basic errors we can encounter. Let's look briefly at each.

Observation Error

This is the uncertainty of the actual measurement when the average wind speed, direction, and variability are determined for a given observation period at the sensor location. The bottom line here is that we *must* sample the wind for a sufficient period of time in order to more accurately determine its speed, direction, and gustiness. The longer that sampling period, the more accurate the measurement. We cannot simply rely on an "instantaneous" reading as this could be a fatal mistake.

Scientists have done much research on our dilemma of how long to sample the wind before we can consider the measurement reliable. Dr. J. Wieringa of the Royal Netherlands Meteorological Institute, consulting over 40 scientists worldwide, wrote a very informative article entitled *Representativeness of Wind Observations at Airports.* I could bore you with the math to prove my point, but I'm sure you have better things to do.

The absolute minimum sample period is 2 minutes. Ten minutes (as is done in Europe) is actually better, but 2 minutes will give us an acceptable statistical error of less than 6 percent. With this in mind, please consider the following: The wind can act like water in the ocean or like water in a nice tranquil pond. If you drop a rock in the pond, ripples (waves) will propagate in all directions. Depending on where you take your measurement, you may detect a wave or you may detect the lull in between. Pilots cannot afford to be told that life is but a peaceful lull only to be met by a tidal wave when they reach (or lift off) the runway.

Translation Error

Simply put, this is error caused by the necessity to deduce from the data we receive from the sensor location what the wind conditions will actually be in the touchdown or takeoff area. Obviously, we cannot put the wind sensor on the runway itself. Therefore, we are not measuring the wind where the aircraft will actually land or take off. Instead, we "assume" the winds are the same on the runway as they are at the sensor. This is not a good assumption. Again, this reinforces the idea that we must sample over at least a 2-minute period to increase the representativeness of our measurement.

Anticipation Error

This is error due to the operational time lag of up to a few minutes between the period when the wind information is transmitted to the aircraft and the maneuvering period when the information will actually be used. We can't do much about this one other than to recognize that time lag works against us. We must make every effort to relay the latest winds to the pilot when they are of significant speed or variability.

How Does the FMQ-13 Work?

The FMQ-13 represents new technology. It does not rely on the spinning cups of the old anemometer-style instruments. Although they were fairly reliable, these spinning cups were prone to a whole host of errors, including how well the hub was lubricated, temperature of the lubricant, corrosion of the moving parts, etc. The FMQ-13 eliminates these problems by using a high-tech system which determines wind characteristics by measuring the amount of electrical current required to keep tiny platinum wires heated to a constant temperature of 100 degrees Celsius. We could write an entire book about this process, but that is beyond the scope of this article.

The FMQ-13 takes the data from this high-tech sensor and then processes it. Its computer samples wind speed and direction information at least once per second and groups these samples into 5-second blocks. It then uses these data blocks to calculate a 2-minute average and displays this value for you. The display updates every 5 seconds. The computer looks back 10 minutes when determining the maximum wind gusts and direction variability. These displays also update every 5 seconds. Keep in mind that before the FMQ-13 came along, the weather observer was doing the 2-minute average and the 10-minute look-back manually when reporting the winds. He or she was *not* reporting instantaneous winds. Air traffic controllers had to watch the wind dials for up to 2 minutes to get a "feel" for the winds. Now, the FMQ-13 does this for you. You need only to read the display.

How Accurate Is the FMQ-13?

Very accurate. Here are the numbers:

Wind Speed

0-50 kts	± 1 kt (this range covers winds over 99% of the time
50-75 kts	± 5% (± 3.75 kts at 75 kts)
75-99 kts	± 10% (± 9.9 kts at 99 kts)
99-150 kts	± 15%, ruggedized only (± 11.5 kts)

Direction

± 3 degrees

Sensitivity

Constant wind speed:	As little as 1 knot.
Shift in wind direction:	As little as 3 degrees shift at a speed of 1 knot.

Here's the Bottom Line

JUST READ THE DISPLAY! The hardware was tested and certified good. The theory of operations and the science behind wind averaging is sound. Instantaneous wind information is dangerous and, therefore, is not displayed by the FMQ-13. On 16 April 1996, Brig Gen Orin L. Godsey, Commander of the Air Force Safety Center, stated that "The purpose of the wind measuring system is not to provide an instantaneous wind picture but to provide, or warn of, wind conditions that can be reasonably expected during a critical phase of flight. Winds, like other atmospheric phenomena, are variable conditions not discrete events, and analyzing them over a statistically significant period of time is the only way to draw reliable, and necessarily generalized, information useful to determine safety of flight. Additionally, due to geographic separation of the wind instrument and the approach/touchdown zone compared to the relative size of gust phenomena, the wind display is unlikely to ever exactly reflect the condition most critical to the pilot." Sound familiar? Couldn't have said it better myself.

How to Read the FMQ-13

The FMQ-13 may take some getting used to, especially if you're a "dial" person. However, once you get over the loss of your analog equipment, you may actually like the digital world. Remember, let the FMQ-13 do the work for you. Here's all you need to do.

1. Be sure the active wind sensor corresponds to the active runway. In most cases, you'll want the data from the approach end of the runway.

2. Simply read the top line of the display for wind direction, speed, and gusts.

3. Look at the second line to read direction variability.

4. Do *not* read the "gust spread" unless this information is specifically requested (such as for helicopter operations). Remember, the "gusts" data from the top line is of primary importance.

It's no more difficult than this. The processor takes care of the rest. We do realize, as with any equipment, malfunctions can occur. If, in your professional opinion you consider the winds suspect, don't hesitate to call the weather folks or the METNAV technicians (meteorological navigation maintenance personnel in comm squadron) to check it out. Overall, you should find the FMQ-13 quite reliable and easy to use. If you have further questions, feel free to call me at DSN 858-5267. ✈

The FMQ-13 represents new technology. It does not rely on the spinning cups of the old anemometer-style instruments. Although they were fairly reliable, these spinning cups were prone to a whole host of errors.

THE AFFSA INSTRUMENT QUIZ

MAJ KEVIN JONES
HQ AFFSA/XOFD

■ By the time you see this quiz, we'll be well on our way towards spring and, hopefully, you all will have had enough time to digest the "new" AFI 11-206, *General Flight Rules,* as well as a second volume of AFMAN 11-217, Volume 2, *Instrument Flight Procedures.* Just to make sure everyone is aware of the changes (as well as some things that have not changed), this month's instrument quiz will cover portions of these two new publications.

1. AFI 11-206 is a common source of directives including:

A. Air Force specific guidance.

B. Federal Aviation Regulations (FARs).

C. ICAO Standards and Recommended Practices (SARPs).

D. All of the above.

2. Which statement is false regarding the directives the pilot-in-commend (PIC) must comply with when operating an AF aircraft?

A. The FARs in domestic airspace unless the FAA has excluded military operations.

B. ICAO SARPs when operating in international airspace or when operating in a nation whose rules are not published.

C. The specific rules of each individual nation as published in FLIP and the Foreign Clearance Guide.

D. AFI 11-206 since it includes all of the appropriate references.

3. **True or false:** PICs are not responsible for complying with FARs. All important information is included in AFI 11-206.

4. **True or false:** HQ AFFSA will issue verbal waivers to AFI 11-206 only in the case of urgent, short-notice mission taskings.

5. Which of the following statements regarding the AF Form 70, Pilot's Flight Plan and Flight Log, is true?

A. A Form 70 is not required on flight conducted within 200 NM of the point of departure when preflight planning of control parameters would be impractical.

B. A Form 70 is required for all flights not conducted in the local area.

C. Before takeoff, complete all entries determined as necessary for safe flight.

D. A Form 70 is not required; the PIC will ensure sufficient fuel is available on board the aircraft to comply with the requirements of AFI 11-206 and safely conduct the flight.

6. Which of the following are authorized sources for obtaining preflight weather information?

A. 1-800-WX-BRIEF.

B. The Weather Channel (TWC) Pilot's Report.

C. U.S. Military Weather Services.

D. All of the above.

7. In order to ensure flight following, after a departure from a nonmilitary installation, the PIC must:

A. Contact the nearest FSS or equivalent after takeoff and request the destination be advised of the departure time.

B. Request the flight plan and actual departure time be relayed to the facility providing flight service.

C. Do nothing since the tower will automatically open your flight plan.

D. Contact FSS only for VFR flight following and traffic advisories.

8. What weather information is required to be documented on the DD Form 175, Military Flight Plan?

A. Source of weather information.

B. Time of receipt.

C. Weather briefer's initials.

D. None of the above.

9. Once equipped with approved GPS equipment, USAF aircraft may fly GPS "overlay" approaches:

A. After completing a MAJCOM-approved GPS training program.

B. As long as the approach can be retrieved from a validated navigation database.

C. AF aircraft will not fly GPS "overlay" approaches.

D. "**A**" and "**B**" above.

10. **True or false:** MAJCOMs may authorize reduced or light-out operations in military operating areas (MOA) in the MAJCOM's supplement to AFI 11-206.

11. What are the VFR cloud clearance/visibility minimums for a fixed-wing aircraft operating in Class G airspace during daylight conditions below 10,000 feet MSL?

A. Clear of clouds, 1 SM visibility.

B. 1,000 feet below, 1,000 feet above, 1 SM horizontal, and 5 SM visibility.

C. 500 feet below, 1,000 feet above, 2,000 feet horizontal, and 3 SM visibility.

D. None of the above; the PIC is the clearance authority in uncontrolled airspace.

12. **True or false:** Pilots must fly under IFR if performing instrument approaches (practice or actual; in VMC or IMC).

13. Which of the following situations require pilots to designate an alternate when filing an IFR flight plan (regardless of the weather)?

A. An unmonitored NAVAID is required to fly the planned approach.

B. Radar is required to fly the planned approach.

C. GPS is the only available NAVAID.

D. All of the above.

14. **True or false:** There are basically two types of GPS approaches: "stand alone" approaches and "overlay" approaches.

15. Which of the following components are included in a microwave landing system (MLS) installation?

A. Elevation station.

B. Azimuth station.

C. Precision DME transmitter.

D. All of the above.

16. An "NVD" is:

A. A turbo-charged NDB typically found in the former Soviet Union.

B. Short for "no visual ID."

C. A night vision device such as night vision goggles (NVGs).

17. At Air Force airfields, the ILS critical area is not protected when the ceiling/visibility is at or above:

A. 1,500 and 3.

B. 3,000 and 3.

C. 800 and 2.

D. 200 and ½.

18. **True or false:** When landing behind a larger aircraft on the same runway, stay at or above the larger aircraft's final approach flightpath; note the touchdown point; land beyond it.

19. You're shooting a localizer approach whose HAA is 400 feet. Assuming a 3-degree glidepath, how far is your VDP from the runway threshold?

A. 1 mile.

B. 1.5 miles.

C. 1.3 miles.

20. Why must non-DoD/NOAA products be reviewed?

A. To hassle the aircrew.

B. To justify the existence of the TERPs shop.

C. Because it is required by the FAA.

D. Because the standard used to construct the procedure is not known. ✈

ANSWERS

1. **D.** AFI 11-206 attempts to consolidate the most important information into a single document. It is important to remember AFI 11-206 does not contain *all* you need to know (AFI 11-206, para 1.2.1).

2. **D.** (AFI 11-206, para 1.2.1)

3. **False.** PICs are responsible for the FARs when flying in domestic airspace. Although 11-206 contains most of the relevant information, it does not contain everything (AFI 11-206, para 1.2.1).

4. **False.** HQ AFFSA issues only written waivers (AFI 11-206, para 1.3.2).

5. **D.** A Form 70 is no longer required—the PIC is responsible for making sure the aircraft has sufficient fuel to complete the flight (AFI 11-206, para 2.2.1).

6. **C.** (AFI 11-206, para 2.3)

7. **A.** (AFI 11-206, para 3.1.5.3)

8. **D.** (AFI 11-206, para 2.3)

9. **C.** (AFI 11-206, paras 5.8.3.2.1 and 5.8.3.4)

10. **False.** MAJCOMs may only authorize reduced or light-out operations in restricted and warning areas (AFI 11-206, para 6.17.1).

11. **C.** (AFI 11-206, Table 7.1)

12. **True.** (AFI 11-206, para 8.1.2) This paragraph has generated some questions; however, it is not a change from the previous AFI 11-206.

13. **D.** (AFI 11-206, para 8.4.2.1)

14. **True.** (AFMAN 11-217, Volume 2, para 1.2.5)

15. **D.** (AFMAN 11.217, Volume 2, para 2.1.1)

16. **C.** (AFMAN 11.217, Volume 2, para 3.1)

17. **C.** (AFMAN 11.217, Volume 2, para 4.4.5.1.2)

18. **True.** (AFMAN 11.217, Volume 2, para 5.8.1)

19. **C.** (AFMAN 11.217, Volume 2, para 6.8)

20. **D.** (AFMAN 11-217, Volume 2, para 7.3)

NO-FAULT FOD?

CMSGT DON A. BENNETT
Technical Editor

When considering one unit's last five foreign object damage (FOD) mishap investigations, you have to wonder how they could consistently come up with unknown, or better yet, no-fault-type conclusions? Since consistency in any endeavor can be an excellent performance or production indicator, shouldn't we strive for consistent positive indicators and not vice versa?

More precisely, four out of five of this unit's FOD mishaps were attributed to unknown reasons. The sole known-cause mishap was caused by mechanic complacency. But aren't the four unknowns consistent, and don't they reflect an undesirable trend? And isn't it safe to "assume" this kind of track record is a negative performance indicator?

For instance, are there any previously unaddressed problems with the unit's execution of established FOD prevention policies and procedures or the way they conducted their mishap investigations? Maybe even both?

Besides this "unknown cause" trend, there's another consistency developing in their FOD mishap reportings. Three out of these five mishaps were well over the $200,000 threshold for the Class B mishap category. Yet they consistently failed to properly categorize any of those costly mishaps as Class B's. H-m-m-m-m. Interesting, isn't it?

In fact, the total cost in damages for the five FOD mishaps was a little over $1 million in a 19-month period! Let's see, that's an average of one FOD mishap every 3.9 months at an average cost of over $200,000 per incident! Now, in *my* opinion, if that's *not* a negative trend or performance indicator (in light of the four unknown reasons for the mishaps) then I'm a monkey's uncle!

Concerning the latest FOD incident, it's interesting to note the airfield conditions prior to takeoff on the mishap sortie would certainly provide the potential for a FOD mishap. Just imagine ongoing, simultaneous major construction on *both* the parking ramp and the main taxiway. These kinds of FOD-infested activities would be a worrisome, chronic nightmare for *any* maintenance headshed's office or squadron commander.

Of course, this unit reports extra care was taken in FOD surveillance and prevention because of the construction, but in their particular FOD mishap-riddled case, apparently their plan didn't work. And in hindsight, what did "extra care" really mean? Remember, it takes only one rock to toast an expensive engine.

Any corps of unit leadership and maintenance supervisors should know it takes just one FOD walker with a wandering mind during a FOD walk to miss that one rock, regardless of how many FOD walks

Some time ago, we received a FOD mishap report here at the Safety Center that had to be one of the best mishap investigations I've ever read. The FOD cost was a tad over $10,000 (thereby *almost* escaping the reportable classification), but that didn't stop the investigating official from conducting an accurate, thorough research effort to determine the true origin of the foreign object. He could have easily blown off the mishap as just another case for a no-fault FOD source.

With only minute rubbings from the several tiny nicks and impressions in some of the engine compressor blades, the investigator (with assistance from laboratory researchers) was able to determine the FOD source was made of a particularly unique metal composition. Next, research revealed the only aircraft or engine hardware made with that particular metal composite. Lastly, he interrogated the most recent CAMS maintenance history that revealed the repair work (and the maintainers performing the work) where those unique metal screws were last used. The final mishap investigation product reflected the long, laborious work devoted in identifying the FOD source, but it was certainly worth the efforts if the unit ever expected to prevent recurrences, right?

Again, I've consistently thought so, too!

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are conducted during a construction day or week. So I wonder, in this unit's FOD-heightened situation, did they have a dedicated team of supervisors appointed to walk behind the FOD walkers to ensure quality FOD walks were being conducted — each and every time? Did anybody walk or drive behind the FOD sweeper to make double darn sure the sweeper was doing a satisfactory job? Were wing, base, or unit leaders actively involved on a daily basis with the proper conduct and execution of the base's FOD prevention program through firm commitments, emphasis, personal follow-ups, and receiving progress reports or briefings? Did the airfield manager take a highly visible role in leading the civilian contractors and military organizations through the daily FOD gauntlet by identifying and resolving FOD-generating problems and operational conflicts? It's important to remember, with major FOD-producing activities going on in the middle of airfield operations, the guard can never be let down nor can constant vigilance be relaxed until the work is ***fully*** completed.

But what if their latest costly FOD mishap really wasn't caused by debris from the construction work after all? What if this mishap, as well as the other three unknown-cause mishaps, were all caused by the same poor housekeeping practices at the job sites or individual mechanic complacency suffered by the sole known cause FOD mishap? Could material deficiencies have played a part too? Maybe only an exhaustive, in-depth, and (hopefully honest) soul-searching investigation would be able to answer all these questions.

Naturally, honest, in-depth investigations can be very painful for some individual or an organization's pride, e.g., when embarrassing causes/facts are repeatedly reported through safety channels. Yet with this many expensive and unexplainable FOD incidents, how could ***any*** unit or maintenance leadership not be willing to commit the necessary time, efforts, and humility to finally solve and prevent these kinds of FOD mysteries?

Obviously, this unit's present-day mode of investigating mishaps isn't working; if in fact the desired outcome is to prevent any more costly and embarrassing FOD mishaps. In these extreme cost-cutting days of austerity, nobody in today's Air Force can afford even ***one*** quarter-million-dollar FOD incident—much less five—on the same flightline.

In closing, aren't consistently accurate, responsible mishap investigations an important element of what the Air Force's mishap prevention program is all about?

I consistently thought so, too! ✈

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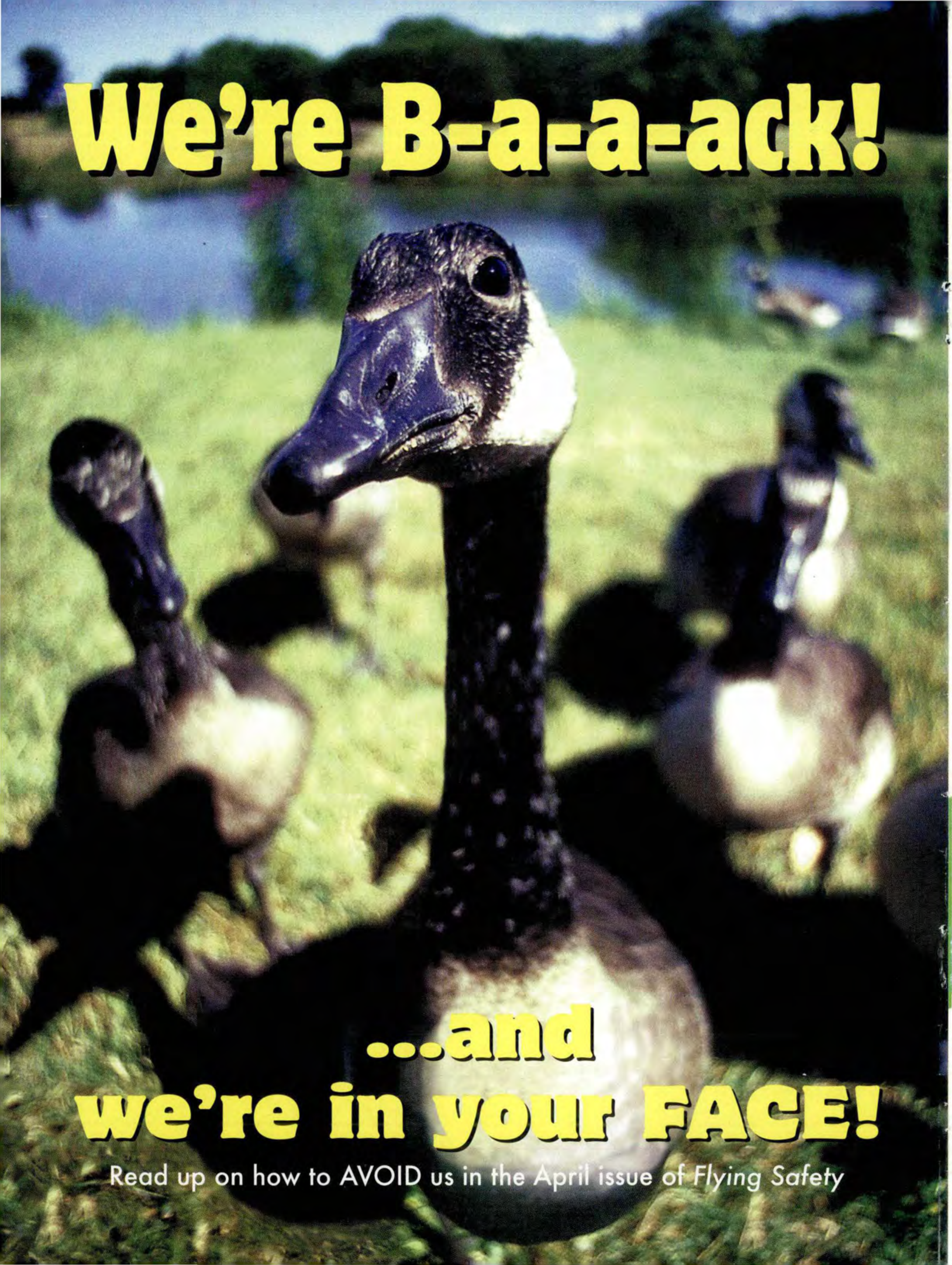
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...and
we're in your FACE!
Read up on how to AVOID us in the April issue of Flying Safety