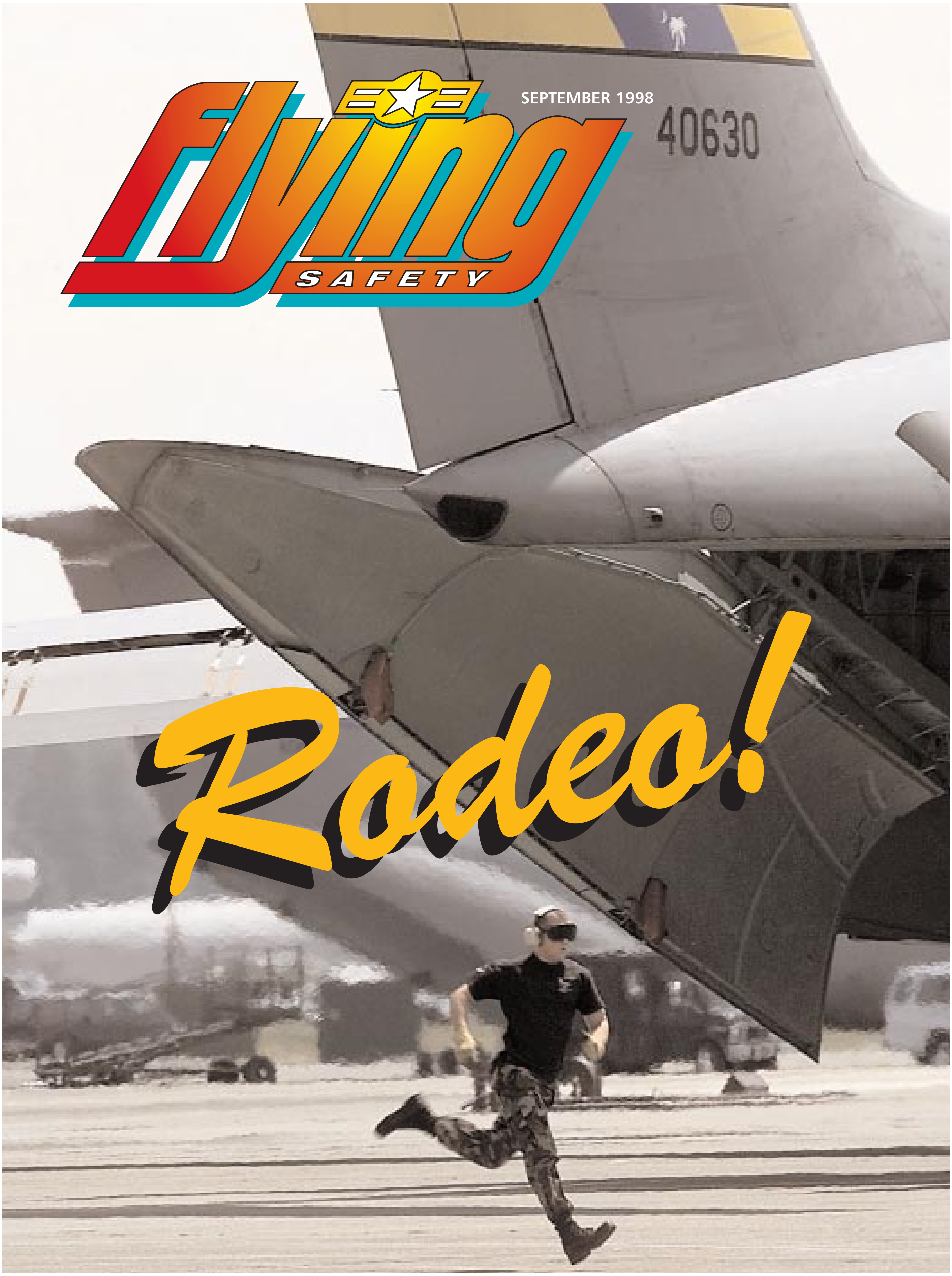

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Front cover photo by SRA Jeffrey Allen at RODEO '98

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FSM notams

CAT Update

CAPT ELIZABETH COATES
HQ AFFSA/XOFD

■ When was the last time you saw high pressure on the weather charts along your route of flight and assumed there would be no hazards?

There are new findings relative to clear air turbulence (CAT) in these high-pressure regions. One recent study (John Knox, June 1997, *Monthly Weather Review;* see also "Why Do Things Go Bump in Your Flight?" at http://www.giss.nasa.gov/research/ intro/knox.01/) indicates that "Up to 20% of CAT reports come from strong high-pressure areas. There is a special type of instability that happens only with **very strong, high-pressure systems** called 'inertial instability.' As highs approach the onset of this instability, they have the potential to cause a lot of gravity waves and turbulence."

Knox reports this type of turbulence was first suspected in the 1950s but has not been investigated in detail until now. He states inertial instability occurs in cases of very strong anti-cyclonic (clockwise in the Northern Hemisphere) horizontal wind patterns. Like a sideways version of convection, inertially unstable regions are characterized by thin and flat layers of rapid horizontal motions that can be turbulent. These "pancake" layers in the troposphere may be only a mile or so deep but can extend for tens of miles in the horizontal.

By now you're probably asking yourself, "Where do I find this stuff on the weather charts?" Well, there's no clear-cut answer. In fact, researchers are still developing a reliable forecasting method. However, one might first suspect this type of turbulence near very high-pressure systems. Next, *wherever* the combination of clockwise wind shears (a change in wind speed) and curvature is strong. Usually, this type of wind shear/curvature occurs frequently on the southern side of the jet stream nearest the tropopause. The likelihood may be greatest in the winter or spring and where the wind speeds associated with the jet are strongest. High flight is also affected. Inertial instability has been observed on much larger scales in the tropical stratosphere and equatorial mesosphere, usually during December-January.

As I mentioned earlier, there is still much research left to be done in this area. However, we do know evidence is mounting that this phenomenon does exist, and the aviation community needs to be informed. ✈

A SIMPLE MISSION

Too many times we insist on learning our lessons from accidents rather than close calls. Both can teach the same lesson.

CW5 JOHN H. STRICKLAND
V Corps Aviation Safety Officer
Flightfax, Jun 98

The Mission

The mission was simple. An OH-58C made a precautionary landing on the range and needed a part flown out. It would take about 30 minutes to replace the part. The aircraft could be signed off and flown back home.

CW3 J was tasked to perform the support mission single pilot. He was told to take along a technical inspector (TI) and a crew chief who would perform the work and return to base in the other aircraft.

CW3 J did the normal things—preflight, weather check, and mission planning. The mission brief was simple; after all, it was a simple mission. He knew the range by heart—every LZ, road, and checkpoint. Navigating was a cinch; he wouldn't have to rely on a map. Of course, he'd take it, along with all the other required publications. He believed in doing things the right way and by the book.

The only thing that bugged CW3 J was the weather. He didn't like flying single pilot at night. Since he had gotten used to NVGs, night unaided had lost its luster. Besides, quite honestly, he hadn't flown unaided in a good while. This was the Cav, where night flights meant goggle flights. He looked at the weather information closely. Clear, moon would be up, and visibility unrestricted. As he prepared a local flight plan, he thought about the fact that this was the fall of the year—hot in the day and cool at night. Ground fog came up fast on the range.

DoD Photo

"Oh well," he thought, "I know that range like the back of my hand—every creek, every lake where the fog likes to hide." Besides, he would be returning early, before the fog began to settle in over the low areas.

The flight out to the downed aircraft was uneventful. After shutting down, the TI and crew chief went to work. CW3 J talked with the two aviators from the downed aircraft. CW3 J kidded the PC about causing him to miss getting home early and having supper with his family.

"Should have let you stay out here—good survival training," he joked.

The work took longer than expected, but about an hour later, it was time to head for the barn. The pilots of the now-repaired -58 at first suggested that CW3 J follow them back. However, as they discussed it, they all realized that they had not been briefed for formation flying. So that was not a good idea.

CW3 J told the other crew to take off first. He would wait a few minutes and then follow. After all, they were going in the same direction. As long as they were not in formation, it should not be a problem, everyone agreed.

On the return flight home, the two aircraft kept their distance but maintained internal FM radio communication. CW3 J maintained visual of the lead aircraft's position lights as they followed the route to exit the range.

Except for the fact that it was about 90 minutes later than he had initially expected, everything was going smoothly. It was simple to follow the route back—mostly range roads—but patches of ground fog were beginning to show in low areas.

About 5 minutes from home, things began to go wrong. The fog was getting worse, and CW3 J lost sight of the aircraft ahead. One call assured him they were okay and that they had the airfield in sight.

Suddenly the fog thickened. CW3 J told the TI, who was in the left seat, to let him know if he began to lose sight of the ground to his left. The pilot slowed the aircraft a little but decided to maintain altitude.

Should he turn around? He could still see the ground, and the PC of the lead aircraft had just flown through this and stated he had no problems. CW3 J knew that they had followed the same route and were no more than a kilometer ahead of him.

When he was almost to the exit point, where he would change frequency from Range Control to the airfield tower, he looked to his right. It was mostly open fields; at night, it appeared to be a black hole.

Suddenly, they were engulfed in fog and rapidly lost all visual contact with the ground. How deep was this fog? How high was it? Was it a simple scud layer? Single pilot at night on instruments? Should he climb? Descend? Do a 180? That didn't sound smart. Neither did the idea of flying in this soup.

"Your left, sir." The TI had seen a sucker hole.

CW3 J immediately turned left, descended through the hole, leveled off, and looked for an open field. He knew there was a field somewhere to his left, off the range road. It was getting difficult to maintain visual reference. Below were trees and more trees. Then, straight ahead, there was the field he had been searching for. Before landing, CW3 J made a quick call to unit ops that he was landing and shutting down. They could come get him—he had no intentions of flying this aircraft back tonight.

As the two crewmembers sat by the fire they'd built in the field they'd landed in, the fog continued to roll in. CW3 J looked over at the TI and realized that he could have killed this young soldier. Of course, that he could have died along with the TI didn't make that realization any easier to take.

What had seemed a simple mission had turned into a close call—brief seconds of fear and decisions involving high risk.

This is a true story. It happened about 12 years ago. I was the pilot.

Same Song, Second Verse

Years later, I was an accident investigator for the Army. One day I found myself walking around the wreckage of an AH-64 that had entered a fog bank. The pilot had initiated a right turn, and, within seconds, both crewmembers experienced spatial disorientation and loss of situational awareness. Now one was dead, and the other was seriously injured.

Theirs had also been a simple mission—to fly an aircraft back to the airfield. They were both experienced, high-time pilots. What went wrong? The same thing that went wrong 12 years before at another time and another place to another—but much luckier—guy.

Much can be said of the safety programs and improved technology in aviation that have reduced risk and resulted in significant reductions in our overall accident rates. However, regardless of that progress, we aviators are still the same human beings who flew the first biplane. Though more knowledgeable, we are still capable of making the same errors we've always made.

We have been successful at standardizing our equipment; technology allows us to improve machinery across the board. Human beings, however, we have to improve one at a time. That is the reason standardization is critical. It allows us to train each aviator to a particular level and standard.

What went wrong on both those nights I talked about earlier was that the humans involved were not adhering strictly to standards. I had completed the risk assessment sheet with all the right numbers, and it had come out "low risk"—nice if everything goes perfect—which it seldom does.

I had not flown unaided in quite a long time, and flying unaided is not the same as flying NVGs. I knew that, but I wasn't going to turn down a mission because of it. I didn't consider it to be a serious factor. In addition, we fudged on the formation flight. Sure, we were *legal*, but we weren't very smart. My intentions were to keep the other aircraft in sight—we would "unofficially" flight follow each other. What I did not know was that the other crew was flying NVGs, and that's why they had fewer problems than I did. Of course, since we were not "flying formation," there had been no need to brief, so critical information was never shared.

Last, but hardly least, was the weather. The risk level changed when the time line changed—the weather was changing even as we were discussing our takeoff. And my decision-making process left out still another critical fact as we droned along that night: The other aircraft was a kilometer ahead, and that made a difference.

The only weather you should trust absolutely is what you are seeing out your cockpit window. The weather that night was saying "Land!" I hesitated almost 30 seconds too long. And that could have cost my life and the life of the TI. I realized as I surveyed the AH-64 crash site that this crew had made the same mistake. They anticipated better weather, they saw a low risk, and they were confident they could handle any situation that might occur. After all, it was a simple mission, they knew the area, and it was a short flight back home.

The ability to learn from your own mistakes is a blessing, not a given. I was allowed to learn from my experience. As I walked through the wreckage of the Apache, I knew that the pilot in the front seat of this aircraft would not have the same opportunity.

It's not our equipment or the environment that causes most of our accidents. Machines and environment are fairly predictable. We can plan on these with acceptable accuracy. Human beings are not quite as predictable; they make decisions that lead to accidents. It's not too difficult to determine *what* they did wrong, but determining *why* is more challenging.

continued on next page

DoD Photo

Lessons Learned

From these two separate events, I learned what I call my top 10 "WHY" lessons.

1. Most "extremely high" risks are self-imposed. Actions we take in flight or on the ground usually are influenced by personal motivation or unplanned responses to a situation. Whether it is desire to complete the mission, ego, or simply not thinking consequences through, the result can be catastrophic.

2. The response to accepting "high" risk is influenced more by *actual* outcome than by *possible* outcome. If we gamble and succeed, we are more apt to see it as a good decision than a bad one. Too many times we insist on learning our lessons from accidents rather than close calls. Both can teach the same lesson.

3. It's better to have a damaged ego than a damaged aircraft or body. Many times we go that extra 30 seconds simply because we cannot or will not admit we've exceeded our capability or made a mistake or bad decision. So we make an even greater mistake or worse decision.

4. Every aviator will be faced at least once in his or her life with making a decision whose outcome can mean the difference between an accident, a close call, or a good no-go choice.

5. Aircrew coordination must involve effective communication and teamwork. One thing I remember most is the silence between the TI and me during our flight. I never communicated my concerns to him or he to me about continuing to fly that night as visibility grew worse. He was ready to land and get out several minutes before we ultimately did. The crew of the other aircraft never communicated to me that they were giving weather observation under NVGs. The crew of the accident aircraft years later never effectively communicated to each other during the last critical 2 minutes of the flight. Two highly skilled pilots do not automatically equal good aircrew coordination.

6. Making a critical decision based on a self-imposed emergency is seldom done without hesitation. The same professional pilot who will instantly respond to an emergency such as an engine failure may hesitate to abort a mission due to such factors as fatigue, bad weather, poor FLIR conditions, or simple personal conflict with another crewmember. We don't react as fast to internal warnings as we do to external.

7. Risk management during every phase of mission planning reduces unpredictable "human" actions. We reduce risk by reducing unpredictable actions. Accident-causing errors usually result from individuals' unplanned actions, and unplanned actions are usually due to unidentified risk.

8. We must seek to anticipate and eliminate every risk. Every aviator must be prepared to identify risk and work the process through to completion. Don't accept unnecessary risk, no matter what phase of the mission you're in.

9. There are no simple missions. The more we identify and eliminate risk, the greater our opportunity for success.

10. Every flight should start and end with standardization. Human beings are the most complicated of the man-machine-environment mix. There is no substitute for training to standards and enforcing those standards. Ignore standards and accidents will occur. ✈

Summary

My top 10 "WHY" lessons are not all-inclusive. When it comes to safety, nothing is. Accidents don't just happen, they're *caused*. The goal of every individual in the unit should be to ensure that nothing he or she does will cause an accident.

And, because you may not get the chance to learn from your own mistakes, take every opportunity to learn from someone else's.

8 TO 1! WE NEVER HAD A CHANCE!

LT BRETT STAFFORD
Courtesy *Approach*, Nov-Dec 95

It was our first night underway, and the first mission of the deployment. Even though we had all been up with the sun, finalizing last-minute details, we were pumped to fly. The mission was an encounter exercise: The Mayport-based ships were to sortie EMCON and try to locate the ships from Charleston and Norfolk before they found us.

We briefed the hop. The weather forecast was low ceilings and no moon, a fantastic pitch-black night. At 2000, we launched. After ensuring our transponder was working, we were vectored to a predetermined location to climb and radiate the radar. The mission went well at first, but weather had deteriorated to the point where we couldn't identify the ships as we flew past them. The fatigue and increased workload made all of us irritable, which was not the way I wanted to start a 6-month deployment.

As we continued to sort out the radar picture for the ship, I noted a white strobe light in the fog and haze ahead. The HAC (helicopter aircraft commander) was describing each contact back to the ship via the Hawklink, while the AW and I tried to match the strobe to one of the many radar blips.


Photo courtesy Sikorsky Aircraft

Suddenly, the HAC piped up that the strobe might be the Seahawk from the ship we were trying to locate. The ASTAC onboard the ship confirmed that the FFG's helo could be airborne.

We discussed that the strobes should have been red for night flight, but we talked ourselves into the possibility that they had forgotten to configure them. At this point, we were still closing the strobe. I was becoming very uncomfortable with our rate of closure, so I began to turn away. I worked very hard to keep the strobe in sight yet not get too close. But every time I turned, a strobe would again pop up out in front of us as if the "bogey" was countering my every move.

Soon all three of us were looking outside the aircraft trying to keep sight of this other aircraft as we jinked, turned, dived, climbed, sped up, and slowed down, all the while passing in and out of the clouds and fog.

We were all convinced that this had become a tail chase, and the discomfort level was now unbearable. The ASTAC then yelled for us to watch out for a tower in our area, but since we were all so wrapped up in the chase, no one really caught on to the important implication of this bit of information. Suddenly, someone had the foresight to place a reference mark (via data link) on each of the towers in the local area. As they appeared on our multipurpose display, the pieces of the puzzle began to fall into place.

We had, for nearly 45 minutes, been chasing (and were chased by) as many as eight different oil platforms marked by white strobe lights. It's no wonder that the elusive helo had been able to stay on us; it was eight on one! I felt pretty stupid in the debrief, but I gained a series of valuable lessons learned on this unforgettable night.

First, take the time to review all the available information during your preflight brief. These towers, "commonly mistaken for helos," were not shown on the VFR sectional covering our op area, but they had been on the Nautical Navigation charts as "hazards to navigation." What an understatement!

Second, the best thing you can do for yourself and your crew is to ask a human-factors question at the beginning of each preflight brief. Ask about crew rest and everyone's state of mind before finding out that fatigue and the desire to make a good first impression are going to fog the otherwise good judgment of the crew. ✈

USAF Photo by SSgt Gary R. Coppage

Moments From Disaster

Adapted from an article in *Approach*
by LTC R. E. Joslin
(Operations Officer, Naval Test Pilot School),
Courtesy *Flightfax*, Jan 98

Figure 1. How heavy does your helicopter feel?

Angle of Bank	G Load	Apparent Weight (pounds)
0	1.00	10,000
10	1.02	10,200
30	1.15	11,500
45	1.41	14,100
60	2.00	20,000
75	3.86	38,600
85	11.50	115,000
90	∞	∞

What are the consequences of rolling into a bank close to the ground? Too often the answer to that question is, "Disaster."

Figure 1 illustrates how our apparent weight (G-loading) increases proportionally with the angle of bank when we maintain our initial altitude and airspeed by applying the required collective power. For example, a 10,000-pound aircraft in a 60-degree bank, maintaining altitude and airspeed, will have an apparent weight of 20,000 pounds. But what happens if we do not have the power available to lift twice our weight, or if we do not apply collective power immediately upon rolling into the bank?

Assume that we're flying along at 300 feet above ground level and roll into a 60-degree bank while maintaining our airspeed but without increasing our collective power. How long will it take before we hit the ground? Figure 2 plots the time to impact from various

entry altitudes and angles of bank. Actually, the plotted time to impact corresponds to when the altitude-sensing port hits the ground; obviously the main rotor will hit first.

This plot is independent of the type of aircraft or gross weight and is merely a function of angle of bank. Note that any partial application of collective power or reduction in airspeed will increase the time until you hit the ground; conversely, any power reductions or increases in airspeed will decrease the time. Also, an initial descent rate at entry will decrease the time; any initial rate of climb will increase the time.

Consider our example of starting at 300 feet AGL and rolling into a 60-degree bank without any power adjustment while maintaining our entry airspeed. The time to impact is approximately 6 seconds, which is probably how long it took you to read this sentence. A moment's hesitation in applying collective power when rolling into an angle of bank at low altitude may result in a descent rate that may not be recoverable.

Even after you roll wings-level and start a dive recovery, the aircraft will continue to descend (figure 3). On any given day, we can determine our maneuvering envelope by reviewing our energy-to-maneuver and excess-power diagrams published in helicopter tactical manuals. The fixed-wing community has been using these diagrams for years, mainly as tools to compare their capabilities to those of their adversaries. The diagrams show an aircraft's ability to maneuver based on its excess power. Excess power is the difference between the power available and the power required for straight and level flight under a given set of atmospheric conditions, aircraft loads, and configurations. The excess power can be used to climb, roll into an angle of bank, or a combination of the two.

In some cases, maneuvering may result in too little power instead of extra power, causing a descent instead of a climb. For example, we decide during preflight planning that our mission must be flown at 100 knots. If we then roll into a bank more than 50 degrees and maintain our 100 knots, even while applying full collective power, we will descend (figure 4).

Planning can define what an excessive angle of bank is for the mission profile on that day and prevent another mishap with the same old cause factor. ✈

Figure 3. Dive recovery and Gs

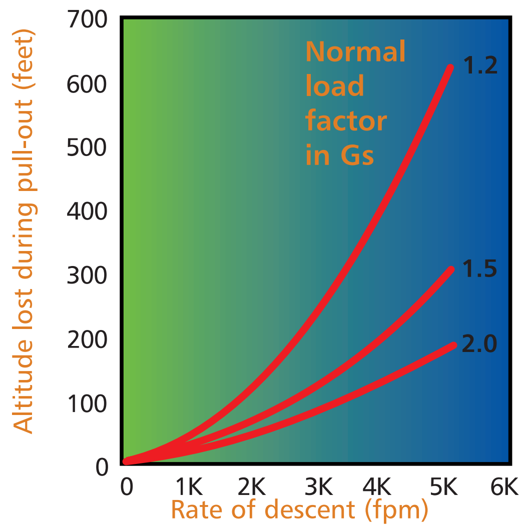

Figure 2. How long until you hit the ground?

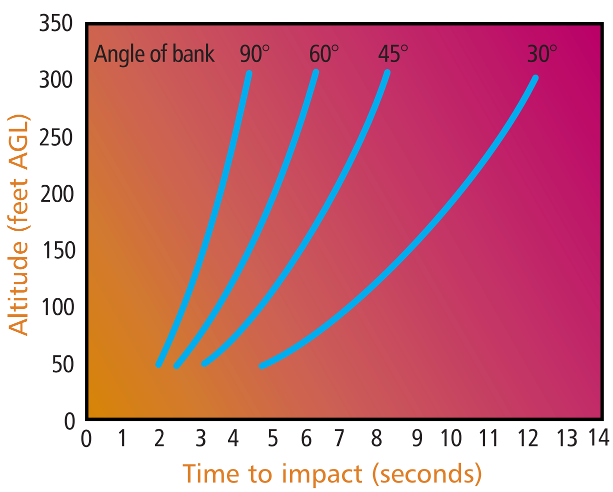

Figure 4. Representative energy to maneuver

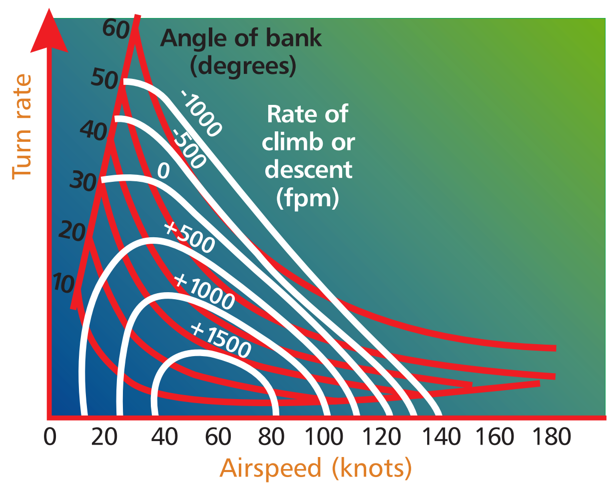

Photo courtesy *TACAMO VQ-3 PRO*

It Was a Dark and Stormy Night…

LCDR MARK CORDEIRO
TACAMO VQ-3 PRO
Spring/Summer Edition '98

It was dark, at least. Perhaps if it had been stormy we wouldn't have been so embarrassed. But then again, we wouldn't have learned a lesson way back then that is still valid today and probably as old as aviation itself.

It was the end of the fifth 11-hour mission in 8 days. The relieving crew was airborne and had assumed the mission clearing us to land at 0400 at Naval Air Station North Island in San Diego. The aircraft commander (AC) was in the left seat while I, as the second pilot, sat in the right. We had flown together for about a year, and I had always been impressed with his knowledge and skills. He was a highly competent perfectionist who had taught me quite a bit.

Approach: "Swaby 73, descend to 2300 feet, heading 030, cleared for TACAN 29, Navy North Island."

Swaby 73: "Rog."

The AC gave me the plane while giving a quick approach brief, covering the minimum required stuff. After all, we had been here dozens of times and were well acquainted with the field. The NAVAIDs and instruments were set up to intercept final from the southwest, making a left turn onto centerline.

AC: "Okay, passing 4000 for 2300, 4 miles from intercepting final and the final approach fix, flaps 50, gear down, landing checks."

I rogered and configured the plane. It was a moonless night but clear for miles. No sooner had we finished the checklist than the AC called "field in sight" which I reported to approach control. They handed us over to Tower control.

Swaby 73: "NASNI Tower, Swaby 73, passing 3000, heading 030 to intercept, field in sight, three down and locked, full stop."

NASNI Tower: "Roger, Swaby 73, call final approach fix inbound, cleared to land runway 29."

The flight deck started joking about our 36-hour liberty in San Diego. Some of the crew wanted to head off to Tijuana while others wanted to hit the beach and relax.

AC: "These instruments don't look right. Tell tower we're proceeding visually."

Swaby 73: "Tower, Swaby 73 is breaking off the approach and proceeding visually."

Tower: "Roger, confirm you are familiar (with NASNI visual procedures of not overflying hotels on the beach)."

Swaby 73: "That's affirm."

I looked down at the approach plate, double-checked the NAVAIDs and the heading dialed into the CDI. The CDI was pointing left; we were still heading for the final approach course and about a mile from the final approach fix. I assumed the AC had the field out the left window and was delaying the turn until the course deviation bar centered. Everything looked okay to me, but I wanted to double-check. I wasn't so much afraid to question the AC as I was afraid of looking stupid for not seeing what the problem was. As I looked down, the course bar was centering, and at the same time, the AC called for flaps to 100 percent and pulled power to descend. We were still heading straight ahead.

CP: "Where do you have the field?"

AC: "Straight ahead, about 3 miles. Review me complete (on landing safety checks)."

Now I was growing more confused. The CDI showed us passed through centerline for the approach, and DME was increasing by tenths of a mile.

I looked straight ahead to see "the field." There were yellowish edge lights, reddish and bluish centerline lights, and what appeared to be a couple of flashing red lights slightly above the edge lights. Where the rest of the field should have been, there was nothing but black. Now I was really confused and decided it was time to speak up, but before I could get a word out…

Tower: "Swaby 73, say heading."

Swaby 73: "Heading 030 to intercept, three down and locked, full stop."

Tower: "Swaby 73, roger gear, turn left to heading 340, intercept final, cleared to land."

The AC and I looked at each other, somewhat alarmed, then looked out the left window. Sure enough, there was the field. We executed a left turn, lined up on centerline, and came in for an uneventful landing.

It was only after we shut down and talked about the approach that we realized the "field" we were ready to land on was actually the Coronado Bay Bridge!

Luckily, the only damage done was a large dent being put in our complacency. What did we learn?

→ Trust your NAVAIDs. Double-check settings. Recheck your inputs. But have faith that they are usually accurate.

→ Even if you are well familiar with the field, an instrument approach backup is valuable information.

→ If in doubt, speak up. There truly is no such thing as a dumb question, except for the one not asked.

→ Even if it's a highly competent AC—even if she/he is senior or more experienced—they're still human and prone to mistakes. Back 'em up.

→ Keep a sterile cockpit below 10,000 feet. Sometimes a slight distraction combined with fatigue and late hours can be truly detrimental.

I don't know who that controller was. She saved us from more than just a little embarrassment. We may have been able to get on the bridge, but getting off would have been a different story. ✈

The Hazardous Air Traffic Report (HATR) Program

MSGT JAMES K. ELLIOTT
HQ AFSC/SEFO

This is the first of many HATR articles I'll be writing for upcoming issues of *Flying Safety* magazine. This one is intended to give you a brief history of the HATR program and tell why it exists.

Creation of the HATR Program

To get a true understanding of the HATR program, we need to see why a separate program was created to deal specifically with hazardous air traffic incidents.

The disastrous Grand Canyon midair collision between a TWA Constellation and a United Airlines DC-7 in 1956—and other very serious mishaps—pushed Congress to enact several laws, including the Aviation Act of 1958.

During the next decade, dramatic growth in the civil aviation sector caused air traffic-related incidents to occur at unacceptable rates. In the 1970s, Congress tasked the FAA to establish a safety reporting program to track and record potential accidents and their root causes so future mishaps could be prevented.

As a result, the FAA established the Aviation Safety Reporting System (ASRS). The ASRS objective is to identify unsafe acts, procedures, rules, regulations, deficient airport designs, and deficiencies in design or operation of equipment.

Program History and Purpose

The Air Force had problems similar to those in the civil aviation community. The existing hazard report (HR) system didn't meet the time-critical demands of an ATC incident so it was not useful. Frequently, by the time an HR got to the investigators, ATC tapes and other records were already gone, making it nearly impossible to recreate an accurate picture of an incident.

The HATR program was established in June 1976 to solve those problems. The program is covered in AFI 91-202, *USAF Mishap Prevention Program,* Attachment 3, Hazardous Air Traffic Report (HATR) Program. The primary purpose was to establish a reporting and investigating system for near midair collisions (NMAC) and other hazardous air traffic control-related incidents or conditions.

Future Articles

Future articles will cover HATR processing, reportable events, investigation and evaluation procedures, responsibilities at all levels, international HATR reporting, and quarterly HATR summaries. Send your additional topic requests, comments, and thoughts to HQ AFSC/SEFO, 9700 "G" Avenue, S.E., Albuquerque NM 87117-5670, call DSN 263-2034, or e-mail elliottj@kafb.saia.af.mil. ✈

First Time for Everything

1 LT MICHELLE "XENA" VESTAL
Davis-Monthan AFB, Arizona

It started as a very normal day as I headed off to work. It was to be my first operational night sortie in the A-10, my first night ride in Korea (my last MQ ride, even though I was already MR), with a double turn, NAAR (night air-to-air refueling) and SAT (surface to air tactical). The weather was Korea standard: 030 SCT, 200 SCT, 4 miles with haze…

We stepped with Suwon as our alternate, which requires 2,100 pounds of fuel for divert. The briefing, ground ops, and takeoff were all normal. On departure, the weather turned out to be what they had forecast, except the haze was all the way up to FL200.

We were cruising to the tanker track at about FL170. Halfway to the tanker, out over the water, I began to get spatial disorientation. I was on the wing, at night, in the soup, with no horizon and no cultural lighting (since we were over ocean). I was just informing lead when I caught a glance of the shoreline lights in my deep six. It's amazing, but that was all I needed to recage the gyros in my brain.

We continued en route to the tanker without further incident. After getting gas, we were scheduled to go to Kooni range and do some night CAS (close air support). Kooni was unusable due to weather, so we did some dry maverick passes just southeast of the range and then RTB'd for the turn.

As we were coming into Osan's airspace, lead sent me to ATIS (air terminal information system), then Approach. I listened to the ATIS, which was calling the weather 3000/4. I remember thinking to myself, "No problem. My minimums are 700/2 at night. That's way above what I am going to need to fly the approach and land." It looked mostly scattered on the recovery, but I couldn't see the airfield yet.

As I was turning on a long base ahead of my flight lead, the controller told us that the last observation from tower was calling the field at 2000/3. Still no problem, so I continued. I entered a thick cloudbank on final that seemed to be endless. I flew a nice ILS, but started to get a little bit nervous as I watched the altitude slowly decreasing and approaching my minimums.

There I was…still in the thick of this cloud. Finally, I reached 740 feet MSL and reluctantly pushed the throttles up to MAX and informed the controller I was going missed approach. On the climbout, I was given the standard climbout instructions. Once I got the spatial D under control, I proceeded as the controller had instructed.

At the time of this incident, 1Lt Vestal was flying with the 25th Fighter Squadron at Osan AB, Republic of Korea.

As I rolled into a left climbing turn to crosswind, I called my flight lead on VHF-FM. "Skeeter One, Two on Fox."

"Two, One. Go ahead."

I asked if he had broken out yet on the approach. He said he was just breaking out as we spoke. My next question was at what altitude he broke out. He casually replied that he broke out at 530 feet MSL. I informed him that I had NOT broken out at MY minimums and had, in fact, gone missed approach and I asked if he had any words for me before I contacted the SOF. He told me, "Stand by a second. I'm in the flare." I guess he wasn't fully absorbing the fact I had not actually landed, and now he was on the ground and I was left to fend for myself in the air.

With my flight lead/instructor safely on the ground, I rolled out on radar downwind and contacted the SOF on VHF-AM. I told him the situation and how much gas I had. And he told me the tower had just turned up the approach lights, and I should try the approach again. I still had about 3,900 pounds, so I continued around the pattern for one more try. Knowing the chances were still slim that I would make it in, even with the lights turned up, I started thinking about divert procedures, got out the Suwon approach plates, and reviewed them. So down the ILS I went, 1,000 feet, 900 feet, 800 feet, 740 feet.

Again I was forced to execute missed approach. I pushed up the engines and began a climb straight ahead. I had no sooner put the gear up when Approach informed me the SOF wanted me to divert. As I looked inside to check my gas, Approach came back and told me I was to divert to Taegu. Taegu! Where in the heck is Taegu?!!!

Caught completely off guard, I requested an initial vector from departure to get me headed in the right direction and started a climb. My first reaction was to check my gas. All those stories you hear about people messing up diverts because of poor fuel awareness and bad luck flashed through my mind. I hurriedly pulled out my in-flight guide and turned to the pink pages, fumbling frantically to find the divert page. I finally got it opened and found that Taegu was 120 NM to the southeast, and the fuel required was 3,400 pounds. I was down to 3,300 pounds. I knew the divert would work out anyway since there is a cushion built into the divert fuels.

When I tuned in the TACAN, I couldn't get the TACAN to lock onto the station, so I punched the Taegu coordinates in the INS and continued the climb to 15,000 feet MSL. Eventually, I figured out why the TACAN wouldn't tune. It was because I had left the X/Y in Y from using the air-to-air TACAN on recovery. I settled down and pulled out the approach plates for Taegu, got ATIS, and switched over to Taegu Approach and started talking with the Korean controller.

Everything seemed to be going pretty smoothly. I was getting vectors to an ILS final, the weather was clear and a million down there, and I had my ducks all in a nice, neat row. Five miles from the field, at about 7,000 feet MSL in the descent, the controller all of a sudden casually mentioned that the runway was closed due to construction. My world had come crashing down on me for the second time in one night! Why hadn't he told me sooner, like before I had committed myself and descended all the way down there?

The Korean/English language barrier was also working against me now. He asked me how long I could hold, and I answered back only about 5 to 10 minutes and told him that was only if I was going to be able to land there. I figured that it could have been only mild construction work, and there was a possibility they could clear the runway long enough for me to land. I had never been anywhere near this far south and had no clue where the next nearest landable runway was. He was, of course, no help. He just kept telling me to stand by.

After a 360-degree turn, I decided it was time to call the SOF. I attempted contact on Victor with no luck. Uniform, no luck. Then I heard one of the Viper guys holding at Crown (the initial approach fix at Osan) talking to the SOF, so I contacted him and asked him to relay my situation. I was now min fuel at Taegu, and the runway was closed.

There were two issues to be relayed: (1) Where do I go next? and (2) Don't send anyone else to Taegu. I heard him trying to communicate with the SOF, but I could hear only one side of the conversation. It seemed like it was taking forever, the gas was just evaporating before my eyes, and I still didn't have a clue as to which direction to turn. I finally called up Airedale combat radar control. I declared emergency fuel and asked for a snap vector to the nearest landable runway. I was ecstatic to hear Kimhae was off my nose for about 30 NM. After playing Twenty Questions with Kimhae Approach, I finally got on final for a PAR and have never in my life been so happy to see the runway lights out in front of me. I landed there without further incident and began a whole new adventure on the ground.

Apparently they had never seen an A-10 before, and they weren't very happy about seeing one then. I had a little trouble seeing the FOLLOW-ME truck since it was lighted with red lights, the same as all of the tower. As soon as the marshaller had stopped me, all of the ground crew disappeared into the darkness.

I called Ground and requested chocks for the tires. The answer I received wasn't what I expected. "Yes, the TRUCKS are right in front of you" (referring to the numerous fire trucks parked nearby with all their lights still flashing).

"Duh! How could anyone miss seeing them?" I thought. I took a deep breath, then sighed, and said gently, "TRUCKS in sight, requesting BLOCKS for the tires so that the aircraft won't roll."

"Rog, you wait five minute."

Then came round two of Twenty Questions. Why had I come there? They called Osan, and everyone else had either landed there or diverted to Suwon. What is emergency fuel for the A-10? What's minimum fuel? When was I going to leave?

I answered all of the questions, patiently trying to explain my plan was to shut down, make a phone call, get gas, and see what I should do from there. At last the chocks arrived and I could shut down. I was very careful to turn everything off, and I gathered up my secrets and pubs and went to step out of the jet. No ladder!

I climbed back in and pushed the ladder release. Nothing happened. I put down all my stuff and leaned over the edge and banged on the door a little. It wouldn't open, so I pushed the button again and repeated the process. That wasn't going to work, so now what?

I grabbed my flashlight, leaned over the edge, and pointed to the small panel that contains the external canopy and ladder release controls. The panel contains two switches, one for the canopy and one for the ladder door. The Korean standing there spoke little English but was trying very hard to help. After a little pointy-talky, he got the panel open and reached in to open the door.

The next thing I knew, the canopy was closing on me like a clamshell. I was still laying over the edge and must have looked pretty darn ridiculous. I threw up my hands to stop him from closing the canopy any further. He freaked out and apologized profusely, then finally got the canopy motored back to the up position. I pointed to the other button, and he pushed it. But again, nothing happened. I motioned for him to stand back and took a nice, hard whack at the ladder door with my fist. Sure enough, the door fell open, and the ladder extended normally. I was pretty happy with myself, having survived the clamshell and all, and looked up at the Korean. His chin was so close to the ground he would have tripped over it had he had the ability to move at that moment. I guessed they weren't used to seeing the rough and tough durability of the Warthog!

What started out as a routine night sortie turned into an international incident involving an emergency aircraft. A series of events occurred which caused the system to break down. The lesson to be learned here is that nothing is truly "routine" in the flying business, and you must always be prepared for the worst. And remember, anything can happen to anyone at any time! ✈

All Alone

There was a flash of light, and I was standing in a room full of foul-smelling smoke. I've never felt more alone...

AME2(AW) WAYNE LAWRENCE
Courtesy *Mech*, Apr-Jun 1998

I was shift supervisor for mid-check in the FA-18 FRS seat shop. I came in a little early to get a good pass-down from night-check and an idea of what day-check expected to be done by 0700. Turnover at 2200 didn't take long because the workload had been light. We did a tool inventory, and I went to the maintenance meeting.

After the meeting, we discussed priorities over a cup of coffee. I told maintenance control we would work on aircraft 430's 448-day seat inspection. We got our pin bag, tools, and de-arm checklist together and jumped right on it.


US Navy photo

The A1-F18AC-120-600 Arm/De-arm Checklist calls for three qualified people to do any arming or de-arming—one worker, one cartridge-and-tool handler, and a third person to read the checklist and observe. Two other PO2s and I would pull the seats. We had de-armed seats together before, so de-arming and removing the seats from the aircraft went smoothly. In accordance with SOP, we only partly de-armed the seats on the aircraft; we would complete the procedure in the shop. Once there, we decided to take a short gee-dunk break (coffee, donuts, etc—Ed.). *That was my first mistake.* The checklist states that once begun, the de-arming process must be completed.

When we returned to the shop, dailies were due. My coworkers suggested they knock out the dailies, and I agreed. Once they were done, we could finish de-arming the seats and concentrate on the test and checks.

While the dailies were in work, I went over the work-load to see if I could make money on anything else, but nothing was pressing. *That's when I made my second mistake*—I decided to finish de-arming the seats myself. I've armed and de-armed so many ejection seats that I honestly thought I could de-arm them alone, without a checklist.

I removed the manual override cartridges from both seats. Then I started de-arming the seat initiators that are connected to the ejection-control handle. To remove seat initiators, you first must disconnect the linkage from the firing sears. You remove two quarter-inch nuts from the connecting-link crossbar, rotate the firing sears outboard, and pull the ejection handle up and clear of the firing mechanisms.

Next, you remove the firing mechanisms and cartridges. I de-armed the forward seat without incident and moved to the aft seat. I stopped what I was doing and went back to the forward seat to make sure I'd placed the quarter-inch nuts back on the crossbar, which I had.

I returned to the aft seat and pulled up on the ejection handle that was still connected to the firing mechanisms. I thought I'd disconnected them.

There was a flash of light, and I was standing in a room full of foul-smelling smoke. I've never felt more alone than I did at that moment. I'd fired two seat initiators and a 0.30-second delay initiator. Even though the trombone tubes on the back of the seat bucket were disconnected, gas pressure from the seat initiators was strong enough to enter the seat and fire the inertia reel. After I calmed down, I told maintenance control and QA about my error. Then I called my supervisor at home.

Other than the dailies, the 448-day check had been our only priority that night. There had been no pressure from maintenance control; they were giving us plenty of time for the inspection. The only pressure that night was self-imposed.

During my 12 years in the Navy, I've always been mission oriented. That night I focused only on the end result and ignored the procedures I needed to get there. Instead of me calling my supervisor that night, my CO could have been calling on my wife and children to tell them I wouldn't be coming home—or worse yet, the wives and kids of my shipmates, if I'd killed any of them.

I will remember that night for the rest of my Navy career. Whenever I look at an ejection seat, I think of how alone I felt in that room full of smoke and realize how good it is to be alive. ✈

Air Mobility Rodeo '98

A Maintenance Perspective

USAF Photos by MSgt Perry J. Heimer

CMSGT MIKE BAKER
Maintenance/Technical Editor

Think of it as the Olympics of the mobility air forces (MAF) world. Air Mobility Rodeo, known more commonly as "Rodeo," is *the* premier readiness competition for MAF units. Sponsored by Air Mobility Command (AMC) and conducted biennially, the primary purpose of Rodeo competition is to improve core air mobility capabilities and enhance air refueling, airlift, and aeromedical evacuation operations. While Rodeo's ultimate bottom line is proficiency in these scenarios, the skills of special tactics, security forces, aerial port, medevac, maintenance personnel, and others—ground power that enables air power—are also put to the test. And therein lies the *real* Rodeo challenge for aircraft maintainers and other participants: providing air mobility capability better than before without sacrificing safety or systems reliability.

Why Rodeo?

The first USAF Rodeo was held in 1962. Although its name has changed a few times over the years, Rodeo has always been about improving air mobility capability and combat skills through friendly competition. Inviting allied nation air mobility partners to participate in 1979 was a logical evolution in the competition because it provided valuable joint and combined training for all participants and fostered a greater sense of "team." Working side by side with our allies has led to a deeper appreciation of similarities and mutual goals and taken esprit de corps to another level.

Present for this year's Rodeo competition at McChord AFB, Washington, were over 2,500 personnel and more than 70 aircraft representing 10 major weapon systems from 41 U.S. and 8 foreign units. Major weapon systems vying for honors this year in the maintenance categories included the C-5, KC-10, C-17, KC-135, C-141, and the turboprop family of C-130, C-160 (France), and CN-235 (Spain) aircraft. USAF competitors represented the Total Force—active duty, Air Force Reserve Com-

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A Dover C-5 blasts off on its way to competing in the air refueling portion of Rodeo.

While not required by tech data, this crew chief decided to be extra careful and inspect the No. 4 engine on his KC-135R *sans* shoes.

mand, and Air National Guard. Allied nation participants came from Canada, Brazil, Saudi Arabia, Egypt, Spain, UK, France, and Belgium. Also in attendance were competition observers from Romania, Greece, Switzerland, Bulgaria, Chile, and other countries.

Safety *Is* the Word

HQ AMC's Directorate of Safety and McChord's Safety Office worked closely with dozens of MAJCOM, base, and local agencies early in the planning process and did a superb job of promoting safety awareness from start to finish. Immediately upon arrival, participants and observers went through Rodeo Safety's in-processing line and were furnished with information that included a safety briefing; welcome packages noting flightline layout, driving patterns, and restricted areas; a familiarization with local area traffic laws, requirements, and on/off-base hazards; a local weather conditions orientation; and a security awareness refresher. Rodeo Safety also published an informative newsletter at the mid-competition point that provided safety observations to date and talked to potential problem areas, reinforcing the "Safety First" message without sounding "preachy." During all Rodeo events, Rodeo Safety was visible and proactive.

Comments from Maintenance Umpires and Maintenance Team members themselves made it abundantly clear that "Work Safe, Be Safe" was not just a hackneyed phrase, but the expected norm. When asked how safety fit in with his responsibilities as a Rodeo Maintenance Umpire, Chief David Doyle, Maintenance Superintendent for the 305 AGS at McGuire AFB, stated, "One of my primary jobs, both at McGuire and here, is to ensure the troops understand that taking a shortcut opens the door for personal injury or equipment damage. Every person is vital to the mission. When safety is their first priority, I know the mission will be accomplished successfully." Chief Al Rogers, C-5 Maintenance Team Chief representing the 439 AW at Westover ARB, said, "I tell my troops to work just like they do at home station. Use the 'Buddy System,' watch out for each other, work safe, and work smart." There's no doubt that safety on and off the job were foremost in competitors' minds, as other umpires and Maintenance Team members repeated comments similar to these throughout the competition.

Maintenance Teams, Umpires, and Scoring

Not later than 2 months prior to Rodeo competition, Maintenance Team members are named, and primary and backup competition aircraft tail

Tool control is a high interest item at Roc Robins demonstrate excellence in tool co

numbers are designated. Ten years ago, aircraft selected for competition were flown very little, and a great amount of effort was expended fine-tuning systems and refurbishing them to gleaming, showroom condition. But in today's dynamic operational environment, it's impractical to pull an aircraft from the flying schedule and devote weeks to polishing and preparation. Rodeo emphasis today is placed on how well an aircraft is maintained and how well it functions, not how pretty it may be. In some cases, the Rodeo-designated aircraft may be in use until just before time to depart for the competition, making the maintenance task that much more difficult. Maintenance condition upon arrival is graded, and points are deducted for discrepancies coded as "awaiting maintenance."

However uncertain it may be as to which aircraft will actually deploy to Rodeo, this 2-month window does provide invaluable time for the Rodeo Maintenance Team members to hone their skills and gel as a team. As you would expect, these maintainers represent the best of the best within their individual maintenance disciplines. Although they are already trained in other specialties, this time together allows them to pick up additional skills that will benefit the team. Cohesiveness and chemistry are critical, since Rodeo preparation and competition are grueling. Workdays (and nights) routinely last 12 to 14 hours and more, with no letup until after Rodeo concludes. How well these maintainers perform both individually and collectively directly impacts how well the aircrew is able to perform in the flying phases of the competition.

deo. Here, 19 ARG maintainers from
ontrol.

Senior NCO maintainers from throughout the MAF world serve as Rodeo's Maintenance Umpires, and they, too, are handpicked based on their breadth of experience and technical knowledge. This year, there were 12 Maintenance Umpire teams, with between 7 and 10 members assigned to each one. The number of teams and team size depend on the weapon system being inspected. Their task is to apply standardized inspection criteria and perform a series of graded inspections on each aircraft. Scores derived from these events then determine Rodeo Maintenance Team award winners. Umpires inspect Maintenance Teams and their aircraft in four primary areas, scoring quality of maintenance, with a maximum attainable score of 1800 points. The four areas are:

- Aircraft Preflight (PRE) Inspection (600 points);
- Aircraft Basic Postflight Inspection/Home Station check (BPO/HSC) (600points);
- Aircraft Refueling (100 points) Evaluation; and
- Daily Observations (100 points for each of the 5 days of competition).

Maintenance competitors from the 446 AW (AFRC), McChord AFB, departing after launching their aircraft on an airdrop mission.

The Competition

Upon arrival at Rodeo, Maintenance Teams are given a schedule that tells them precisely when, during the 5 days of competition, they'll be receiving their PRE, BPO/HSC, and Refueling evaluations. Even though these maintenance tasks are performed throughout Rodeo, each of them is formally graded only once. For the PRE and BPO/HSC evaluations, Maintenance Umpires use the same work-

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Maintainers on the C-130 ramp muscle a power cart into position after blocking in their aircraft.

cards as the Maintenance Teams to see how well inspection workcard criteria were followed. Getting the maximum of 600 points for each of these events may sound relatively easy until you consider that each major discrepancy results in a deduction of up to 100 points, and each minor discrepancy may cost up to 20 points. Attention to detail is paramount. Whereas these two evaluations are done after the fact, the Aircraft Refueling scenario is done as it's being performed. Safety, reliability, and working within prescribed time limits are the keys to obtaining the maximum 100 points available here. In the final category, Daily Observations, Maintenance Umpires observe the teams throughout the day as they perform launch, recovery, and other routine maintenance activities over each of the 5 days of competition. Teams receive a maximum of 100 points each day, so long as they work safely and by the book.

Once each PRE, BPO/HSC, and Refueling evaluation is done, the Maintenance Team Chief is given a copy of the score sheet, allowed to review any discrepancies, and appeal the score if he/she feels points were deducted in error. Likewise, the Team Chief acknowledges Daily Observation score sheets and, again, has the opportunity to appeal if an error was committed. Maintenance Teams must have their ducks lined up, since any unsubstantiated appeal results in the loss of an additional 100 points. With the exception of BPO/HSC results, aggregate scores are posted throughout the competition so each team knows how it's doing. BPO/HSC scores are known to individual Maintenance Teams but aren't publicized, in order to preserve the competitive spirit right up until the end. Rodeo's Maintenance Staff tallies overall maintenance results to determine award winners and forwards the scores to Rodeo Central, where they're incorporated with the other competition scores derived from flying, security forces, aerial port, and other events to help decide overall Rodeo award winners.

Rodeo '98 Final Results

Competition was tough! As in the Olympic decathlon, those who did well

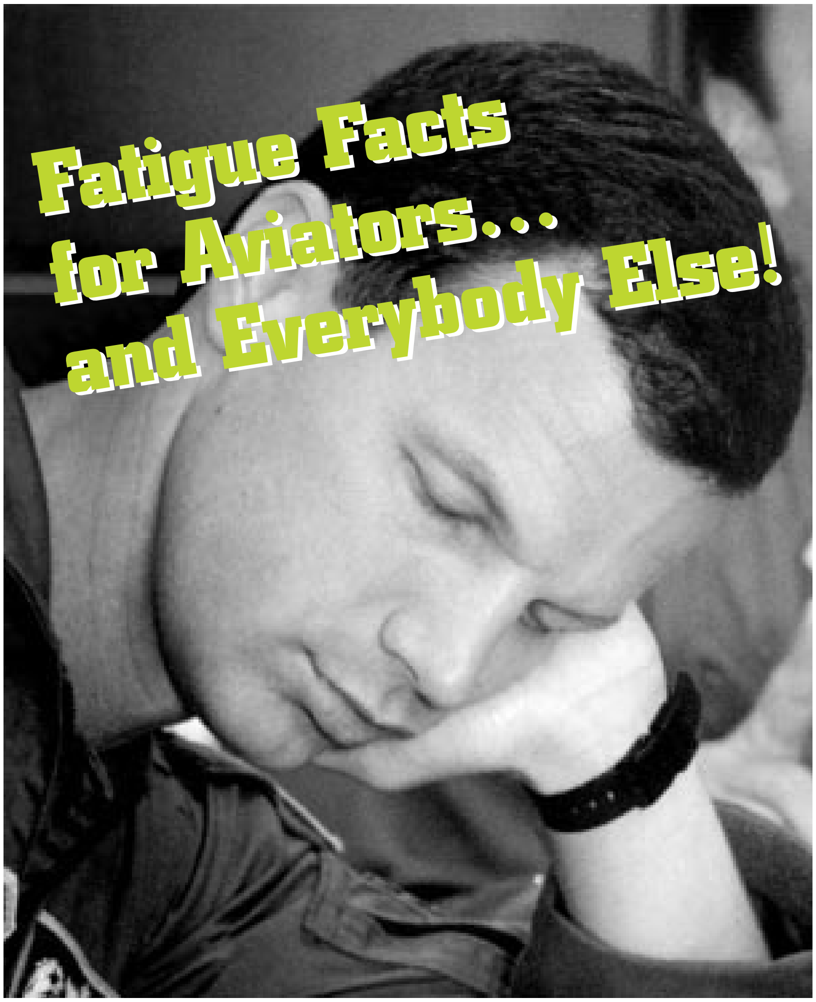
over the long haul prevailed over those who did well in only a few areas. While looking over the list of winners to see who was selected Rodeo's "Best of the Best" Maintenance Award winners, consider this: *No one team or segment dominated.* Allied nations, active duty, Reserve, and Guard units all took awards home!

Final note on safety: *Congratulations to all competitors for making this year's Rodeo one of the safest ever!* When people who fly and maintain several different types of weapon systems from locations throughout the country and around the globe are brought together to an unfamiliar location, in a highly demanding environment, the chance for a mishap is ever present. However, meticulous planning, application of risk management principles, and nonstop emphasis on adherence to, and enforcement of, safety directives paid off again. *Kudos to all!* See you at Pope AFB, North Carolina, for Rodeo 2000! ✈

RODEO MAINTENANCE AWARD WINNERS

Best C-5 Maintenance Team	**349 AMW (AFRC), Travis AFB CA**
Best C-5 PRE Team	349 AMW (AFRC), Travis AFB CA
Best C-5 BPO/HSC Team	439 AW (AFRC), Westover ARB MA
Best KC-10 Maintenance Team	**349 AMW (AFRC), Travis AFB CA**
Best KC-10 PRE Team	349 AMW (AFRC), Travis AFB CA
Best KC-10 BPO/HSC Team	514 AMW (AFRC), McGuire AFB NJ
Best C-17 Maintenance Team	**437 AW, Charleston AFB SC**
Best C-17 PRE Team	315 AW (AFRC), Charleston AFB SC
Best C-17 BPO/HSC Team	437 AW, Charleston AFB SC
Best C-130/C-160/CN-235 Maintenance Team	**France**
Best C-130/C-160/CN-235 PRE Team	France
Best C-130/C-160/CN-235 BPO/HSC Team	Canada
Best KC-135 Maintenance Team	**22 ARW, McConnell AFB KS**
Best KC-135 PRE Team	121 ARW (ANG), Rickenbacker ANGB OH
Best KC-135 BPO/HSC Team	927 ARW (AFRC), Selfridge ANGB MI
Best C-141 Maintenance Team	**446 AW (AFRC), McChord AFB WA**
Best C-141 PRE Team	446 AW (AFRC), McChord AFB WA
Best C-141 BPO/HSC Team	62 AW, McChord AFB WA

Fatigue Facts for Aviators... and Everybody Else!



Official USAF Photo

Although written with the aviator in mind, the precepts in this article apply to <u>all</u> personnel, regardless of AFSC. —Editor

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Fatigue impairs alertness and performance, often without your awareness. In fact, sleepiness/fatigue can be as dangerous as intoxication. Just 18 hours without sleep causes mental and motor skills to deteriorate as much as they do when blood alcohol concentration (BAC) reaches 0.05 percent. Twenty-four hours of sustained wakefulness equates to a BAC of 0.10 percent, the legal intoxication limit in most states. Fatigue is a significant risk factor in aviation as well as ground operations, but the consequences of being tired are too often underestimated or ignored.

What Is Fatigue?

The terms "fatigue" and "sleepiness" are often used interchangeably. One definition of fatigue describes it as a subjective state of tiredness associated with prolonged work and/or prolonged wakefulness (or sleep loss). This may be experienced differently by different people. One of the reasons the risks associated with fatigue or sleepiness are underestimated is that no biological markers or "Breathalyzers™" for fatigue exist. Thus, it's difficult to determine how many accidents and other problems are associated with fatigue. Fatigue-related impairments are underreported because sleepy pilots, drivers, and workers are reluctant to admit they fell asleep (or even became inattentive) on the job, especially if an accident results.

Is Fatigue a Big Problem?

Despite the fact fatigue is difficult to measure, there's plenty of evidence that fatigue-related problems have reached almost epidemic proportions. As a society, we sleep too little and ignore our biological clocks. The demands of everyday life have reached the point where slumber is routinely sacrificed for work, family, and recreation. As a result, approximately 63 million Americans chronically suffer from moderate or severe daytime sleepiness. And because of this, on-the-job concentration, decision making, problem solving, and performance are adversely affected.

Forty percent of adults now say their daily sleep is inadequate. Much of this is simply due to the fact people go to bed too late and get up too early or don't sleep well due to stress or other factors. Also, the requirement to work rotating shifts leads to disrupted or insufficient sleep. There are over 25 million shift workers in the United States, many of whom find it impossible to stay alert during their night jobs because sleeping during the day is contrary to the body's internal biological clock. Thus, there are a lot of sleep-deprived people in America, and many of them are in the military.

Interestingly, however, most of us see our sleepiness as a badge of honor rather than as a condition to be remedied. Twenty-six percent of career-minded adults feel sleepiness is part of the price to be paid for being successful. In the military, commanders place a high value on troops who "tough it out" despite the fact these individuals are increasing accident risks because they are suffering from dangerous alertness deficits.

Is Fatigue Worse at Some Times of the Day Than at Others?

The simple answer to this question is yes. Human beings have a number of biological rhythms (for hormone secretions, temperature, etc.) which are synchronized to 24-hour cycles by exposure to daylight, knowledge of clock time, meal intervals, and activity schedules. Because of these rhythms, alertness is greater during the day than the night, and research has shown people not only feel sleepier at nighttime, but perform less skillfully as well.

For instance, it's been found that truck drivers fall asleep behind the wheel more frequently at night (after midnight) than during the day. Also, they are seven times more likely to be involved in a drowsy driving accident between midnight and 0800 than at other times. Studies of truckers have shown that time of day is more likely to impact driving performance than the amount of time on duty or the number of consecutive trips.

In a variety of other occupations, errors and accidents have been shown to increase at night. Thus, time of day is as important a determinant of fatigue as is the amount of wakefulness since the last sleep period. However, both of these factors work together to influence alertness levels, and because of this, both must be considered when attempting to minimize sleepiness on the job.

There are over 25 million shift workers in the United States, many of whom find it impossible to stay alert during their night jobs because sleeping during the day is contrary to the body's internal biological clock. Thus, there are a lot of sleep-deprived people in America, and many of them are in the military.

What Are the Costs Associated With Fatigue?

Unfortunately, sleep deprivation affects almost every aspect of daily functioning, but attention, complex thinking, judgment, decision making, and motivation are the most vulnerable. As a result, it's estimated $18 billion in U.S. industrial productivity is lost every year because of sleepiness on the job.

On the highways, drowsiness costs more than $12 billion a year in lost productivity and property damage. About 1,500 deaths and 76,000 injuries occur annually because drivers fall asleep while traveling.

Besides these costs at work and on the highways, many of the over 50 percent of aviation mishaps chalked up to human errors are directly related to fatigue and sleepiness in the cockpit. Some have described flying as "long periods of boredom interspersed with seconds of sheer terror," and it's now known this boredom (associated with flying routine, uneventful missions) places pilots at greatest risk for falling asleep at the controls. Passive monitoring tasks (such as navigating at altitude) are the most susceptible to being botched as a result of sleep deprivation.

Why Are We So Tired?

Two of the major causes of fatigue are (1) inadequate sleep prior to work and/or (2) extended periods of wakefulness (as in sustained operations). Although the military, the trucking and railway sectors, and commercial aviation have sought to combat fatigue by restricting the amount of time spent working, there's little clear evidence hours of work, per se, adversely affect performance as long as adequate daily sleep is obtained. Instead, the most readily identifiable cause of fatigue is sleep loss. This is alarming since chronic sleep deprivation in America is on the rise.

At the turn of the century, before the advent of electric lights, people slept 9.5 hours per day, most of which was at night (since artificial lighting was inadequate for working during hours of darkness). However, many of us now sleep less than 7 hours per day, and some segments of the population (i.e., shift workers) sleep even less. As a result, sleep deprivation is taking a heavy toll on job productivity, personal safety, and well being.

What Are the Warning Signs of Inadequate Nightly Sleep?

In general terms, excessive sleepiness at work indicates insufficient sleep while off duty. Sleepiness (fatigue) can result either from acute periods of deprivation ("pulling an all-nighter") or from chronically shortened sleep periods across several days (leading to cumulative sleep debt). Indicators of inadequate sleep include:

→ Difficulty waking up without the aid of an alarm clock.

→ Repeatedly pressing the snooze button to sneak in a few extra minutes of sleep.

→ A strong desire to take naps during the day.

→ Difficulty staying awake while in meetings, riding in a car, or watching TV.

→ Falling asleep rapidly after going to bed at night (usually in less than 5 minutes).

→ Looking forward to weekends when one can "catch up on sleep."

→ Sleeping 2 or more hours than usual on days off.

Many fatigued people blame their sleepiness on boredom or on inactivity. However, in well-rested individuals, boredom causes a feeling of irritation or agitation and not the irresistible urge to nod off which re-

continued on next page

sults from sleep deprivation.

How Much Sleep Is Necessary to Be Fully Alert?

There are substantial variations in sleep needs from one person to another, but on average, adults need about 7 to 9 hours of nightly sleep to be fully alert during the day. Although there are some people who can get by on much less sleep, it's not possible to accurately predict which individuals are "short sleepers" and which are "long sleepers." Age, fitness level, intelligence, motivation, and personality appear to have no reliable relationship to sleep needs. In fact, the only way to determine sleep requirement is by trial and error. However, learning how much sleep is necessary (and ensuring this much is obtained) is essential to remain fully awake on the job. Studies have shown the loss of even 2 hours of sleep during a single night is enough to significantly degrade next-day alertness.

How Can I Determine How Much Sleep Is Right for Me?

Individual sleep needs can be determined in two ways. The best way is by studying your own behavior while on your next vacation, particularly if the vacation is a couple of weeks long. However, it's possible to determine sleep needs during nonvacation times as well.

→ ***While on vacation***, sleep until you wake up without an alarm clock for several days and record the amount of nightly sleep. The average is how much sleep you naturally need. When trying this, start keeping records on the third day after you've overcome any preexisting sleep debt.

→ ***While on a regular work schedule***, add 1 hour to your usual nightly sleep and maintain this for a week. At the end of the week, evaluate how alert you felt at work each day. If more sleep is needed, add an hour the next week, and so on.

Once your natural sleep requirement is established, carefully evaluate factors that may be preventing adequate daily sleep. Usually, reprioritizing or simply rearranging the course of a normal day will help to ensure enough sleep to maximize on-the-job alertness.

Can I Train Myself to Need Less Sleep?

It's a fact some people need more sleep than others. If you're one of those people, there's unfortunately no way to train yourself to get by on less than your biologically determined amount of slumber. Some people think repeated exposure to sleep deprivation improves their functioning during sustained wakefulness. This, however, is not the case. Simple tasks can be made resistant to the effects of sleep loss by overpracticing them to the point they become automatic. *But this won't work with tasks requiring thought and judgment.*

People who think they have made themselves immune to the effects of sleep deprivation through practice have actually just learned to reprioritize work tasks so sleep loss seems to have less of an impact. But their higher mental processes continue to decline while their chances of involuntarily falling asleep increase.

People who think they have made themselves immune to the effects of sleep deprivation through practice have actually just learned to reprioritize work tasks so sleep loss seems to have less of an impact.

Furthermore, *sleep-deprived individuals are often unaware of their own impairment since sleepiness interferes with accurate self-evaluations.* Just like the drunk who boasts of being able to drive better after several drinks (and actually believes it), the reality is his performance is seriously impaired, but he is simply incapable of realizing it.

How Can I Improve My Nightly Sleep?

If you are allowing yourself a sufficient amount of time to sleep every day but feel your sleep is less than optimal, you may be suffering from bad sleep habits. Everyone struggles with occasional sleep problems, and one or two nights of trouble are not a major cause for concern. However, if you have insomnia for several days, weeks, or months, something is wrong. One possible cause of chronic insomnia is a medically recognized sleep disorder, but since most aviators are reasonably young and healthy, they are unlikely to be suffering from one of these (such as sleep apnea or nocturnal myoclonus). On the contrary, the sleep problems of most adults stem from behavioral or environmental factors. If you repeatedly are unable to fall asleep at night, make sure you do the following:

→ Stick to a consistent bedtime and wake-up time even on weekends.

→ Use the bedroom for sleep only and not for watching TV, reading, or working.

→ Develop a soothing nighttime routine (take a warm bath, read for a few minutes, etc.).

→ If you are a bedtime worrier, set aside an earlier time to resolve daily dilemmas.

→ Once in bed, avoid watching the clock (face it away from the bed).

→ Include aerobic exercise in your daily routine, but not within 3 hours of bedtime.

→ Don't take naps during the day.

→ Don't consume caffeine (in coffee, tea, chocolate, or medications) within 4 hours of bedtime.

→ Don't drink alcohol within 3 hours of bedtime.

→ Don't smoke cigarettes within an hour before going to bed.

→ If you can't fall asleep, don't lie in bed awake. Instead, engage in a quiet activity until sleepy.

Adhering to these principles will help overcome chronic sleep problems because they break mental associations that prevent sleep and avoid substances known to delay or disrupt sleep. However, it may take several days or weeks for these new habits to repair the damage done by months or years of poor sleep practices.

Is It Possible That Shift Work (or Reverse Cycle) Is Making Me Sleepy?

If you usually sleep well and feel alert but suffer from fatigue when rotating to a new work/rest schedule, you are experiencing the normal problems associated with disruptions in your body's internal rhythms (referred to as shift lag). Shift lag is similar to jet lag in terms of its effects. The primary problem is that restful sleep during daylight hours is contrary to our normal circadian rhythms. As a result, night workers often become chronically sleep deprived because they sleep 2 to 4 hours less per day than day workers.

Although shifting the biological clock improves daytime sleep (and enhances nighttime alertness), the process is slow, often taking more than a week. Also, the readjustment is hampered by the fact external timing cues (such as sunrise and sunset) conflict with the new sleep schedule. Anyone who has ever traveled from the U.S. to Europe can appreciate the difficulties associated with reprogramming the biological clock.

Even when everything (i.e., sunrise, sunset, meal times, activity, etc.) in the new time zone is fully synchronized with the new sleep schedule, fatigue, gastrointestinal discomfort, concentration problems, and insomnia persist for 8 to 10 days (or 1 day for each time zone crossed). Needless to say, shift workers suffer chronically from such problems because they rarely work the same shift for very long and, therefore, are in a constant state of readjustment. However, there are strategies that can speed adjustment to new work/rest schedules.

On the highways, drowsiness costs more than $12 billion a year in lost productivity and property damage. About 1,500 deaths and 76,000 injuries occur annually because drivers fall asleep while traveling.

What Strategies Promote Adjustment to a New Work Cycle?

Although transitioning from one shift to another will invariably cause feelings of fatigue and discomfort, certain strategies can facilitate readjustment and minimize how long the discomfort will last. These are especially important when changing from day to night shift.

➢ Maintain the new work/rest schedule even when off duty.

➢ Rapidly adjust meal times (breakfast, lunch, and dinner) to agree with the new schedule.

➢ Talk to friends and family about your need to sleep at a different time than they do and gain their cooperation.

➢ Unplug the phone, disconnect the doorbell, put blackout shades on the windows and turn on a fan and/or use earplugs to mask out noise.

➢ When a solid 8 hours of sleep is unobtainable, use napping to get as much as possible.

➢ If possible, use a sleeping medication ***under medical supervision*** during the first 3 days of the new rotation.

➢ Judiciously use caffeine in the middle of the night shift to enhance alertness, but avoid caffeine within 3 to 4 hours of the next sleep period.

➢ If sleeping during the day, wear dark glasses and limit time outside before bedtime, then take a walk in the sunshine after awakening later in the day.

➢ If planning a night cycle, (1) try to end the mission well prior to daylight so personnel can get to bed before sunrise, (2) make sure night crews are not required to attend meetings or other activities which will interfere with sleep, and (3) in field scenarios, make meals available at reasonable times so that no one has to make a choice between eating and sleeping.

Consistent rest/activity cycles and "bright light discipline" are the most important factors when adjusting to a new schedule. Circadian rhythms are very sensitive to being reset (or to resisting resetting) by exposure to bright light.

How Can I Safeguard My Alertness Even When I Can't Readjust to a New Shift or When the Long Missions Just Have to Be Done?

Avoiding fatigue during night flights is difficult because few people are able to fully adapt to night duty beforehand. However, even day flights can be challenging, especially when the flights are long and are sandwiched in between additional duties. Obviously, it's best to avoid flying at night if this is your normal sleep time. Day flights are much safer because of improved alertness. However, if there's no flexibility in establishing when a flight will take place, the following strategies should be implemented:

→ Obtain plenty of sleep before the flight (or the duty day when the flight is planned).

→ If the flight is late in the day or at night, take a 45-minute nap before takeoff.

→ Avoid alcohol consumption within 24 hours prior to night flights because alcohol increases fatigue by interrupting pre-mission sleep and causing blood sugar changes.

→ During the flight, swap tasks (navigation, radios, etc.) between pilot and copilot to minimize boredom.

→ During the flight (or immediately prior), consume caffeine for the stimulant effect.

→ If possible, avoid hot refueling in favor of shutting

continued on next page

down and walking around for a few minutes (a break every 2 hours is very helpful).

→ Note that increasing radio volume and exposure to cold air do not fight off sleepiness.

→ Remember that after being awake for a long time, involuntary sleep episodes will occur despite your best efforts to the contrary.

What Are Some Warnings That Fatigue Is Becoming Too Great?

The dangers of fatigue from prolonged wakefulness, sleep deprivation, or disruptions to the body's internal clock should be obvious at this point. However, optimum mission scheduling is often impossible. When there is no choice but to fly when tired, be attuned to these indicators that falling asleep at the controls may occur in the next few seconds:

➩ Your eyes go in and out of focus.

➩ Your head bobs involuntarily.

➩ You can't stop yawning.

➩ You seem to have wandering, disconnected thoughts.

➩ You don't remember things you did in the last few seconds.

➩ You missed a navigation checkpoint.

➩ You forgot to perform some routine procedure.

➩ Your control accuracy is degrading (altitude and airspeed fluctuate).

If you experience even one of these symptoms, the safest course of action is to end the flight as soon as possible and get some sleep. Despite popular opinion to the contrary, sleep-deprived people cannot will themselves to stay awake no matter how hard they try. *Even personnel who think they are staying awake are susceptible to falling asleep for several seconds at a time without realizing it.* This is a serious problem given that an aircraft flying at only 90 knots can travel more than the length of a football field during a micro sleep of only 4 seconds.

It's a fact some people need more sleep than others. If you're one of those people, there's unfortunately no way to train yourself to get by on less than your biologically determined amount of slumber.

Can Napping Help?

Since one of the major contributors to fatigue is the lack of recent, restorative sleep, napping is the best countermeasure for drowsiness in prolonged missions. Several research studies have shown that long (4- to 5-hour) naps during a period of sleep loss can restore performance to near-normal levels. Also, 2- to 3-hour naps taken shortly before a period of sleep deprivation can minimize the loss of alertness and performance that would have occurred without a nap.

How Long Should a Nap Be?

Generally, the longer the nap, the better its ability to lower the impact of fatigue. Although 2-hour naps cannot erase the effects of sleep loss, they are very beneficial because they provide sufficient time to go to sleep and complete one full sleep cycle. It takes about 90 minutes to transition from light sleep to deep sleep and then into dream sleep. Even 10-minute naps appear to be better than nothing. Just remember—if napping is used in close proximity to the duty area, anyone who naps should be allowed at least 15 to 20 minutes to awaken before they fly or perform other complex tasks because everyone feels a little groggy when they wake up due to sleep inertia.

What Factors Are Important When Planning Naps as a Fatigue Countermeasure?

In situations where a full sleep period is not possible because of work demands, naps can substantially reduce fatigue. When implementing strategic naps:

➧ Establish a relatively quiet, dark, and comfortable place for napping.

➧ Use sleep masks or earplugs if necessary to block out sunlight and noise.

➧ Place the nap when sleep is naturally easy (i.e., 1400 to 1600 or 0220 to 0600).

➧ Make the nap as long as possible under the circumstances.

➧ Consider implementing a nap in the afternoon prior to an all-night mission

➧ Plan the nap early in the sleep-deprivation period rather than late.

➧ Allow 15 to 20 minutes for sleep inertia to dissipate before resuming work tasks.

What if a Long Mission Is Necessary Despite No Opportunity for Sleep?

Missions that pop up without warning, those involving unanticipated night flight, and/or those requiring extended periods of sustained wakefulness are inherently risky because many of the normal fatigue countermeasures cannot be employed. Commanders and pilots should consider the following as risk reduction/risk management tools when flights must be completed despite fatigue or inadequate sleep (in an operational environment):

➼ Be sure to eat high protein foods like yogurt, cheese, nuts, and meats.

➼ Avoid high fat foods (candy) and high carbohydrate foods (cereals, breads, etc.).

➼ Drink plenty of fluids since dehydration compounds fatigue.

➼ Converse with other crewmembers, and rotate tasks to minimize boredom.

➼ If possible, try to move around in the cockpit. Definitely exercise during refuels.

USAF Photo by SSgt Andrew N. Dunaway, II

Despite popular opinion to the contrary, sleep-deprived people cannot will themselves to stay awake no matter how hard they try.

➳ Once fatigue becomes noticeable (but not before), take caffeine in some form.

➳ In combat situations, request a stimulant such as Dexedrine™ from the flight surgeon.

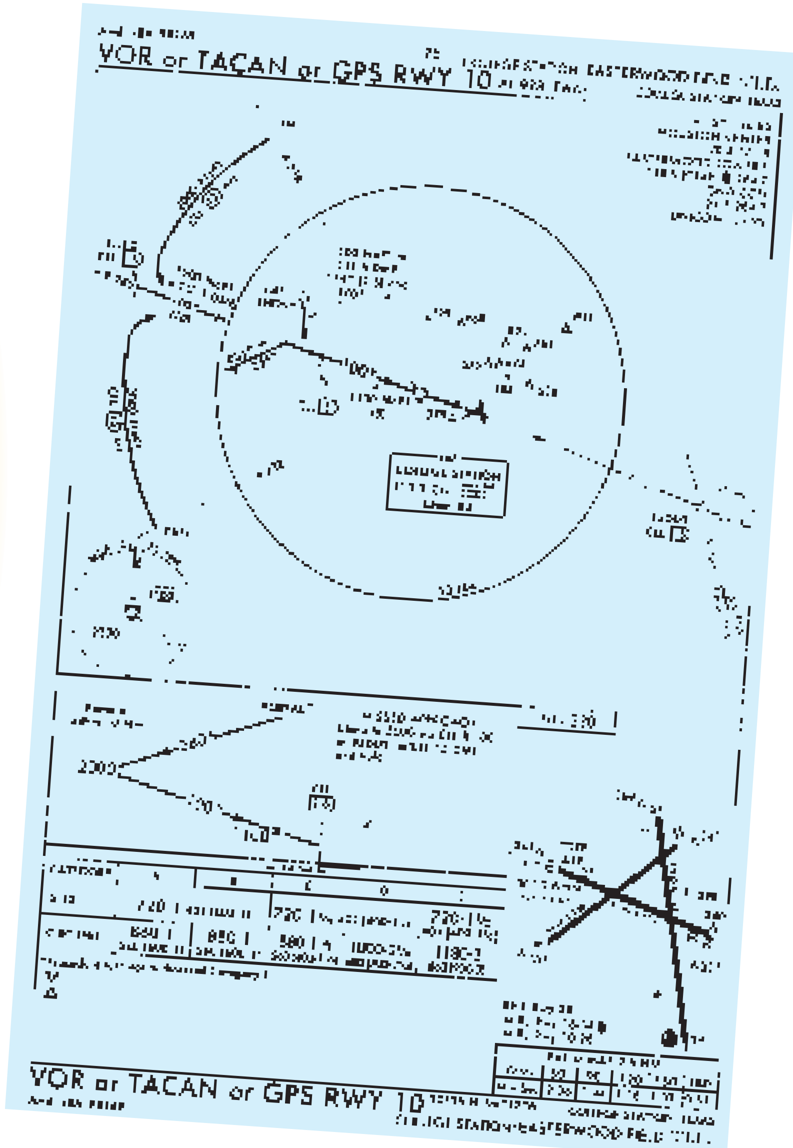
These strategies may provide some short-term enhancement of alertness, *but with the exception of caffeine and dextroamphetamine, they are only minimally effective.* During peacetime, the best countermeasure, other than adequate sleep, is the judicious use of caffeine which is helpful primarily for people who ordinarily don't drink coffee, tea, or caffeinated sodas. However, it's important to remember that regardless of which countermeasures are used, someone who has been awake for 18 hours or more is seriously impaired, particularly if the flight occurs from 0300 to 0900 with no prior sleep. Even the most powerful prescription amphetamines are no substitute for sleep!

So What's the Bottom Line?

Fatigue is a serious threat to the military as an organization and the individuals who make up each unit, whether ground troops or aviators. Adequate, restful sleep is a biological need like hunger or thirst, and it's the only cure for fatigue—there is no substitute. Recognizing the threat posed by on-the-job sleepiness, identifying the causes of insufficient sleep, implementing countermeasures to ensure proper rest, and developing crew rest cycles that will ensure well-rested and alert crews are among the best force multipliers. ✈

Air Force
Flight Standards Agency

Instrument Quiz



MAJ KEVIN JONES
HQ AFFSA/XOFD

For the purposes of this quiz, you are flying a weekend cross-country in your T-38 (Category E aircraft, TACAN only) from Barksdale AFB to Kelly AFB. As luck would have it, a freak weather system has surrounded the San Antonio area with thunderstorms, and you are forced to proceed to your alternate—Easterwood Field in College Station, Texas. As you approach the airport from the west, Houston Center issues you the following clearance: "Track 32, proceed direct to ILLED, maintain 2,000 until established, cleared TACAN RWY 10 approach."

1. What is the earliest point you can depart 2,000 feet MSL?

A. Immediately, since I have been cleared for the approach.

B. Established on the CLL 280°R inbound.

C. Established on the CLL 280°R inbound inside of 15.0 DME (CLL).

D. After passing 5.0 DME (CLL).

2. Continuing inbound on the approach from ILLED, what is the earliest point you may descend to 1,100 feet MSL?

A. Established on the CLL 280°R inbound.

B. Established on the CLL 280°R

inbound inside of 5.0 DME (CLL).

C. At the final approach fix.

D. Outbound abeam on a parallel or intercept heading.

3. Upon reaching the CLL VORTAC, what will you do?

A. Turn left and correct to the outbound course with at least 20° of intercept.

B. Turn right to a heading of 280° on the maneuvering side.

C. Turn right and teardrop up to 30° from the inbound course.

D. Descend to the MDA.

4. On climbout, Houston Center clears you: "Track 32, climb and maintain 3,000. Turn left and proceed direct to the College Station VORTAC. You are cleared the TACAN RWY 10 approach; report procedure turn inbound." How will you fly the approach?

A. Proceed direct to the VORTAC and teardrop.

B. Proceed direct to the VORTAC, intercept the 280°R outbound, and do the 45/180 maneuver.

C. Request another clearance—the procedure turn is not authorized for Cat E aircraft.

D. Either "**A**" or "**B**" is correct.

5. Houston Center now gives you the following clearance: "Track 32, climb and maintain 3,000; proceed direct to the College Station 318 at 15; cleared the TACAN RWY 10 approach." When may you depart 3,000 feet MSL?

A. Immediately.

B. Established on the 280°R inbound.

C. Established on the 15 DME arc.

D. Passing 5 DME (CLL) inbound.

6. Once you are established on the 15 DME arc, what is the earliest point you may depart 2,000 feet MSL?

A. Established on the 280°R inbound.

B. Upon reaching your lead radial and beginning your turn to intercept the 280°R inbound.

C. Established on the inbound segment.

D. Established on the 280°R inbound and inside of 5.0 DME (CLL).

7. What is significant about the approach lighting for RWY 34?

A. The lighting includes sequenced flashers.

B. The runway lights are high-intensity.

C. The lights are pilot-controlled when the tower is not open.

D. Both "**A**" and "**C**" are correct.

8. When departing College Station, is there an obstacle requiring a climb gradient greater than 200 feet per nautical mile?

A. Yes.

B. No.

ANSWERS

These eight questions were part of the exam administered to about 1,000 pilots during the USAF Instrument Training Review during the summer of 1997. In parentheses following the answer is the percentage of pilots who missed that particular question.

1. **C** (15%). Once you are established on the 280°R inbound and inside of 15.0 DME, you may descend to 1,500 feet MSL.

2. **B** (28%). Continuing inbound on the 280°R, you may depart 1,500 feet for 1,100 feet once you are past 5.0 DME.

3. **D** (7%). Since you are on "NoPT" routing, you are expected to commence the approach upon reaching the CLL VORTAC without executing the procedure turn.

4. **C** (22%). Trick question? Not really—attention to detail is important. Don't forget to read all the notes. In this case, you must read the note which states, "Procedure turn not authorized Category E."

5. **C** (7%). You may depart the last assigned altitude once you are established on a segment of the approach. Once you are established on the 15 DME arc, you may descend to 2,000 feet MSL.

6. **B** (25%). Once you reach your lead point and begin your turn to intercept the 280°R inbound, you may depart 2,000 feet MSL.

7. **D** (19%). The dot on top of the "A5" symbol indicates the lighting system has sequenced flashers, and the black background of the symbol indicates pilot controlled lighting.

8. **A** (38%). The presence of the "trouble T" indicates there is a penetration of the 40:1 obstacle identification surface and a climb gradient greater than 200 feet per nautical mile is required. ✈

Maintenanc

Three Can Be a Huge Number

LT TERRY LADAU
Courtesy *Mech*, Jan-Mar 98

You're in your work center, rack, or maybe the chow line when you hear, "FOD walkdown. All hands not on watch are encouraged to muster on the bow of the flight deck for this morning's FOD walkdown." Do you stop what you're doing and head up to the flight deck? Or do you ignore the call, thinking, "They've got enough people. No one will miss me. I'll make the next one—it's not that important"?

As squadron FOD Prevention Officer, it's my job to drum up support and enthusiasm for the program. Before taking the job, I was as guilty of poor attendance as the next person. But handling investigations and attending council meetings have taught me the real importance of FOD prevention.

My air wing FODed three jet engines in 3 months. Not a huge number, but consider the cost in time and money. First, that's three airplanes down. Our maintainers will have to change those engines in addition to their normal workload. Three engines will have to be reworked by AIMD (if they can be salvaged). Three FOD investigations must be done by at least five people, each taking up to a week or more to complete. Three incident reports will have to be drafted and sent all the way up to the CNO (Chief of Naval Operations).

Consider the man-hours required to do all this, the money for parts, damage analysis, salaries, and what those people could accomplish if they weren't tied up with FOD incidents. Last, consider the multimillion dollar price tags of those damaged or destroyed engines.

Suddenly, three doesn't seem like such a small number. All this because of a few errant pieces of FOD that you might have picked up if you had been at the walkdown that day. That 20 minutes walking the flight deck is a small price to pay to avoid all those headaches.

So go on up to FOD walkdown, get some sun and fresh air, and find that 15-cent screw that can sideline one of those $60 million aircraft.

(Lt Ladau was VAW-113's line division officer when he wrote this article.)

Maverick Misadventure

The F-16 was loaded with six BDU-33s on station 7, a live Maverick on station 3, and ready to depart for its training mission, but during end-of-runway checks just prior to takeoff, the pilot reported Maverick video was inop. After discussions between the pilot and technical personnel, it was determined that the weapon could be safely launched without a video lock, so the aircraft proceeded to the range.

However, once at the range, and ready to launch, the pilot encountered more problems with the missile when its dome cover wouldn't blow and station 3 reported a system fault code. Another round of discussions with technical personnel ensued, with primary concern focusing on whether or not it would still be safe to attempt a launch. Since the worst-case scenario would be a hung missile, and that contingency had been thoroughly briefed, the pilot was given the go-ahead to launch. Imagine the surprise when the Maverick *and its launcher* left station 3 *together!* They impacted the range 2 miles short of the target and were destroyed. The aircraft was impounded immediately upon return to home station.

Investigation determined that the station 3 pylon, which had been installed on the aircraft just 3 days prior to the mission, was the culprit. Four wires on one of the connectors were found reversed, and the signals passing through these misrouted wires were identified as causing the mishap. Records revealed that the pylon had been in the shop for repairs nearly 6 months earlier, where a connector backshell had been replaced prior to returning it to service. Forms indicated the appropriate functional checks were signed off, both after the in-shop repair and after the pylon was installed on the aircraft.

Although this mishap held great potential for being much more serious, we were lucky that it wasn't. Reminder: Tech data is written to ensure equipment operates as designed, but unless strictly adhered to, potentially deadly mishaps *will* occur.

ce Matters

It's Only Routine

LT MARK KANAKIS
Courtesy *Mech*, Jan-Feb 96

Sounds easy, doesn't it? Routine maintenance. No sweat, under control, everyday, been-there, done-that maintenance. Aircrews don't get hurt because of routine maintenance. We see slips and trips, eyes poked, cuts, burns, and bruises from human error, but endanger an aircrew? We have no critical parts to remove and replace, no functional check flights to sweat. What could happen?

Two airmen from my shop walked out to the wash rack to lube an aircraft. As Airmen Greaseman and Cleanup walked to the aircraft with a grease gun and a known number of rags, they decided to split the job. Cleanup started, but Greaseman got bored and left for a break.

The wash rack got too lonely for Cleanup after a while, so he laid down his grease gun for a coffee break. Greaseman returned and didn't find the grease gun, so he got another gun and started working.

Cleanup returned from the coffee mess and was impressed with Greaseman's initiative in doing the lion's share of the work. Cleanup left the scene again to get petty officer (PO) Eyeball to inspect the work. While Eyeball inspected Greaseman's portion of the job, maintenance control interrupted and sent him to troubleshoot a turning aircraft.

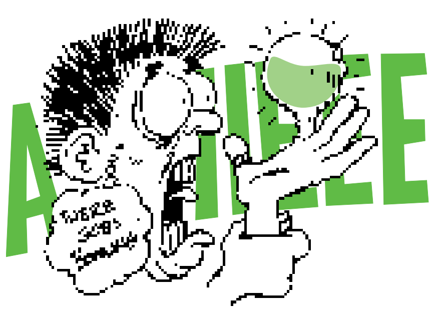
Later that evening, PO Eyeball returned to the shop to find Airmen Greaseman and Cleanup awaiting their next assignment. He made sure someone put the grease gun away and counted the used rags. Then they moved the aircraft to the flightline for the next day's launch. A plane captain, Airman Catchall, did a daily and turnaround inspection.

The next morning, Lt Doublecheck found a grease gun in a flight-control compartment during his preflight inspection—the last chance to prevent a mishap worked.

Four people screwed up doing routine maintenance. Where was the tool-control program during this simple lube job? Airmen Greaseman and Cleanup showed poor coordination, no attention to detail, and didn't inventory their tools after the job. Their supervisor, PO Eyeball, didn't complete his inspection and glossed over the inventory at the end of his shift. The plane captain missed the grease gun during his inspection.

A worker signed the job complete. A collateral duty inspector signed the job inspected. A plane captain signed the daily and turnaround inspection. Shift change occurred with tools signed and accounted for. Maintenance Control released the aircraft safe for flight. Still, the danger from routine maintenance went undetected.

People make mistakes. How *safe* is your routine maintenance?



Safety Guard Didn't

The airman was preparing to cut a piece of stainless steel stock with the shop's power shear. He aligned the stock in the shear, stepped on the foot-actuated power switch to activate it, and the shear's stock brace promptly lowered—on one of his fingers.

Investigation determined that the safety guard on this piece of equipment had been *modified* at some time in the past—by person/persons unknown—and its bottom rail had been removed. It was obvious to those investigating that this "mod" was done with skill and pride, because the area was smoothly machined and painted so well that the guard looked "original." Unfortunately, this mod also allowed fingers to come dangerously close to moving parts, and as a result, a young airman lost a fingernail and the tip of one finger. Even though he might disagree, the mishap could have been much more serious.

Reminder: A periodic inspection presents a great opportunity for thoroughly examining equipment condition while performing routine maintenance. But forcing yourself to look the equipment over as if it's the first time you've seen it, even though you've "been there, done that" several times before, may uncover hidden hazards. The shop had owned this shear for 7 years before the undetected hazardous condition made itself known. ✈

What Can Be Said About Comfort?

LCDR MARK WILCOX
NAS Whidbey Island, Washington

Finally a good deal! After enduring the fear of numerous FAM, bombing and ACM hops with fresh-from-the-training-command CAT I pilots, I was finally scheduled with a CAT II department head. Although there was a lot to do on this particular flight, I was much more comfortable being with a guy who had logged over 1,000 hours instead of the usual student experience level of 50 to 80 hours. But in spite of my newfound satisfaction, I was quickly reminded once again that being "comfortable" was something to be wary of.

Following a thorough briefing and uneventful preflight, my flight taxied to the hold short. As usual, the tower pattern was clobbered, so we were anxious to get our clearance as quickly as possible and go. We were cleared to cross 32 L and hold short of 32 R.

After several minutes and a few holes I thought we could have squeezed into, the tower cleared us for takeoff on runway 32 R. The GCA traffic at 3 miles was *supposed* to land on Runway 32 L. I looked out to my right and saw the approach light of another Tomcat on GCA final. "No factor," I thought. "He's been cleared for the left runway."

As we were turning to line up with the runway centerline on the 32 R, I took one last look over my shoulder at the GCA traffic and was shocked by what I saw. I wondered if my eyes were deceiving me. Was that GCA traffic really lined up on our runway?

For clarification, I requested, "Tower, confirm the Tomcat on final is for the left." Tower replied that the traffic was cleared for the left runway. While I felt a little better, something told me to keep watching him anyway.

By this time, we were in position on the runway awaiting release. I was doing my patented RIO R2D2 impression, looking completely behind my jet at the rapidly approaching Tomcat. Things were happening fast now. Fortunately, I wasn't the only one concerned. Simultaneously, my pilot, the flight lead, the tower controller, and the jets in the hold short came to the same realization. The GCA traffic was indeed lined on our runway, rapidly approaching the "in close" position.

I asked tower again, much more frantically, "Tower, confirm the GCA traffic is for the left!" But realizing there was no time to wait for tower's response, I keyed my mic and screamed, "WAVE OFF! WAVE OFF!"

Of course, everyone knows GCA traffic isn't controlled on the tower frequency. So the Tomcat continued its approach, preparing to touch down on centerline, with a centered ball. The problem was the crew had still failed to notice that 120,000 pounds of Tomcat were sitting on the touchdown point. My mind was racing. *"Do I tell the pilot to put our jet in the grass? Do I tell him to taxi forward? Will he know what the heck I mean even if I do say something?"*

It didn't really matter, I suppose. The time for action had run out. Suddenly, and with a roar, the nose of the Tomcat rotated upward, and the jet began to climb. I guess the pilot was as frightened as I was since he wasted no time tapping his afterburners. I watched in horror as the jet passed some 20 feet above my head. "(Expletive!) That was close!!!" Amazingly, as quickly as it had started, it was over. And in no time at all we were en route to the working area.

After an otherwise uneventful flight, we took some time to debrief and discuss what had happened with the tower. There was confusion which ended with GCA giving the Tomcat clearance to land on the wrong runway. Tower could only concur and, like us, couldn't determine that the approaching F-14 was lined up on the wrong runway until it had reached the "in close" position.

I patted myself on the back for recognizing the im-

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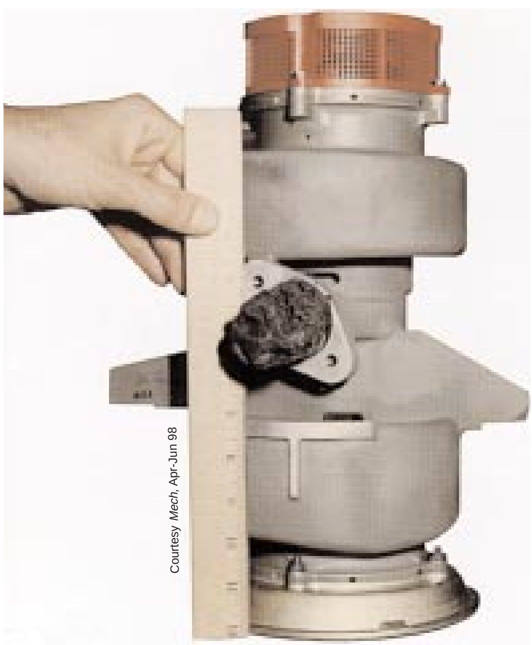
pending problem. But I slammed myself for not taking action more quickly. Any of us in the flight could have suggested we not take the runway if there was uncertainty about there being enough time to execute a proper takeoff. Moreover, when the problem became apparent, I should have been more assertive by giving directive instructions to the flight. I'm not exactly sure what I would have said, but something like "GUNFIGHTERS, TAXI INTO THE GRASS NOW!!!"

And what about Guard, or Air Force common, if you prefer? Tower claimed to have made several calls on Guard. Interestingly, neither my flight nor the approaching Tomcat heard anything. Is it possible that everyone flying in the immediate area that day may have deselected Guard because an ELT was jamming the frequency? How many times have any of us done that? How many times do we remember to reselect Guard when the comm jam ends?

This incident reinforces the old adage I first heard years ago in flight school—"Everyone is out to kill you." I can honestly say I now think about that tried-and-true piece of aviation wisdom very often. I also think about the guy who seemingly pops up out of nowhere while I'm at the top of my pop looking for the target, rolling into the groove, or joining on the tanker. So what can be said about comfort? Save comfort for the club. ✈

LCDR Wilcox flew with VF-101 at the time of this story. He later flew with VF-32 and is currently serving with the "Fighting Phoenix" of VAQ-128.

We Found Your Rag


Courtesy *Mech*, Apr-Jun 98

LT PAUL MACKLEY
Courtesy *Mech*, Apr-Jun 98

AD2 Luis Guerrero and ADAN Alexander Gutierrez troubleshot a complex fuel-transfer problem and found a rag jammed in No. 3 tank's engine-feed boost pump. The Hornet had been accepted by the squadron only a month before the incident.

The rag had twisted into the centrifugal section of the pump and could not be removed. We don't know where the rag came from because the logbook makes no mention of maintenance done in that area. Rags can travel throughout the fuel system until they lodge in a valve or a pump.

A pilot wrote a MAF (maintenance action form) that No. 1 fuel tank would not hot-refuel to full capacity. Since there were no other apparent fuel-transfer or flow problems, it wasn't a downing discrepancy. AD2 Guerrero and ADAN Gutierrez could find no failures in No. 1 tank, and it refueled to capacity with the engines shut down.

Further investigation revealed several seemingly unrelated maintenance codes dealing with the tank-pressure-interconnect valve and the boost pump in tank 3.

Maintenance on these components requires 100 man-hours, so the troubleshooters consulted a fuel system diagram to see if these components were causing the refueling problem. The fuel system diagram pointed to a possible relationship. If the boost pump in tank 3 failed, the tank-pressure-interconnect valve would remain open and cause all fuel to be fed to the engines from a single pump in the No. 2 fuel tank. In this situation, tank 1 would provide fuel to tank 2 at a much higher rate than normal. The transfer pumps do not operate without the engines turning, so this malfunction didn't appear during normal refueling. *Thorough troubleshooting prevented a possible mishap.*

Although a single transfer pump can feed both engines, that situation is a backup. If an emergency had forced the pilot to press the fire light on the starboard engine, both engines would have flamed out from fuel starvation. Pressing either fire light causes the crossfeed valve to shut, which was how the port engine was receiving fuel.

The pilot's gripe easily could have been signed off and the unrelated discrepancies deferred. ✈

BACK COVER CONTRIBUTING PHOTOGRAPHERS—counterclockwise from upper left: SrA Patty Zimmerman, MSgt Perry Heimer, SrA Jeffrey Allen, SrA Patty Zimmerman, SrA Jerry Morrison, SrA Patty Zimmerman, TSgt Billy Johnston, TSgt Lance Cheung. Background photo by SSgt Cary Humphries.

Rodeo '98 Highlights