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HUMAN FACTORS & LIFE SCIENCES

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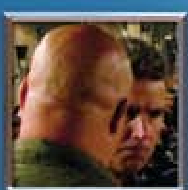

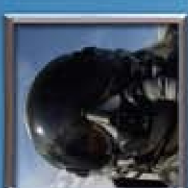

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U.S. AIR FORCE

JULY 2008, VOL 64 NO 7

"A man's got to know his limitations."

Probably one of the more popular movie quotes out there by Clint Eastwood, and it has a lot to do with this month's edition, focusing on Human Factors and Life Sciences. Historically, 60-80 percent of all Air Force mishaps involve human factors. What are human factors? The DoD defines Human Factors as a body of scientific facts about human characteristics. The term covers all biomedical and psychosocial considerations; it includes, but is not limited to, principles and applications in the areas of human engineering, personnel selection, training, life support, job performance aids, and human performance evaluation. Big definition, huh? In safety, we analyze and categorize our human errors through the science of human factors. Got it? Sure.

Moving back to smaller words to prevent headaches (mostly mine), this edition contains several examples of people being people and relaying their human errors; we hope the rest of us won't have to repeat them. It also has a few articles relating to our physical limitations — that's the Life Sciences part. As aircrew, we find ourselves working in extreme environments that the human wasn't designed for (very little oxygen, freezing to death, and being mentally limited by numerous Gs). It's in these environments that we rely heavily on our training and equipment to get us through the mission, as a few of the authors within found themselves doing. Hope you enjoy this edition and learn from a few of the stories on Human Factors and Life Sciences. Fly safe!

Safety Sage

DEPARTMENT OF THE AIR FORCE — THE CHIEF OF SAFETY, USAF

PURPOSE — *Flying Safety* is published monthly to promote aircraft mishap prevention. Facts, testimony, and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. The contents of this magazine are not directive and should not be construed as instructions, technical orders, or directives unless so stated. SUBSCRIPTIONS — For sale by the Superintendent of Documents, PO Box 371954, Pittsburgh PA 15250-7954. REPRINTS — Air Force organizations may reprint articles from Flying Safety without further authorization. Non-Air Force organizations must advise the Managing Editor of the intended use of the material prior to reprinting. Such action will ensure complete accuracy of material amended in light of most recent developments.

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What Are "Human Factors"?

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How did that tool get in the aircraft intake? Why was that tire flat? How did that bomb fall off the forklift? How did you crash your car in broad daylight? Why did you land short? How could you be so human? According to Air Force Safety Center analysis, human factors are the cause of 60-80 percent of accidents in a complex system. But what are human factors?

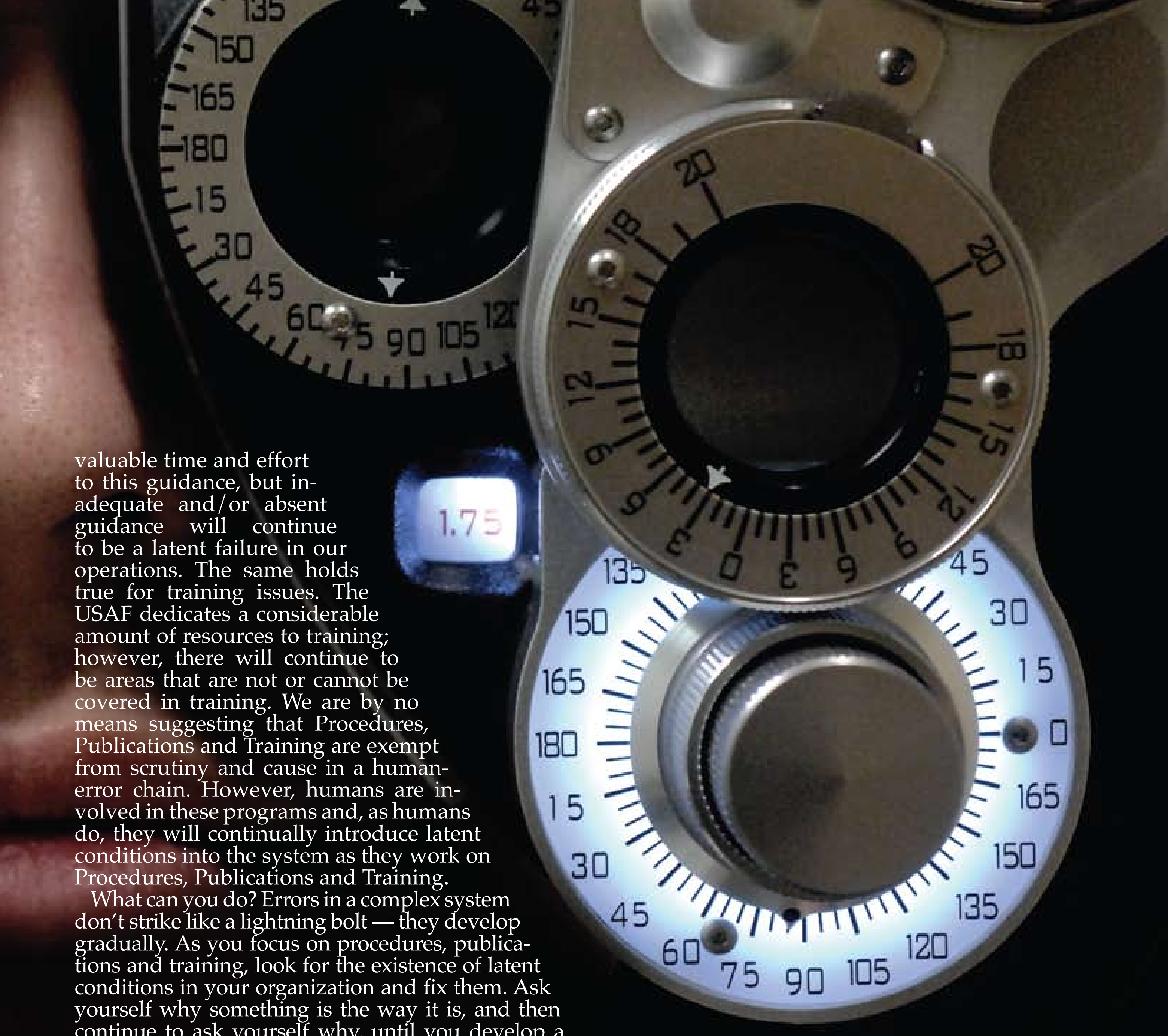
Human factors are scientific facts about human characteristics. The term covers all biomedical and psychosocial considerations. In other words, the brain, the body, and stuff we humans use. Human factors allow us to look at not just individual human failures, but the failures in the systems that humans design, build, operate and maintain. When we hear of a mishap, we often ask the question, "How could that person have been such an idiot?" However, human beings, even well-intentioned ones, will invariably make errors in a complex system. Most, if not all, the work we do in the U.S. Air Force is considered working in complex systems. Humans make errors — that is a fact. We cannot change that condition. Humans will continue to get distracted, have a finite attention span, get tired, be confused and have fluctuations in motivation. We can change the conditions in which humans work, though. By better understanding how mishaps in complex systems occur, we can better change these conditions to prevent future mishaps.

Mishaps are rarely attributed to a single cause, or in most instances, even to a single individual. Latent failures are errors in the design, organization, acquisition or training that leads to operator errors, and whose effects typically lie dormant in the system for long periods. For example, if a major command or a wing fails to supplement instructions based on the publication of a significantly revised Air Force instruction, the troops may not receive the training requirements specified in the revised AFI. Viewed from this perspective, the actions of individuals are the end result of a chain of factors originating in other parts (often the upper echelons) of the organization. The problem is that these latent failures or conditions may lie dormant or undetected for a while before they manifest as mishaps.

In FY07 Class A Aviation mishaps, we continued to see the presence of Procedures, Publications and Training issues. Procedures and Publications will never be perfect. Competent members of the USAF and supporting agencies will continue to dedicate valuable time and effort to this guidance, but inadequate and/or absent guidance will continue to be a latent failure in our operations. The same holds true for training issues. The USAF dedicates a considerable amount of resources to training; however, there will continue to be areas that are not or cannot be covered in training. We are by no means suggesting that Procedures, Publications and Training are exempt from scrutiny and cause in a human-error chain. However, humans are involved in these programs and, as humans do, they will continually introduce latent conditions into the system as they work on Procedures, Publications and Training.

What can you do? Errors in a complex system don't strike like a lightning bolt — they develop gradually. As you focus on procedures, publications and training, look for the existence of latent conditions in your organization and fix them. Ask yourself why something is the way it is, and then continue to ask yourself why, until you develop a prudent answer. When you set out to change something, pay attention to what you want to remain unchanged. Change often has a domino effect and influences things we intended to remain unchanged.

When an accident occurs, the human is the final link in the chain. The human is generally the final domino that allows latent conditions to culminate in an active failure. "Active Failures" are the actions or inactions of operators that are believed to cause the mishap. These failures are related to the broader categories like Procedures, Publications and Training mentioned above, and are also related to preconditions that exist in a system. Preconditions can be related to the environment in which people operate or related to how they function. Humans get tired, need to eat, have communication and learning issues, have physiological responses to environmental conditions, and have attention-management problems. Mishaps, whether they are



U.S. Air Force Photo by Abner Guzman

flight or ground, continually have some form of attention-management problems. We continually see attention-management problems like Channelized Attention, Task Oversaturation and Confusion. Attention management problems were cited in 50 percent of the Class A Aviation mishaps for FY07. You are a human, and these attention management problems are part of the package. We will continue to have these problems, but must also continue to combat these problems. When you attempt to delete a file on your computer and popup windows say, "Hey dummy, are you sure you want to delete this?," we are combating attention-management issues. Designers attempt to integrate this into the development of a system to help you, the operator, function better. But what can you do? Increased understanding of these factors can help you per-

U. S. Navy Photo by MC2(AW) Kitt Amaritnant

form better and prevent human error. Understanding these issues and how they can affect you and your environment will help prevent human error. Self-analyze your operations and take action. Do you find yourself less attentive after lunch? Have someone double-check your work. Do you get overwhelmed in certain situations? Take a look at these operations and understand the circumstances that lead to you becoming overwhelmed. The bottom line is to understand the situations in which your attention-management limitations led to errors, and in most instances, these are Judgment and Decision-Making errors.

The conditions described above weigh on your judgment and decision-making, generally the final link before an accident. Judgment and decision-making errors were present in 55 percent of FY07 Aviation Class A mishaps. Four-wheel private motor vehicle accidents generally result from the decision to speed, and two-wheel private motor vehicle accidents generally result from judgment when negotiating a turn. Be aware of operational risk management. The steps of ORM are not new to the human factors community, because they are general steps that all humans use when trying to reason or think through a situation. Whether you're walking to the dining facility, driving to work, carrying your toolbox on the flight line, or engaged in combat operations, you're constantly assessing the hazards in your environment and making decisions and judgment based on these hazards. Sometimes, you make the wrong decision, leading to an error. The error may not cause an accident, and then you reassess the situation based on this error and the current hazards, and make a new decision. The key to this process is to truly understand the hazards and errors that drive your decisions and judgments, and to manage them properly.

Comprehending how all these functions link up to create errors that lead to accidents is to fully appreciate Human Factors. The Procedures, Publications and Training provided by an organization and managed by supervisors, coupled with the preconditions that exist in our environment and are conditions of us as humans, all link together when we make decisions and judgment calls. Understanding these relationships and the hazards and errors present in your operation can help you manage your performance and prevent an accident.

Human-error management is a complex subject and cannot be fully described here, but this article can provide some key takeaway information. (1) When thinking in terms of mishap prevention, we should not think of why the error occurred, but why it failed to be corrected in the first place. We should ask, "What did I do or not do that could have prevented this mishap?" (2) Rules are good. It's your responsibility to ensure, first and foremost, that rules are valid, that they are followed, and people are held accountable for not following the rules. If the rule is not smart, then use the appropriate avenue to change the rule. (3) Go to http://afsafety.af.mil/SEF/SEFL_home.shtml and educate yourself on the DoD Human Factors Analysis and Classification System (DoD HFACS), the taxonomy we use to investigate the human factors present in mishaps. Remember: you are the Human Factor!

When Was Your Last PRICE Check?

Anonymous

U. S. Air Force Photo by Master Sgt. John E. Lasky

On any day at any undergraduate pilot training wing, a T-37 student pilot and his instructor pilot brief a regular contact sortie. During ground operations, the student pilot performs the oxygen-regulator check and recognizes some irregularity with his oxygen supply. It seems to him that he has low air flow with the regulator set to oxygen 100 percent. After some rudimentary maintenance on his oxygen regulator performed by the crew chief, the trainee assesses the regulator air flow to be normal. The crew believes the malfunction has been alleviated and elects to continue with the mission. The following ground ops proceed uneventfully. The crew completes pattern training at the home field and enters the military operating area for aerobatic and spin training. The student pilot flies the G-awareness turn, obtaining 4.2 G, and performs a good anti-G straining maneuver, lasting four breathing cycles. After completing spin training, he starts to feel nauseated and selects oxygen 100 percent to prevent air sickness. In turn, the student continues with the profile and gets ready to set up for a loop. He accelerates to 270 knots and initiates a 4.5 G pull up. About 45 degrees into the maneuver, the instructor pilot notices the student pilot stopped pulling back on his stick. Initially, the instructor assumes his trainee is feeling air sick again and resumes controls. He initiates a nose-high recovery and returns the aircraft to straight-and-level fight.

The instructor pilot then recognizes that his student had a G-induced loss of consciousness. The student pilot regained consciousness within five seconds and coherency within 20 seconds. After declaring a physiological emergency, the instructor pilot started back to base. Passing 6,500 feet above mean sea level, the trainee started to experience hypoxia symptoms. The instructor directed him to go 100 percent oxygen. The student pilot, already in 100 percent oxygen, said he wasn't getting enough airflow, and was then directed by the instructor pilot to pull his emergency oxygen-cylinder handle. The instructor pilot continued to recover the aircraft by a straight-in approach and landing. The crew was met at the end of the runway by the flight surgeon. After exiting the aircraft, the student-pilot oxygen regulator still had sufficient oxygen, according to the oxygen pressure gauge.

During the bench test performed by local maintenance, the regulator failed, due to low flow in the diluter setting 100 percent oxygen. The oxygen regulator was then sent off to depot for further investigation. The age of the regulator was estimated at 10-12 years. The exterior showed signs of heavy wear and was extremely dirty. The overall condition of the regulator was poor. It failed all leak tests in emergency and test-mask position. The oxygen ration test couldn't be accomplished due to the condition of the regulator. The regulator was further tested on a field tester and failed there, as well. The interior was described as "extremely dirty" — so dirty that it caused the regulator to leak and prevented the diluter aneroid to seal properly. You think that difficulties breathing may lower your G tolerance?

A couple of days later, during a solo contact sortie, a student pilot performing an ops check in the MOA found that the regulator blinker wasn't functioning correctly. A great job performing a good ops check, but then the student pilot elected to maintain 12,000 feet MSL while troubleshooting the problem, rather than descending to a lower altitude where supplemental oxygen is not required. As a reminder for those who don't remember the days back in UPT or who have trained in the T-6, the unpressurized cockpit of a T-37 "Tweet" 12,000 feet MSL equals 12,000 feet cockpit pressure altitude. Luckily, the student pilot didn't experience symptoms of hypoxia and recovered the aircraft to home base without further problems.

Over three months, besides the described GLOC, the wing experienced two hypoxia incidents and two cases of decompression-sickness symptoms. In all these cases, the aircraft oxygen regulators were found to be at fault or to have contributed to the incident.

The oxygen regulator is a fly-to-fail component in the aircraft. All the incidents have been in the unpressurized T-37, but that doesn't mean other aircraft are not susceptible.

The first defense against this problem is a good PRICE check. During ops checks, make sure your oxygen system is performing as required. Just going through the motions without a thorough check of the system is asking for trouble.

U.S. Air Force Photo by MSgt. Andy Dunaway

Pressure — The regulator pressure gauge should indicate system full and agree with the other regulator pressure gauge.

Regulator — Check the regulator "ON" and the diluter lever in 100 percent oxygen. Hook up your mask, select "Emergency" and perform a pressure check for mask or hose leakage. If you have trouble exhaling with the emergency lever back in "Normal," the mask's valve has a defect. The last step is to select 100 percent oxygen and place the supply lever to "OFF." If you can draw air through your mask, your regulator's diluter lever valve, the oxygen hose or a connection is at fault.

Indicator — With the diluter lever in 100 percent oxygen, check blinker for normal operations. Also, check for a seal.

Connections — Check the general condition of your oxygen hose (no kinks, cuts or fraying). Quick disconnect is not warped and the rubber gasket in place. A 10-12 lb pull should disconnect the two parts. Finally, check that the mask hose is properly connected to the regulator.

Emergency — Check that the emergency oxygen cylinder is properly connected. During parachute pre-flight, check the cylinder pressure gauge.

All these incidents could have been avoided with good PRICE checks. When an oxygen-system problem is suspected or known, gang-load the regulator and start a descent below 10,000 feet MSL while flying back to base. If needed, disconnect from system oxygen and pull the green apple.

If you suspect hypoxia symptoms, unusual joint pains or mental confusion (not the standard student type), select 100 percent oxygen and descend. Declare physiological emergency so medical personnel will be there to meet you on the ground. Once you're on 100 percent oxygen, stay on it until medical personnel say otherwise. This can mean the difference between a short trip to the flight surgeon's office and five to six hours in a dive chamber downtown.

PRICE checks and awareness will help to minimize potential physiological problems. Contact your Life Support shop if you have further questions.

Human Factors
Remembering The Basics

Anonymous

In this world of ever-increasing technology, planes are becoming more advanced. Analog gauges are being replaced with digital systems that can do just about everything but fly the plane for you. With these newer hi-tech aircraft, it's important to remember the basics of flying to ensure a safe flight.

Growing up flying civilian aircraft, I remember the days when if a plane had the standard six instruments and a nav/comm panel, you really had something. But today's aircraft are equipped with sophisticated avionics and safety systems, such as the BRS parachute. Civilian aircraft manufacturer Cirrus Aviation is one example of a new era in aircraft. The aircraft's interior is modeled after the inside of a Lexus. It's roomy, with a side-stick controller and a well-thought-out layout. It has a full array of avionics that feeds into a few multi-function displays. You can get weather info, map data, approach-plate info and even radar info, if so equipped. With its three-axis autopilot, it easily cruises at 150 knots and is all-weather capable. At roughly $500,000, it fits the budget of lawyers, doctors and executives nicely, and is very easy for them to fly.

Herein lies a problem. Because these next-generation airplanes are so easy to fly, some pilots forget about the basics. They're more worried about scud-running under the weather to make their sons' hockey game than they are about filing a flight plan or checking the weather. The result is a crash that kills two hockey dads. Others think that the plane is capable of climbing 12,000-foot mountains at 1500 fpm. The result is a crash that kills one. Still others deal with engine problems and don't employ the parachute that the Cirrus aircraft has. They try to dead-stick the aircraft in somewhere. The results are multiple crashes killing several. These pilots are dying because they're getting caught up in automation and forgetting about the basics. Instead of using technology as a tool, some of today's pilots have come to rely on it.

What can we do? First, start by being mentally prepared. Whether they have 40 hours or 35,000


U.S. Air Force Photo by Tech. Sgt. Andy Dunaway

hours, pilots must be mentally ready to fly. That means getting adequate rest and eating right before they fly. It also means concentrating on the flight and not problems they have at the office or home. It means not getting complacent, which can happen to the best of us at the worst possible times.

Second, good pilots are well-prepared and proficient. They thoroughly check the weather before flying. They check NOTAMs at several airports along their route. They know the route from point A to B, and are familiar with all the obstructions and divert fields along the way. They file a flight plan and remember to activate and close it. They know the terrain they'll be flying over and bring the proper survival equipment should problems arise. They also practice and study.

Third, good pilots perform a thorough pre-flight of the aircraft. They ensure all fluids are ready to go and have enough gas, with reserves, to make it to their destination. They know their aircraft and all the particulars associated with them. They won't take the aircraft until they're sure it's safe for flight.

Fourth, good pilots must know their limitations. Back in 1996, I remember flight-instructing at a local FBO. A young pilot walked in, working on his instrument rating. He wanted to rent a Piper Seminole to fly to Aspen with his girlfriend. Our manager wanted to have his business but couldn't rent him the aircraft, because he didn't meet the total time requirements and didn't have his instrument rating. Being from a well-to-do family from Calif., he bought a Piper Aerostar, a high-performance twin-engine civilian aircraft that can be challenging to fly if problems arise. The VFR pilot flew to Aspen with his girlfriend and her three kids. After a week of skiing, they were ready to return home. They loaded up the Aerostar and were ready for takeoff. Tower advised that the weather was less than 200/1. The pilot decided he was going to depart anyway, and a minute after takeoff, his communications with Aspen tower ended. Searchers found the wreckage a day later. He had flown himself and the four passengers into the side of a mountain, killing all. Was this preventable? A case of get-home-itis? It certainly was a case of bad judgment.

Fifth, good pilots must maintain situational awareness at all times, which is having an awareness of what's happening in the environment around you. It could be something as simple as knowing where your turn point is on a route before you get to it, or it could be as complex as keeping track of a USAF 60-ship strike package when you're the mission commander. Whatever the situation, you need to be prepared and think ahead of the aircraft. If you find yourself bored while flying, you may be missing something and might want to rethink your situation. You never know when something could happen, and you must be prepared to handle it.

The basic principles of airmanship apply to all flying careers. Today's modern airliner is very much automated. It's widely accepted and taught that the autopilot can fly the plane better than the pilot, and its use is encouraged, if not mandatory. Pilots must remember that it's just a tool to help fly the airplane and isn't meant to take the place of good airmanship and judgment. The military's mission and modern aircraft are full of advanced technology that can sometimes leave a pilot task-saturated with a complete loss of SA. Remember to use the technology as a tool, but don't let it overwhelm you. If something doesn't look or feel right, then it's probably not right. Fly the airplane first and use your resources. You may also want to get another opinion; it may be the person next to you or another flight member who can re-cage your cranium.

Whether flying a Cessna 172, C-5, or anything in between, pilots must remember basic airmanship when it comes to flying. Don't let today's hi-tech, semi-automated aircraft make all your decisions. Be prepared, keep your SA high, and fly safe. ✈

Insidious Decompression

Capt. John M. Boos
20th Bomb Squadron
Barksdale AFB, La.

The sortie started out as your average training mission. It was a normal weekday at the 20th Bomb Squadron, Barksdale AFB, in the battle-tested B-52H. We thoroughly briefed the mission the day before, ensuring all the paperwork was accomplished. The mission would take us to Lancer ATCCA for simulated weapons-activity training for an hour and a half, then off to rendezvous with a tanker for some aerial-refueling training, ending with us back home to beat up the pattern for a bit. A little non-standard was that we would be flying with the vice wing commander, who was a radar navigator by trade, and it was also going to be a night sortie.

We assembled at the squadron's front desk, where we exchanged paperwork with the duty dogs and received our step briefing. The bus got us to our jet with time for ground ops and on-time takeoff. During engine start, we had some mechanical issues, which ended up causing us to depart late. It wasn't a big deal, because we were scheduled for an hour and a half in the area and had some make-up time. The delay only cost us 30 minutes. The plan was to go into the area, do a couple of maneuvering gravity-bomb runs, and follow up with some simulated JDAM/CAS work.

The wing vice CC and I decided we would split seat time in the area. I had the radar navigator seat from takeoff until the first two gravity runs, and then I would turn it over to him for a gravity run and the JDAM/CAS work. I'd be playing the role of the joint terminal air controller, and had worked up challenging targets for the crew. The first series of targets I passed the crew was a multi-target run, which would require a max bank turn after the first weapon release to avoid the simulated threat, and achieve Launch Acceptability Region for the second weapon release. I passed the crew the target set, and they went to work on prosecuting the targets. During all of this, I was sitting in the instructor navigator seat, and it is a dark cockpit at night. The IN seat is on the lower deck of the BUFF, right above the crew-entrance hatch, surrounded by avionics gear, and the wonderful urinal tucked in the corner. I would have to compare it to sitting in a dark, noisy, smelly corner.

The crew did a great job taking the target information and other external information, and came up with a plan of attack. We made our push to the first of two targets, and everyone's full attention was on the task at hand. We struck our first target and then made a hard-break turn for target No. 2. In the turn, I started to feel a little short of breath; my view of the offense compartment started to go blurry. I convinced myself it was because of where I was sitting and that the hard turn was making my breathing a little shallow. After we rolled out, I was still feeling a little short of breath and having to breathe harder. We were about a minute out from

U. S. Air Force Photo by Senior Master Sgt. John Rohrer

releasing on the second target when the AC spoke up and asked if anyone else was feeling weird. He instinctively looked up at the cabin pressure gauge and realized the cabin pressure was climbing to meet us at FL340. He immediately called center for an emergency descent to FL180 and ordered the crew on 100 percent oxygen. The cabin pressure ended up meeting the aircraft altimeter at FL260 on our way down to FL180. Everyone got up on oxygen in a timely manner, and we decided it would be a good time to take the jet home. We stayed on oxygen all the way. The flight doc met us at the jet and gave us the OK to come off of O2 after checking us for signs of decompression sickness.

Several different issues came into play with this incident. The biggest was the decompression of the aircraft. This was not a rapid decompression, but an insidious decompression — one that, in my mind, is much more dangerous. Being in the middle of a weapon run had caused the whole crew to have some form of channelized attention. The problem could not have happened at a more inopportune time in the sortie. The pilot asked if anyone had been feeling a little weird before we realized the problem. After we leveled off and talked about it, all crew members admitted they felt a little off before the pilot spoke up. This led me to wonder — if the pilot hadn't spoken up, would anyone have? I convinced myself the reasons I was feeling off was because I was sitting in the dark and we were in a max-bank turn, although the symptoms I felt were the same hypoxia symptoms I'd experienced in the chamber during physiological training. After all, although not an excuse, we only get chamber training once every five years. The symptoms are something, as aviators, we should be looking out for at all times. Something as small as insidious decompression is just waiting to rear its ugly head when we least expect it. Often, these small things can be fatal if not recognized and dealt with in the ways we're trained. That's why all our training as aircrews is so important. It can and will save our life and the lives of those flying with us, as long as we fall back on our training.

Because we survived that incident to train and fight another day, I took away some valuable lessons from that sortie. The first is to speak up if you're not feeling quite right about something. You may not have all the information at your disposal, but you may clue someone else in to something that's going on, putting a stop to the chain of events leading somewhere you don't want to go. The other lesson I learned is to always fall back on your training. The Air Force spends a lot of money to train crew members so we can go out there and perform our jobs effectively and safely. The reason for our decompression issue was due to a failed part. These things will happen, and aviators must be prepared to deal with them correctly by using our training and constantly having our head on a swivel. Your life and those you fly with might just depend on it.

A Lesson In Spatial Disorientation

Capt. Travis Higbee
35th Fighter Wing
Misawa AB, Japan

U.S. Air Force photo by Tech. Sgt. Wolfram M. Stumpf

There I was, descending from 4,000 to 2,000 feet above the ocean's surface in 30 degrees of left bank, turning from the 15 DME arc to final on the HI-ILS 28 penetration into Misawa AB, Japan. I was also letting the jet slow from 300 to 250 KIAS as I made the turn. This was my first instrument check in the F-16CJ since my FTU training at Kelly AFB a year and a half ago. I hadn't flown a sortie before this one in two solid weeks, due to poor weather, but all my currencies were good, and I felt confident I could handle it.

The radio crackled. "Fang 22 with chase, Misawa approach, you're cleared ILS approach 28 at Misawa. Call the final approach fix." The thick Japanese-accented controller's voice was decently clear today. Some days they can be difficult to understand, but today I was in luck.

"Fang 22, cleared ILS 28, WILCO," I replied.

The weather was the typical Misawa rain clouds from 500 feet AGL to infinity, with an occasional broken deck of clear airspace. The clouds were especially dense today, and as I roamed around in them, I couldn't remember the last time I'd seen a visible horizon. My poor chase-ship was tucked in really close to prevent going "lost wingman," and he did his best to monitor my actions, which wasn't much because he had to fly so close to me. I was fully on the gauges, being smooth with control inputs to help out my wingman and praying I wouldn't do something stupid to hook my check ride. Suddenly, I realized my ears and my eyes weren't agreeing with each other on the spatial orientation of my aircraft. Left bank felt like level; up felt like down. My hand grew heavy as it tried to apply maneuvers my eyes were telling me were incorrect. In my mind's eye, with the ocean's surface growing quickly closer, the situation rapidly became very serious!

Somewhere back in my UPT days, an instructor once told me that you have three bags you carry with you every time you fly. Each one is filled with a different, yet essential item. The first bag is skill – your personal capacity, whether genetic or learned, to fly an aircraft (your stick-and-rudder skills). The second is experience – all the wiles that time has taught you (that whole "something ain't right here" feeling). The third is plain old dumb luck (that "Wow, I'm glad that didn't happen!" thing). The idea behind these three bags is simple: put enough in your skill and experience bag that you'll never have to reach into your luck bag. You see, the luck bag is hard to keep full, and you never know when you'll find it empty. Thus the old adage, "A crash is when you run out of altitude, airspeed, good ideas and luck — all at the same time!" My IP's instructional words, given so many years before, must have etched themselves well enough onto my small 250 megabyte brain that my thoughts now turned to that little nugget of wisdom, as if to find a ray of sun on a cloudy day.

Flashback to training … I'm no stranger to instrument flying. As FAIP at Vance, I spent hundreds of hours in the weather, many of them solo. I've felt the effects of spatial disorientation and have overcome it countless times. I've seen the effects of spatial disorientation on many students, and have instructed on its dangers, how to identify it, and how to overcome it. Notwithstanding this, I have one experience that dwarfs all my experiences with special disorientation.

When I was flying T-38As in UPT in November 2001, my instructor and I were taking off on my last T-38 ride of the course. It was an 87 ride that I needed to complete the required number of hours in the program. We were flying the departure on a round-robin out of Vance AFB, headed down to Oklahoma City to shoot an ILS or two before returning home. The weather was very cloudy and rainy with a few thunderstorms developing and dissipating throughout the area, which was standard for Oklahoma. As we leveled off at 10,000 feet MSL between two decks of clouds that completely obscured the sky and the ground, but left us in a small layer of clear airspace, I realized I'd completely lost track of which way was up. I felt like I was upside down! The eyes and ears were in total disagreement. I fought to keep the jet upright. My hands instinctively wanted to roll the jet over without my consent. It took every ounce of concentration I had to not do what my gauges said could kill me – roll inverted. The Giant Hand syndrome set in. I trimmed the best I could and then loosened my grip on the stick. With my hand an inch away from the controls, I physically couldn't roll the jet over. I said to my instructor over the intercom, "I'm really spatially D'd right now; it feels like I'm upside down. I think you should take the jet." The response was less than reassuring. "I'm not any better than you are!" I later found out in the debrief that sitting in the back seat had spatially disoriented my instructor worse than me. Great, now it was up to me. I had to fight through it. Training rushed to mind. Fly the plane first! I ignored every radio call made over the next 15-30 seconds. Luckily, none were for us. I stared at the attitude indicator like it was the prettiest supermodel I had ever seen. To keep from losing altitude, I had to keep my pitch neutral. I had to kill any VVI. I set the power to a known RPM to keep the airspeed constant. I had to keep those stubby wings upright! I had to keep everything constant and wait. Wait for the brain to re-cage itself. Miraculously, at the time, it worked. Suddenly, my mind flipped everything right side up again, and I was on my merry way, as if nothing had happened. But something had happened. I had added a vital piece of wisdom to my bag of experience.

Back to today … I swooped down over the Pacific Ocean in one of the world's premier spatial-disorientation machines (the F-16), turning, decelerating, configuring, checking radar, talking on radios, and doing it all in the weather at 2,000 feet above the absolute floor. I realized I was completely disoriented. Up felt like down, and left felt like level. Today, however, I didn't have to reach into my bag of luck. Instead, I reached into my bag of experience and pulled out the ray of light on a cloudy day. When faced with seemingly incapacitating spatial disorientation, get the nose up to the horizon (which felt like I was pulling down toward the ocean's surface) and keep airspeed and altitude constant, then sit and stare at the attitude indicator and let the mind figure it out. I pulled back on the stick and added power to keep the airspeed constant. I pinned the attitude indicator center dot above the horizon and cross-checked that my VVI was zero and my airspeed was steady. I then began the nerve-wracking task of waiting. Seconds seem like eternity. The Heavy Hand syndrome was so strong that I was unable to get the jet out of 30 degrees of bank, but that didn't matter. I had lots of room to turn over the Pacific Ocean, but not a lot of altitude to lose. I turned at 20-30 degrees, but the airspeed and the altitude stayed constant. About 20 seconds later, my mind re-caged. I made a turn back to final without incident. I had eluded disaster. Thoughtfully pondering what my instructor had told me so long ago, I gratefully placed yet another piece of wisdom into my bag of experience.

Are you aware of yo

U. S. Air Force Photo by Maaster Sgt. Connie Reed

our Human Factors?

Battling The Fatigue Dragon

Master Sgt. Bradley Tucker
435th Aeromedical Squadron
Ramstein AB, Germany

U. S. Air Force Photo by Airman First Class Gary M. Edwards Jr.
Illustration/Photo Illustration by Dan Harman

Fatigue continues to be a human factors threat to our flight and ground crews. Several mishaps have cited it as a causal factor during both flight and ground safety mishaps. We also need to consider the near-misses that that could have ended in tragedy if not for someone's timely intervention, or just sheer luck. The threat of fatigue is something we're aware of, but sometimes don't manage as well as we could, because we have an overriding sense to get the mission done. Unfortunately, we can't measure someone's fatigue level, so we have to rely on the individual and wingmen to recognize when fatigue has degraded the ability to safely perform the mission. The key to combating fatigue is to manage and prevent it; however, in the following story, I failed to do both. I'm not proud of the incident, but I know it occurs quite often in our Air Force with the increased ops tempo and reduced troop strengths — working harder, longer.

During a deployment to Southeast Asia, I found myself battling extreme fatigue. The deployment started as all others, with a long flight across the pond, so I resorted to a good habit that had helped me during many deployments: stay awake until I arrived in theater and then go to sleep as soon as possible to combat fatigue from the time change and jet lag. Upon arrival at the squadron, I soon realized that I would be working the graveyard shift, and my plan to get some much-needed sleep had been derailed. Being a hardened warrior as we all are, I fell into the misconception that I could just push through and get the mission accomplished, so I began performing my duties around 9 p.m. We had an uneventful launch, and all was going well, until 1 a.m. when the Fatigue Dragon began to creep up. I quickly decided to resolve this problem with a hot pot of java, which gave me a short-lived solution, until 3 a.m. when I began to find myself mentally checking out when accomplishing the simplest of tasks. My two technicians were taking a power nap, so I took a walk up to the ops office to engage in some friendly conversion with the ops officers to stimulate my brain. The officers had taken the same approach to fatigue: one was up and the rest were hard asleep. After a few minutes of small talk, I was back in the shop and made a critical mistake of lying down in a recliner, which put me to sleep almost immediately. After being awakened by someone tapping me on the shoulder, I soon realized it was the pilot I was charged to recover. Fortunately for me, he seemed to take the approach of "No Harm – No Foul," since the technicians were there for the recovery and all went well.

The point to this story is that fatigue is a human factors threat, and we need to educate the flight crews and the ground crews that support them. Here is some information you can use to help prevent, recognize and fight the Fatigue Dragon:

Sleeping Suggestions

On average, most individuals need 7-8 hours of sleep each night. The following recommendations can help improve both the length and quality of your sleep:

• Maintain a zero-balance sleep debt; recent studies have shown you can make up for lost sleep
• Avoid alcohol starting six hours before bed
• Avoid stimulants, such as coffee, chocolate, or soft drinks, starting six hours before bed
• Don't take medicine that may disturb sleep, i.e., aspirin or ibuprofen
• Maintain good physical fitness
• Eat complex carbohydrates for dinner (pastas, potatoes, breads); avoid large meals within three hours of bedtime
• Sleep in an environment optimal to sleeping — limit noise, seek a comfortable temperature, and darken the room. Cloth-covered light protectors and hearing protection may help

Staying Awake

The following techniques can make it easier to stay alert and productive:

• Move around to prevent your blood pressure and heart rate from falling too low; isometric exercises are effective if mobility is limited
• Expose yourself to sunlight or bright light. If you work in the dark, find a bright place for at least 30 minutes (also a great time to exercise or stretch to get the blood pumping)
• Sugary foods and drinks can give a boost, but should be consumed at 45-minute intervals to avoid "sugar crash" as taught in physiological classes
• Caffeine every 3-4 hours can help increase alertness; however, too much can cause stomach irritation and headaches; use it as a tool, not as a constant crutch. Also, keep in mind that it takes about 30 minutes for the effects of caffeine to kick in
• If you have 30-45 minutes available, take a nap

Napping Techniques

• Naps are an excellent way to "make up" for lost or inadequate sleep
• Must be approved by leadership and in compliance with guidance if naps are taken during duty hours or during flight for aircrew members
• Nap in a comfortable, dark, quiet environment to ensure better sleep quality
• Should not exceed 45 minutes to prevent reaching deeper stages of sleep, unless nap can last more than two hours
• Naps don't substitute for adequate rest, but they can help decrease your sleep debt

How to Survive Jet Lag

Jet lag is the common term used to describe the disruption of various cycles that control human body function. If you're exposed to a new time zone or a work shift change for less than five days, don't change your internal time clock. If you're exposed to a new time zone or a new work shift for more than five days, allow your internal clock to adjust to the new time zone. Some helpful hints:

• Ensure a good sleep environment
• Get as much morning sun as you can; light is a strong time setter
• Avoid caffeine, exercise and exposure to large amounts of sunlight within three hours before your sleep time, regardless of whether you're trying to sleep during the day or night
• Change the timing of your normal routines to correspond the new work schedule
• When all else fails, go see your flight docs for current policy on go/no-go pills; they're there to help you

The Four C's

Capt. Adam Ackerman
90th Space Wing
F. E. Warren AFB, Wyo.

I had recently been upgraded to aircraft commander during my first assignment. I was still the newest aircraft commander in the 1st Helicopter Squadron at Andrews Air Force Base, Md. It was a great feeling to know leadership now trusted me to maneuver a UH-1N Huey helicopter and command a crew of three (pilot, co-pilot, flight engineer) in the highly visible and security-restricted National Capitol Region. This area includes a great number of America's treasured buildings and monuments, and its security is vital to the government's continued operation. Helicopter flight provides a panoramic bird's-eye view of the lively District of Columbia and more than a few unique memories; however, I can no longer recall any details from the standard 2½ -hour helicopter flight that occurred just a couple of years ago. What I do remember are the events and lessons that followed. The sequence taught me that the responsibility of an aircraft commander extends beyond maneuvering an aircraft and managing a crew.

The flight itself was of the most popular flavor, vanilla. After shutdown, I remained strapped in and started to work on the aircraft forms while the flight engineer hopped out and began to walk around the helicopter and conduct the required postflight inspection. The crew chief met us at the aircraft and began his standard duties. About the time I finished the forms and was ready to help finish the postflight, the flight engineer told the crew chief and me that he had discovered some fuel on the deck of the No. 2 engine compartment. The puddle was a foot or two in diameter and definitely a concern for an aircraft the size of a Huey. We poked and prodded around looking for the source, and checked the general condition and security of everything in the compartment. After a few futile minutes, I returned to the forms to write up the leak. The crew and I then gathered our personal equipment and went inside to avoid interfering with maintenance and to finish our postflight duties.

A few minutes later, I received a page over the intercom from the Supervisor of Flying to report to the operations desk. I already knew what was

U. S. Air Force Photo by Capt. Adam Ackerman

coming (a maintenance ground run for the aircraft), so I grabbed my helmet and checklist on the way. The SOF delivered the expected news, and I went to the aircraft to meet the crew chief again. I conducted an extensive ground run with the crew chief, but there was no evidence of a fuel leak in the engine compartment during operation or postflight. I documented that no leak was discovered during the ground operations and returned the aircraft to maintenance. The end of the day was approaching, and I expected the leak to be investigated further, so I was shocked the next day to learn the same aircraft conducted a precautionary landing in the middle of downtown DC due to the smell of fuel in the cabin. No leak was discovered in the engine compartment, but maintenance eventually found the source in the compartment just forward of the engine that isn't examined during pre- or postflight. The fuel my crew observed the previous day was only what worked its way into the engine compartment during flight and didn't indicate the actual size of the leak.

When I heard the news, I felt a sinking feeling in my stomach, but luckily no damage or injury resulted from the leak during the flight. The full extent of my responsibility and mistakes became painfully clear. After the ground run on the previous day, I didn't intend for the aircraft to be returned to flight before fixing the hidden leak. I assumed this was implied to the crew chief in our conversation and wouldn't be passed to other maintainers as a problem that couldn't be replicated. Regardless, a large chunk of responsibility still rested on my shoulders since I filled out the events in the forms. First, maintainers, just like pilots, always prefer the opportunity to have face-to-face conversations about an aircraft with one another. It's important to realize the chance doesn't always exist, due to workloads and other external factors. It's also important to recognize human factor topics, such as "the strength of an idea" and "hidden agenda" don't only apply to people operating aircraft. While the tiny box in a 781 may be the only method of communication a maintainer or aircrew member receives, we hope it will be the most valuable one. I used to look at the forms as simply a place to write down problems for maintenance. However, now with each official write-up, I try to think about the "Four Cs:" Clear, Concise, Coherent and Consequences.

When I land, I'll be the first to admit I'm generally focused on either quickly emptying my bladder or filling my stomach, thus the readability of my penmanship often suffers like my organs. I have to force myself to focus on making a clear, legible write-up that won't be lost in translation. The write-up itself is important, but I think the biggest culprit is the name block. You never know when someone is going to have additional questions about a write-up for you.

Making write-ups concise saves the writer's ink and the reader's time. When I find myself with a relatively complex problem, I find two questions helpful in determining whether a write-up is concise. 1) Does maintenance need all this information to fix the problem? 2) Should this go as two separate write-ups?

Next, bullets and fragments can be coherent, but good grammar is a more dependable way to produce something understandable and easy to read. It is also crucial to use only the most commonly accepted abbreviations (e.g., ACFT, ENG, etc.), in order to correctly grasp the whole message.

Finally, I ask myself the consequences of my write-up, and whether it'll be helpful to others. While it's important to provide helpful information to fix the problem, maintenance should not be told how to fix the problem in the write-up. If a part is broken or missing, just put that, don't direct a repair or replacement. While repairs and replacements are expected outcomes, write-ups will also have the consequence of additional paperwork for the crew. If it's an unusual event or occurrence, see your neighborhood flight safety office for appropriate actions.

Life In The Fast Lane

Lt. Col. Ned Linch
12th Air Force
Davis-Monthan AFB, Ariz.
Capt. Lynn Lee
201st Airlift Squadron
Andrews AFB, Md.

High Ops Tempo?

Is the high ops tempo wearing you down with excessive fatigue? If so, this article is for you! Maybe it's time for you to personally manage your fatigue in the FAST lane.

Historically, 70-80 percent of mishaps occur due to pilot error, and fatigue has been a cause or significant contributor to about 20 percent of these mishaps. It's a fact … there's a direct link between fatigue and "task saturation, confusion and decision making/risk assessment," the three most common error-related human factors. With ops tempos and manning issues wearing our folks out, it's time we take a closer look at the *monster* we call fatigue.

Fatigue, resulting from sleep deprivation, disrupted circadian rhythm, and/or associated conditions, drives breakdowns in CRM, shortens attention spans, increases susceptibility to spatial disorientation, and causes deadly micro-sleep events in crews on final approach and landing. Yet, we routinely take off in the middle of the night and fly across the "pond," landing a complicated, multimillion dollar aircraft after barely staying awake all night, or we ineffectively shift flight schedules from day to night, causing excessive swings in circadian rhythms, increasing fatigue and the chances for a mishap.

Flying Drunk?

Did you know that you can get a free buzz from just staying up well past your normal bedtime? According to Dr. James C. Miller, a retired senior research scientist at the Air Force Research Laboratory, "16-17 hours of continuous wakefulness (a normal day) brings the average person to an approximate cognitive equivalency with having a 0.05 percent blood alcohol content, while 20 hours of continuous wakefulness brings the average person to an approximate cognitive equivalency with a 0.10 percent blood alcohol content." That's a free buzz!

This buzz may sound cool, but it isn't if you're flying. A recent mishap indicated the pilot was operating at the equivalent of .08 BAC when he took off for a five-hour mission. You need to take personal responsibility to ensure you're not

Personally Managing Fatigue

U. S. Air Force Photo

fatigued to a level equivalent to "flying drunk."

FAST

FAST is the acronym for Fatigue Avoidance Scheduling Tool, an Air Force Research Lab-validated, Windows-based scientific tool, which predicts pilot performance due to fatigue. At the heart of the tool is a highly researched and recognized model of human sleep and its relationship to cognitive performance, based on 20 years of sleep and circadian-rhythm research. FAST is a proactive, rather than reactive, approach to fatigue monitoring, allowing the military flight planner and pilot the chance to consider the lessons of sleep and performance research when planning flying operations.

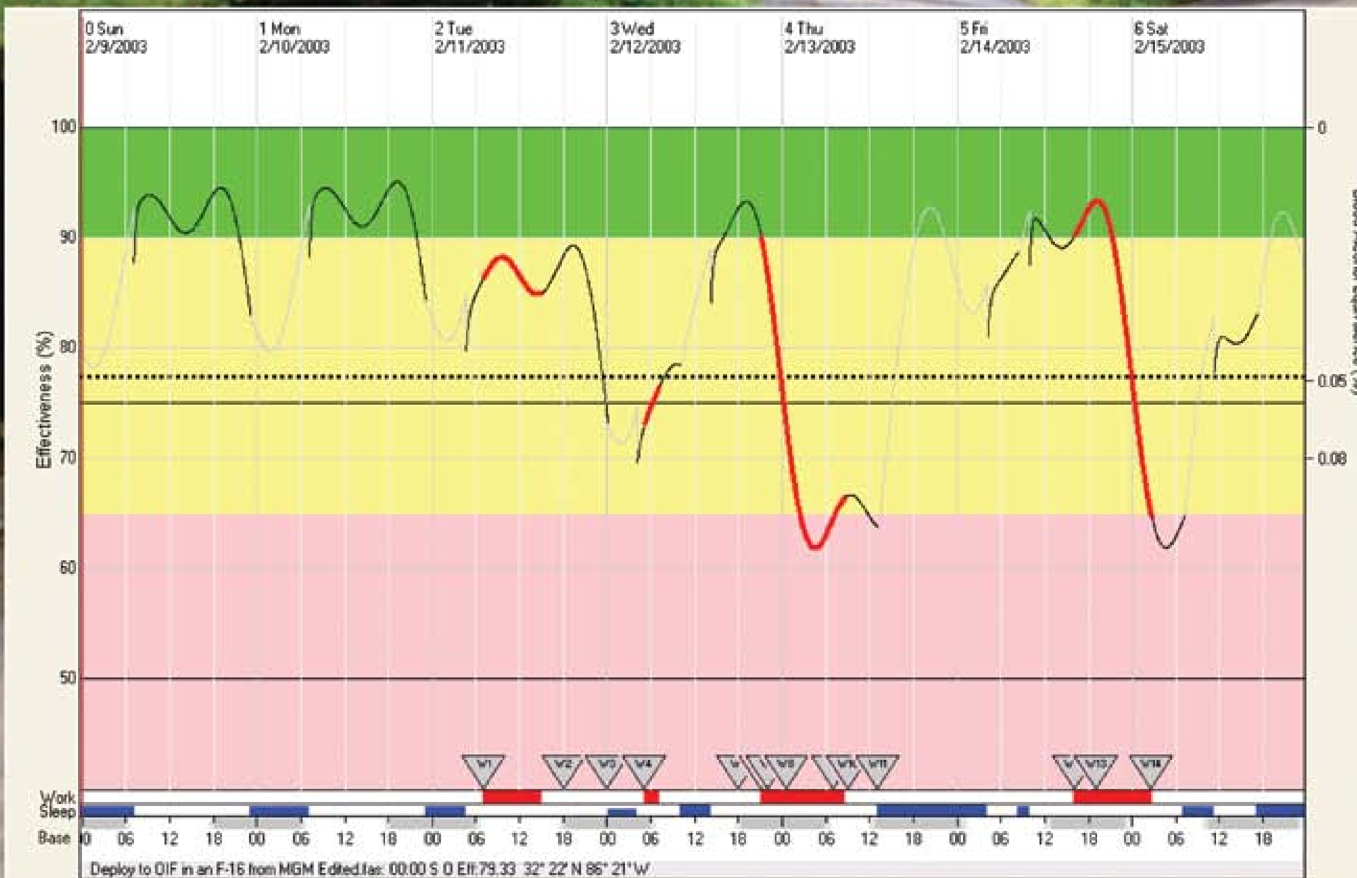
You input information such as the date, location coordinates, duty times, sleep time, and sleep quality. FAST then projects expected cognitive performance based on those variables, including your equivalent blood alcohol content.

The Air National Guard Aviation Safety Office, led by Lt. Col. Ed "Hertz" Vaughan, is currently redesigning the FAST interface into a Web-based, user-friendly, interactive model. A select group of 20 ANG flying wings is iteratively developing and testing this new interface, called FlyAwake. Their feedback on design changes, graphics and specific mission and airframe requirements are essential to creating a new fatigue product usable for all types of aircraft. By the end of 2008, under Phase Three of the ANG-funded project, the improved fatigue model will be integrated with PEX scheduling systems for day-to-day use in aircrew and mission scheduling. Visit www.RealBase.org for project status, articles, and to receive e-mail updates on the Air National Guard's fatigue-management project.

Fatigue Management with FAST

According to Dr. Miller, the goal in fatigue management, using FAST, is to keep you above 90 percent effectiveness when conducting safety-sensitive jobs, such as flying a single-seat fighter jet. When a pilot/aircrew reaches the 90 percent level of effectiveness (the point where the pilot/aircrew has been up for 16 hours of continuous wakefulness), it's time to knock it off and get some sleep. At this point, the brain is saying, "It's time for sleep and recovery." It's NOT saying, "It's time to operate an aircraft." Using FAST or FlyAwake before the mission, in order to schedule sleep for a fatigue-friendly flight, can help keep our pilots at their optimum performance level.

USAF Photos by Capt Joe Leeper



2003 OIF Deployment FAST Plot

1. Drive to Montgomery to load jets
2. Called to be in at 5 a.m.
3. Drove to Maxwell, got Q room & 4 hours sleep
4. Drove home after deployment briefing
5. Goodbyes to family & drive to Montgomery
6. Arrive at squadron, briefing with Governor
7. Step to jets. I was a spare.
8. Takeoff for Moron, Spain
9. Last air refueling, struggling to stay awake
10. Land at Moron, Spain
11. Arrive at hotel in Seville, sleep 15 hours
12. Depart hotel
13. Takeoff from Moron
14. Land in Middle East

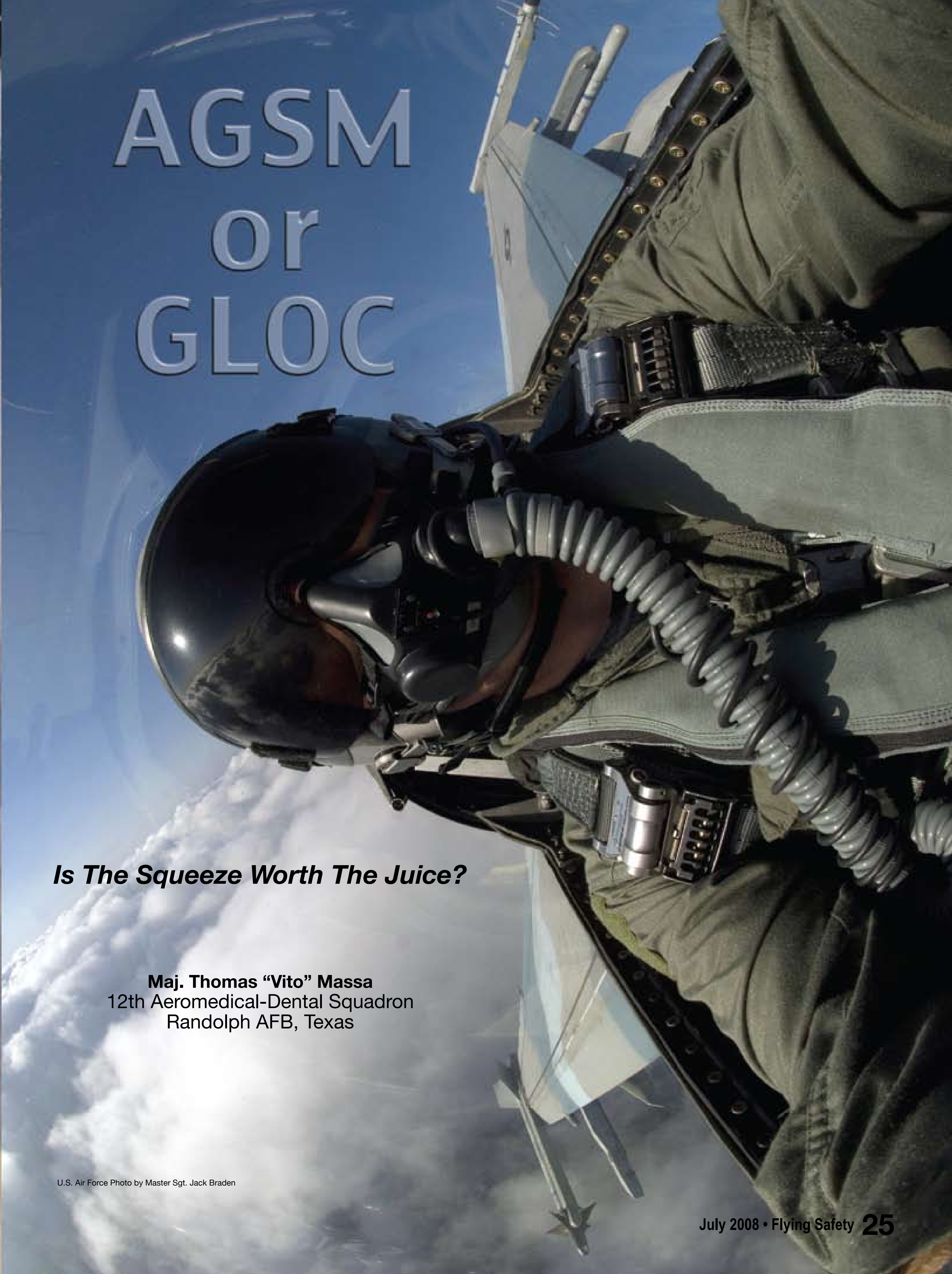
Conclusion

Making smart decisions is the key to preventing mishaps. Using FAST to analyze your personal schedule is smart decision making, as well as effective leadership in the planning process. In the long run, we'll have fewer pilot/aircrew error mishaps due to folks learning how to manage fatigue while living and "flying in the FAST lane."

Notice the dip in performance on Day 2 to 65 percent effectiveness. Everyone in the flight had trouble staying awake toward the end of the first day. I remember yelling at myself (as if I were my own instructor pilot), struggling to stay awake on the last refueling, over the ocean trapped by fatigue.

Chart Coutesy of Author
Photo Illustration by Dan Harman

AGSM or GLOC



Is The Squeeze Worth The Juice?

Maj. Thomas "Vito" Massa
12th Aeromedical-Dental Squadron
Randolph AFB, Texas

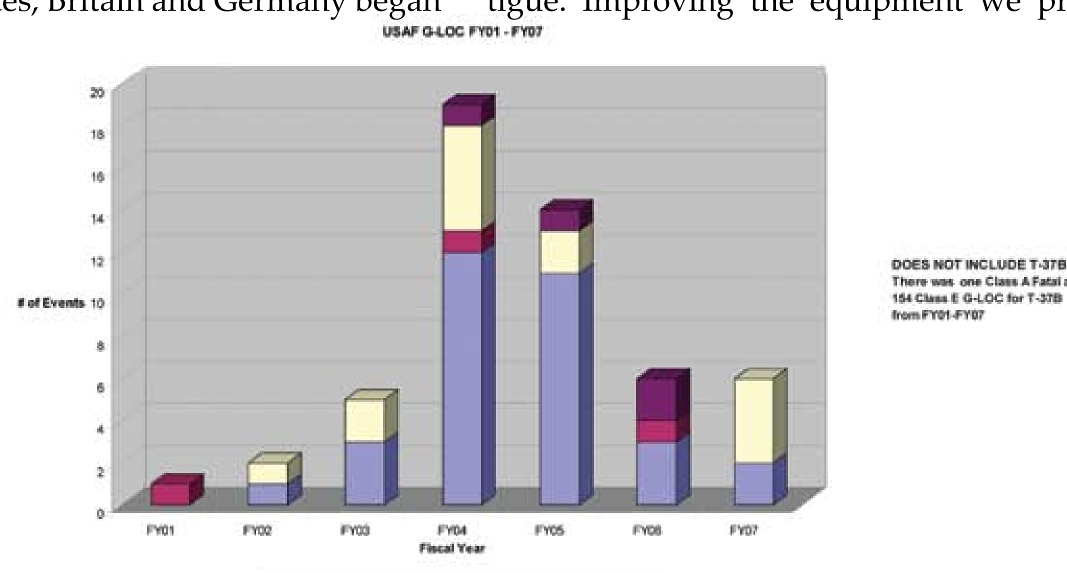
U.S. Air Force Photo by Master Sgt. Jack Braden

"Check away" and "Fight's on" are the calls; both aircraft then engage each other in a two-circle fight. Nine Gs slam against the pilots' bodies as they attempt to maneuver into an offensive kill position. Both pilots know the time-tested aircraft can survive the twists, turns and rigors placed upon them during flight, but without warning, one aircraft enters an extremely nose-low attitude and accelerates toward the terrain. *"Knock it off … pull up … pull up … recover and eject … eject"* are the radio calls. The aircraft impacts the ground, but you see a parachute, and immediately start the search and rescue. The above hypothetical scenario, as you may have guessed by now, was the result of gravitational-induced loss of consciousness, otherwise known as G-LOC.

Unfortunately, the threat and consequences of G-LOC are not new. In 1919, Dr. Henry Head described the problem of G-LOC, but used the phrase "fainting in the air" to explain the phenomenon. During World War II, G-LOC became better recognized within the aviation community, and the invention of the G-suit emerged, which is the same design used today. G-suits work by transferring a force via air-inflated bladders to the lower limbs to increase peripheral vascular resistance, thereby reducing venous pooling. This improves venous blood flow back to the heart and increases cardiac output. In pilot speak: a G-suit squeezes the abs and legs, forcing the blood up toward your cranium to help maintain vision and consciousness. It wasn't until the 1970s and the introduction of modern fighters, such as the F-15 and F-16, that G-LOC became increasingly recognized as a possible cause of a number of fatal aircraft mishaps. The United States, Britain and Germany began extensive research with the Human Centrifuge to investigate G-LOC. Pilot unconsciousness at the time was viewed as a barrier, and the purpose of the research was to come up with new methods/equipment to push the performance barrier back — to make the human system less susceptible to the high G-environment. Modern G-suits, anti-G straining maneuvers, tilting seats, and positive-pressure breathing systems (Combat Edge) are the results of this approach. Each one has increased pilots' G-tolerance in measurable amounts and allowed us to operate better in the high G-environment; but together, they have not eliminated the pilot's susceptibility to G-LOC.

Still, we're faced with the challenges of G-LOC. Today's technologically advanced aircraft, such as the F-22 and F-35, are capable of operating in high G-extremes that can easily exceed the physiological capabilities of the operator. Existing equipment like the CSU-13B/P anti-G-suit being used in our legacy fighters are limited in providing the G-protection necessary to meet future mission demands. The physiological and equipment barriers of the past are still valid performance concerns today. It is unlikely that we can change man's physiological limitations to high-G, but we can provide better G-protection in the form of full-coverage G-protection suits.

Centrifuge comparative performance analysis has been performed on a variety of commercially available off-the-shelf anti-G-suits. Testing has shown that by extending the surface area coverage of lower anti-G suits (full/extended coverage), coupled with positive pressure breathing for G, we can significantly improve G-protection capability and reduce aircrew fatigue. Improving the equipment we provide



our warfighters with the latest full-coverage G-suit/systems to combat the effects of G-LOC is a good start. Although as a physiologist who has investigated too many "smokin' holes" and teaches methods to prevent G-LOC, it's important to emphasize that you mustn't rely solely on your equipment to mitigate the risk of G-LOC. There are several other variables to consider, and I offer you the following when working in the high G-environment:

The chart provides data on the reported Class A and E physiological G-LOC incidents from the F-15 and F-16 during FY01-07 (compliments of Major Brian Musselman, Air Force Safety Center).

The majority of these Class A and E physiological G-incidents result from an inadequate AGSM, due to task misprioritization. As operators of bone-crushing machines, you need to bring your "A" game every time to optimize performance when in the high G-environment. You're probably wondering, "What exactly does that mean to me?"

1. Daily Preparations — Ensure you and your students, wingmen and flight leads are mentally and physically prepared for the demanding sortie. A good night's sleep, proper hydration, nutrition and a weekly fitness regimen are the assumed starting points.

2. Before Flight — Assess your fitness to fly, and review your students' grade book and your personal performance on the last sortie. How long has it been since you or your wingman has flown (long layoff from high-G activity)? Are there any historical G-trends from members of the flight that need to be addressed? Does your squadron have a good G-ORM program in place? Did you thoroughly brief the high-G threat phases of flight and mental preparation required for an AGSM during tactical maneuvering?

3. During Flight — Ensure the G-Awareness exercise validates your ability to survive in the high-G arena. All aircraft and G-protection equipment must be working properly. This is your opportunity to determine if you're feeling like that 9G warrior or if you need to employ old-man BFM tactics today. Adequately assess the onset of high Gs, which is easier said than done. It requires good AGSM habit patterns, muscle memory and G-situational awareness. Starting your AGSM after G-onset or waiting for light loss could be detrimental to your well-being. Unload the aircraft and start over, if necessary. Continually assess your G-performance and that of the other flight members between and during engagements. You may need to terminate early, especially if all the desired learning objectives have been met. (Say what? I still have a few hundred pounds of fuel; just one more set-up!) Most G-related incidents occur late in the sortie as the aircraft performs better, but human performance diminishes over time, due to fatigue. Call "knock it off" or terminate, and get that instrument approach if it's not your G-day. Don't worry about the repercussions — tomorrow will be a better day!

4. Debrief — Review AGSM performance throughout the sortie, using the tape review and assess proper equipment function. Annotate any G-trends (breath holding, exchange rate fast or slow, etc.) and reinforce the importance of establishing a subconscious AGSM habit pattern. If necessary, call upon your local aerospace physiologist to assist with 1 v 1 AGSM training. Call me if you don't have one!

Back To AGSM Basics: (Review AFPAM 11-419, G-Awareness for Aircrew)

- Anticipate the rapid G-onset
- Preparatory breath inhalation with aircraft lift vector movement
- Simultaneously tense all lower-body muscle groups, legs, butt, abs, (maintain this strain)
- First exhalation on top of G or three seconds, followed by short/quick inhalation of less than one second
- Minimize communications
- G-strain continued until G is unloaded

Working in high-G environments is part of our daily operations. We must do whatever we can to improve safety, to lower the physiological risks that high-performance aircraft generate. Several variables factor into managing the threat of G-LOC. Once you hear **"Fight's On,"** the standard of **"Kill and Survive"** requires you to be lethal at the merge, but more importantly, **AWAKE!** If you feel the squeeze of the G-suit, you'd better be prepared for the juice, the G-onset. We must continue to make leadership decisions and lifestyle choices to ensure we can fly, fight and win our nation's wars. **You** are our most vital asset and the most critical link in the chain to stop preventable mishaps before they occur.


USAF Photo by SrA Brian Ferguson

U. S. Air Force Photo by Tech. Sgt. Michael D. Morford

"Oh Man, Am I Beat!"

Lt. Col. Joe Hayslett Jr.
36th Wing
Andersen AFB, Guam

While attending a Flight Safety Officer class, I looked around at all the "young guns" attending with me, and my first thought was, "These folks aren't old enough to be fighting wars." Then it hit me: I was the oldest guy in the room. After that initial shock, and then being made class leader, I was immediately heartened to know these young men and women were willing to work hard, maintain the highest level of technical and professional skills, and perform all tasks requested by our nation. I quickly replayed my career through my ever-slowing brain cells. I remembered the excitement of going to new places, long days performing missions under less-than-glamorous circumstances, eating at whatever fast food joints we could find on base, and how my crew members would forever be family.

During the first day of training, some class members felt jet lag from traveling halfway around the world to attend this course. We performed our obligatory head nods into sleep-wake cycles and drank enough coffee to maintain a world-class aerobic heartbeat, giving us a decent workout without leaving our seats. We also skipped lunch, so we didn't have to stand in back of the classroom all afternoon. The phrase for the day is, "Oh man, am I beat!" This spawned the idea for my article and some interesting research on sleep-deprivation effects.

Everyone has experienced sleep deprivation either from travel, sickness, a lost night's sleep, shift change at work, or a late night out on the town. Many studies have been performed to test these effects on the human body, and the conclusions are not earth-shattering. They support what you already suspect, but how much they affect your performance could surprise you and help you perform your mission in a safer manner. To make this hit even closer to home, I'll compare sleep deprivation in relation to the effects of alcohol consumption. These tests are very close to the time frames and day lengths that many have encountered on missions all around the world.

In 2000, 39 subjects were tested — 30 from the transport industry and nine from the U.S. Army. They were tested on sleep deprivation (up to 28 hours), and then again tested using varying levels of alcohol ingestion instead of sleep deprivation to compare results of the same individual against the different test results *(Williamson, Feyer, 2000).*

After 17-19 hours awake (equating to between

10:30 p.m. and 1 a.m. when many of us go to bed), the participant's performance corresponded to 0.05 percent blood alcohol content; half the legal limit. This is a fairly normal day for most military members, especially those flying large aircraft on long cargo-carrying or air-bridge missions. Their response speeds during the tests were 50 percent slower overall, and accuracy measures were significantly poorer than at the 0.05 percent BAC level of alcohol. At longer levels without sleep, their performance reached levels equivalent to the maximum alcohol dose given to subjects of 0.10 percent *(Williamson, Feyer, 2000).*

Alcohol testing on athletes (18-24 years old) in 2000 revealed that alcohol has a causative effect in sports-related injuries, with an injury incidence of 54.8 percent in drinkers, compared with 23.5 percent (less than half) of non-drinkers. Researchers believe that this is due to the hangover effect of alcohol consumption, which has been shown to reduce athletic performance by 11.4 percent *(O'Brien, Lyons, 2000).*

Additionally, an alcohol study done on military pilots yielded some interesting results. Ten pilots were tasked to fly simulators before and after consuming alcohol. They drank no alcohol 48 hours before the test, and then were asked to drink alcohol mixed with diet soft drinks until 0.10 percent BAC was reached. When retesting in the simulator 14 hours after consuming the alcohol, pilot performance was worse in the hangover condition on virtually all measures *(Yesavage, Leirer, 1986)*. Interesting results when you compare that to our current standard of "12 hours, bottle-to-throttle." Combine those results with a poor night's sleep in some far-away land, and you have a set-up for extremely poor crew performance. Will crew members in this condition be able to meet their requirements during a critical phase of flight or perform the needed tasks during an emergency situation?

Reduced opportunity for sleep and reduced sleep quality are frequently related to accidents. Poor quality sleep and inappropriate recovery leads to increased fatigue, decreased alertness and impaired performance in a variety of psychomotor skills. Add in the formula that each 0.01 percent of alcohol ingested equates to 1.16 percent of performance reduction, which associates to 11.6 percent performance reduction at .10 percent BAC. That, and the reduction of performance during the hangover phase, and you soon realize the combined effects of sleep deprivation and alcohol consumption drastically reduce your ability to perform any task *(Dawson, Reid, 1997).*

How can this help you? Easy. If you lead a crew, watch for signs of excessive fatigue, ensure your crew members are receiving adequate rest before a mission, and pay attention when crew members tell you they're having trouble sleeping or having problems at home. In all testing reviewed, only the 10 percent alcohol rule was used as a standard, but what about the drinkers who bust that standard when out for a night? Accidents can happen in the blink of an eye, and without adequate rest, your recognition and reaction to an incident could make the difference between life or death for you or your crew.

If you're not leading a crew, you're not off the hook, either. An aircrew by its name ensures continuity and teamwork. Watch your crew mates both in the plane and on the ground. Ask questions, and if you lead students, ensure they understand the ramifications of their actions relative to their crew responsibilities. We depend on everyone to do their job effectively and safely. I'm not saying, "Don't drink," but when drinking, ensure you don't overindulge. Remember, our 18- to 24-year-olds, "the invincibles," need your guidance. Explain what you expect in relation to proper rest and nutrition, and then explain to them what could happen to their performance after binge drinking or not receiving the needed rest before strapping on their jet.

Lastly, after 24 hours of sustained wakefulness, cognitive psychomotor performance decreases to levels equivalent to the performance deficit observed with alcohol concentration of 0.10 percent. Effects of sleep loss are equivalent to moderate alcohol intoxication. By relating sleep deprivation to alcohol intoxication, we give our leaders an index of relative impairment associated with fatigue *(Dawson, Reid, 1997).* This could lead to decreased risk-taking on non-critical missions, ways to judge crew performance over long TDYs, and allow for assessment of crew needs, where mission accomplishment requires continually leapfrogging of time zones, while providing a safer operating environment. Take care of each other and fly safe!

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The Aviation Well Done Award is presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Mishap Prevention Program.

AVIATION

Senior Airman Joshua Hanak
31st Logistics Readiness Squadron
Aviano AB, Italy

The Aviation Well Done Award is presented to Senior Airman Joshua Hanak, 31st Logistics Readiness Squadron, 31st Fighter Wing, Aviano Air Base, Italy. On Nov. 8, 2007, Airman Hanak was a passenger on an Army HH-60 Blackhawk that experienced a malfunction and crashed. Immediately following impact, Airman Hanak performed swift life-saving actions. Even though he was injured, Airman Hanak placed an emergency call, initiating a scramble of lifesaving rescue and medical teams. Airman Hanak then quickly administered first aid and comfort to fellow injured passengers, despite the risk of fire and explosion from leaking aircraft fuel and hydraulic fluid. He facilitated interaction of severely injured personnel, preventing shock until medical help arrived. As medical staff arrived, Airman Hanak quickly directed aid to those more severely injured. Later, hospital medics indicated Airman Hanak saved a passenger's life who had a severe head wound and who was slipping in and out of consciousness. Senior Airman Hanak's superior skill and ability to perform under extreme circumstances reflect great credit upon himself, United States Air Forces in Europe, and the United States Air Force.

Class A Flight Mishaps
FY 08 (Through May 1)

	Class A Mishaps		
	FY08	Same Date in FY07	Total FY07
ACC	5	3	8
AETC	5	5	5
AFMC	0	0	1
AFRC	1	1	1
AFSOC	0	0	1
AFSPC	0	0	0
AMC	2	2	3
ANG	3	1	5
PACAF	1	0	1
USAFE	0	0	1
AF at Large	0	1	1
TOTAL	17 / 1.44	13 / 1.10	27 / 1.32

Flight Rate Producing

Nov 01	F-22A		No. 2 engine FOD discovered during post-flight walkaround
Nov 02	F-15C	✈	Crashed on training mission; pilot suffered minor injuries
Nov 12	KC-10A		No. 2 engine compressor stalled; rotor/stator damage
Nov 20	E-8C		Hard landing; wing/pylon/gear/radar damaged
Nov 28	T-6A	✈	Dual T-6 midair collision
Nov 29	HH-60G		Hard landing during brownout; damaged FLIR, WX radome
Jan 15	F-16C	✈	Aircraft crashed in ocean during training mission
Feb 01	F-15D	✈	Aircraft crashed in ocean during training mission
Feb 20	F-15C	✈	Dual F-15C midair; 1 pilot fatality
Feb 23	B-2A	✈	Aircraft crashed on takeoff
Mar 14	F-16C	✈	Aircraft crashed during student training; 1 fatality
Apr 02	F-16D		Aircraft landed gear up
Apr 04	B-1B	✈	Landed, taxied clear of runway; fire/explosion
Apr 23	T-38C	✈	Crashed on takeoff; 2 fatalities
May 01	T-38C	✈	Crashed on touch-and-go; 2 fatalities

UAS

Nov 29	MQ-1B	✈	Departure from controlled flight; cause undetermined
Dec 17	MQ-1B	✈	Lost link; cause undetermined
Apr 09	MQ-1B	✈	Aircraft crashed

- A Class "A" aircraft mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of a USAF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crew members successfully ejected/egressed from their aircraft.
- Reflects all fatalities associated with USAF aviation category mishaps.
- "✈" Denotes a destroyed aircraft.
- USAF safety statistics are online at http://afsafety.af.mil/stats/f_stats.asp
- **If a mishap is not a destroyed aircraft or fatality, it is only listed after the investigation has been finalized. (As of May 1, 2008).**

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