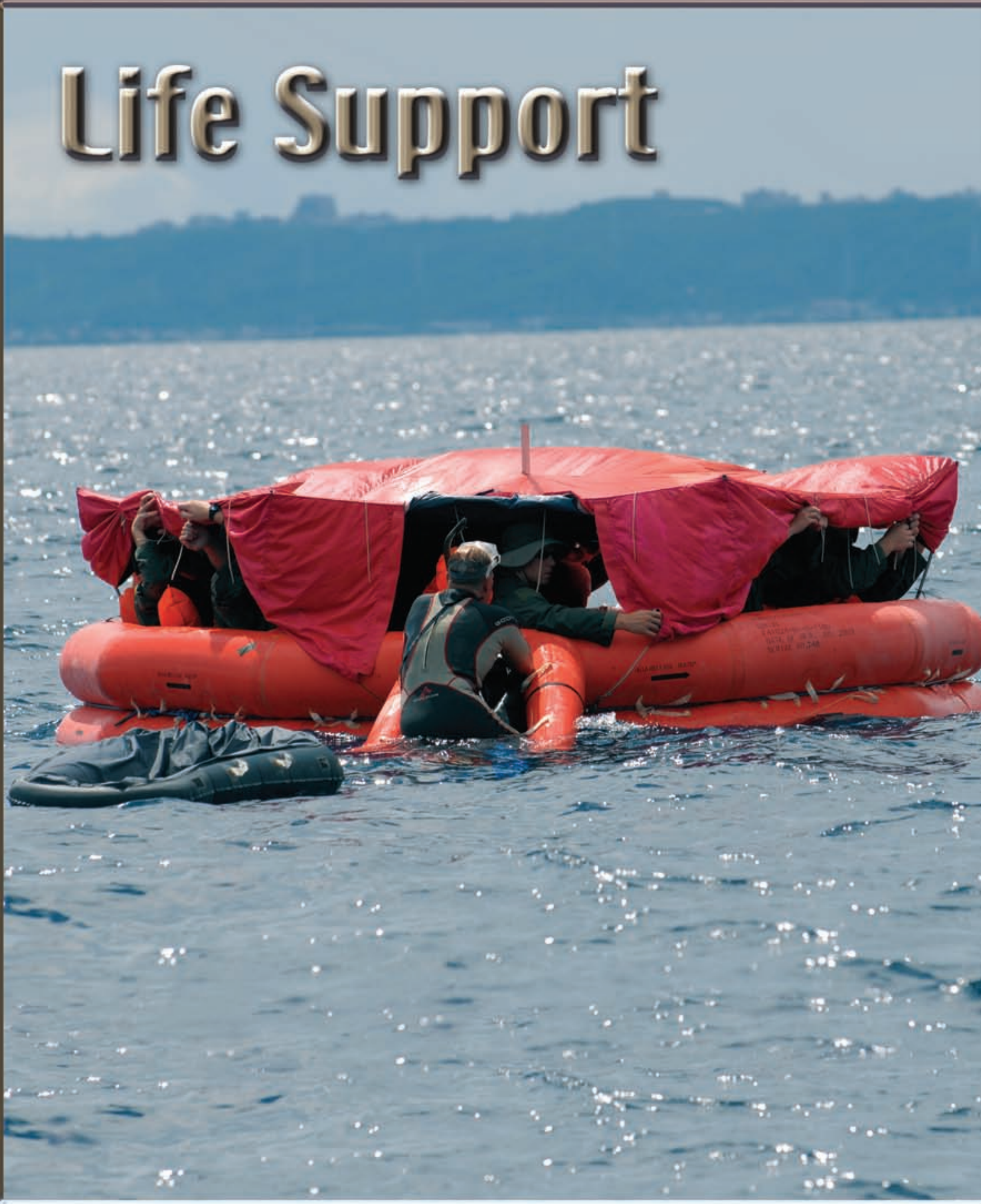
UNITED STATES AIR FORCE
FSM
DEC 2007
FLYING SAFETY MAGAZINE

Life Support



FSM
FLYING SAFETY MAGAZINE

AIR FORCE RECURRING PUBLICATION 91–1

CONTENTS

Cover: USAF photo by SrA Jeremy McGuffin
Rear Cover: Official USAF photo

Flying Safety Magazine on line: http://afsafety.af.mil/SEMM/fsmfirst.shtml

U.S. AIR FORCE

U.S. GOVERNMENT PRINTING OFFICE 2008-760-498-41039

SAFETY SAGE

"Take It Seriously!"

Aircrew Life Support plays a vital role in ensuring the day-to-day survival of aircrew and passengers. Their responsibilities range from training personnel on the use of something as simple as camouflage application to maintaining extremely valuable and highly complex night vision goggles. The work they do on a daily basis is often not recognized by the aircrew until they find themselves in the unfortunate position of having to rely on the training and equipment our talented Life Support Airmen provide. To ensure their efforts are not in vain, aircrew need to do their part. Many is the time I've seen aircrew step to the aircraft without a proper pre-flight of their life support equipment, and too often, this has resulted in unfortunate "Darwinian" comments contained in safety mishap investigation reports. "Mishap crewman failed to properly adjust helmet straps, which enabled separation on impact, resulting in fatal injuries." "Mishap pilot was unable to make contact with SAR assets due to lack of operating knowledge of the PRC-112." When you sit through your multi-hour long Annual Life Support Training Course, take it seriously. Participate and ensure you come away with a working knowledge of how to use all of your life support equipment. Before you step to the aircraft, make the time to inspect your gear. The minimum penalty might be an embarrassing discussion with your Operations Officer on explaining a late takeoff because your helmet's communications cord failed. The maximum? A lot worse. To all the Life Support Airmen out there, thanks for the hard work!

— *The 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.

DISTRIBUTION — One copy for each three aircrew members and one copy for each six maintainers and aircrew support personnel.

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

CONTRIBUTIONS — Contributions are welcome as are comments and criticism. The editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning.

Commercial Prefix (505) 846-XXXX

E-Mail — afsc.semm@kirtland.af.mil
Address Changes — afsc.semm@kirtland.af.mil

24-hour fax: DSN 246-0931

HQ Air Force Safety Center web page: http://afsafety.af.mil/
***Flying Safety Magazine* on line: http://afsafety.af.mil/SEMM/fsmfirst.shtml**

The Air Up There!

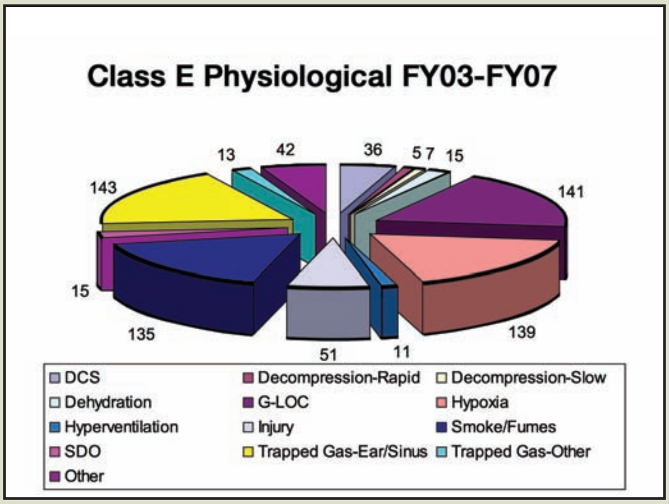
USAF photo by TSgt Deborah K. Alvarado

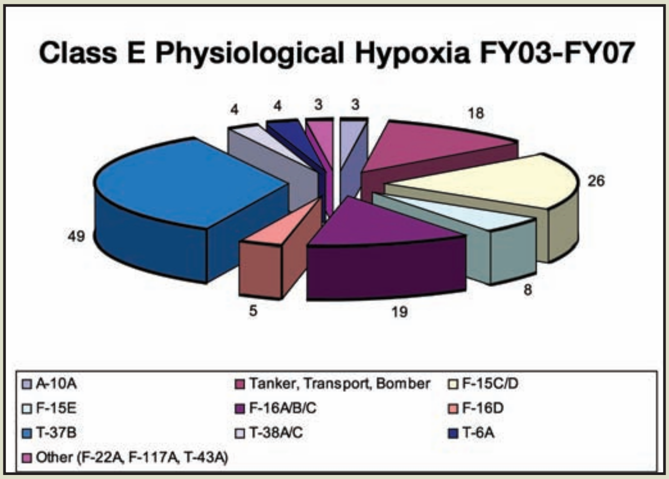
MAJ BRIAN "MOOSE" MUSSELMAN
AFSC/SEFL
Kirtland AFB NM

Remember your last physio refresher? During the course of the discussion, there was probably mention of Class A aviation mishap data with an emphasis on the contributions of human factors. Due to increased emphasis on human error causation over the last decade, discussion of this topic is important; however, there is another component of military aviation still contributing to aviation hazards: human physiological responses to flight. Confused? You shouldn't be! I am talking about hypoxia, decompression sickness, trapped gases, smoke and fumes, etc. In FYs 03-07, there were 144 Class A mishaps with a rate of 1.31 per 100,000 flying hours. During this same time frame, the numbers for reported physiological incidents is somewhat surprising. There were 753 reported physiological incidents between FYs 03-07 at a rate of 6.85 per 100,000 flying hours.

Feeling All Warm and Fuzzy. During FYs 03-07, hypoxia was reported on 139 separate occasions. Do you remember your cardinal signs of hypoxia? These 139 folks did! You may be thinking these events are limited to undergraduate pilot training (UPT) students; however, during an alert launch, an F-15E pilot experienced hypoxia symptoms. The

Official USAF photo



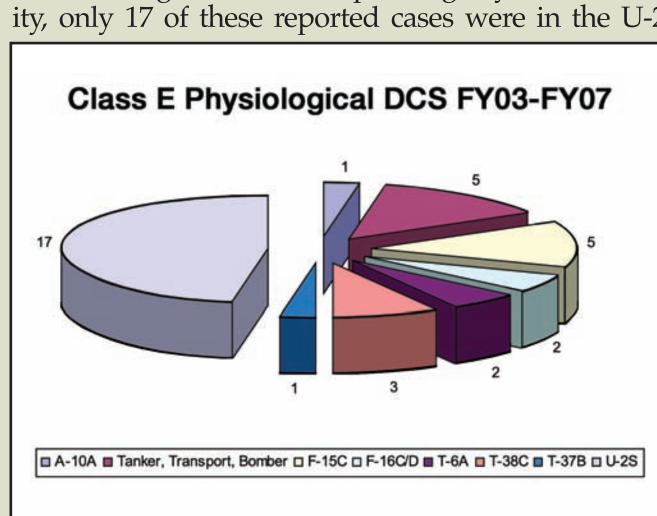


crew was number two of an alert flight and scrambled in support of a troops-in-contact situation. They climbed to FL265 and the pilot noticed that no one was responding to his calls. When he checked the communication cord, he noticed the cord and the oxygen hose from the mask to the CRU-94 were disconnected. He reconnected both leads and continued the flight. About five minutes later, he felt like cabin air was entering the mask instead of oxygenated air. He looked down, noticed the oxygen hose was disconnected again, and reconnected the hose. Later, the pilot again noticed the same sensation of breathing cabin air instead of normal oxygen provided by the oxygen system. He had the weapons system officer (WSO) fly while he tried to get the oxygen hose to stay attached to the CRU-94. The pilot reported the cabin pressure was around 10,000 feet MSL and 15 minutes later started to experience hypoxia symptoms. He reported blurred vision, tingling of the hands, and slowed performance of aircraft duties. The pilot informed the WSO, gang-loaded the regulator, and started a rapid descent to 11,000 feet MSL. Realizing the oxygen mask was still disconnected, he reconnected the oxygen mask hose to the CRU-94 and held them together with one hand. He started to feel the oxygen coming through the mask and felt the bladder in the back of the helmet inflate, indicating good oxygen flow. The flight lead declared an emergency for the hypoxia symptoms. The pilot returned to base and attempted to land, but was told to go around for being too high and too fast. He landed successfully on the second approach. During the investigation, the CRU-94 was found to be dirty and difficult to use. It is required to be inspected every 30 days and was inspected 22 days prior to the incident. This example reiterates the importance of a proper P.R.I.C.E. check and hypoxia recognition training.

The hazards of hypoxia are not unique to fighter/trainer aircraft either. An EC-130H crew departed for an OCONUS flight and as they climbed through 10,000 feet MSL, the pilot noticed a normal indication on the cabin altimeter. After receiving clearance, the pilot began his climb to a cruising altitude of FL210. As the aircraft passed through 17,000 feet MSL, the pilot felt what he described as "warm and uncomfortable" and noticed that the flight deck seemed "unusually quiet." The flight engineer also recalled losing his color vision. The pilot noticed that the cabin altimeter was indicating 17,000 feet MSL and directed the crew to go on 100% oxygen. Upon recognizing possible hypoxia symptoms, the pilot was able to correct what could have turned out to be a bad situation. The crew eventually discovered a stuck valve in the cargo compartment under the floor heating system which was preventing the aircraft from pressurizing. The pilot turned off the heat and was able to pressurize the aircraft. Every AF crew member is trained to recognize his or her hypoxia symptoms in a controlled environment to facilitate recognition and recovery during an actual flight.

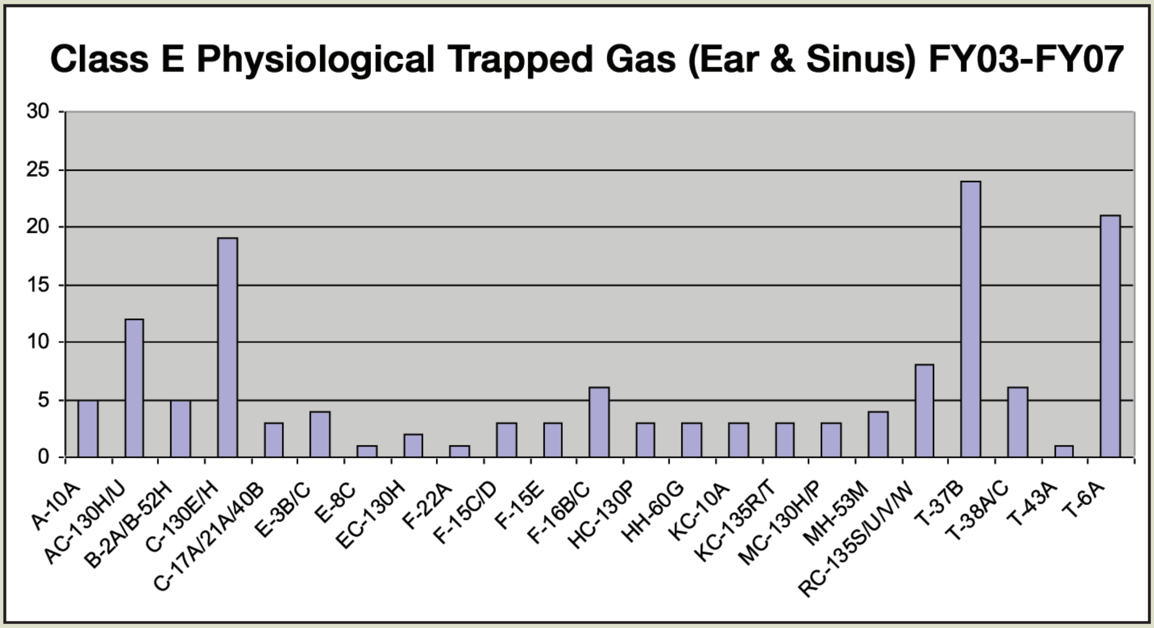
Get Bent. We do not purposefully induce decompression sickness (DCS) in physiology refresher students; however, this doesn't mean we haven't thought about using it as an incentive for students to remain coherent during the classroom instruction! Although some may think that DCS is no longer a hazard in modern military aviation, there were 36 reported DCS cases during FYs 03-07. Separating myth from reality, only 17 of these reported cases were in the U-2.

Official USAF photo



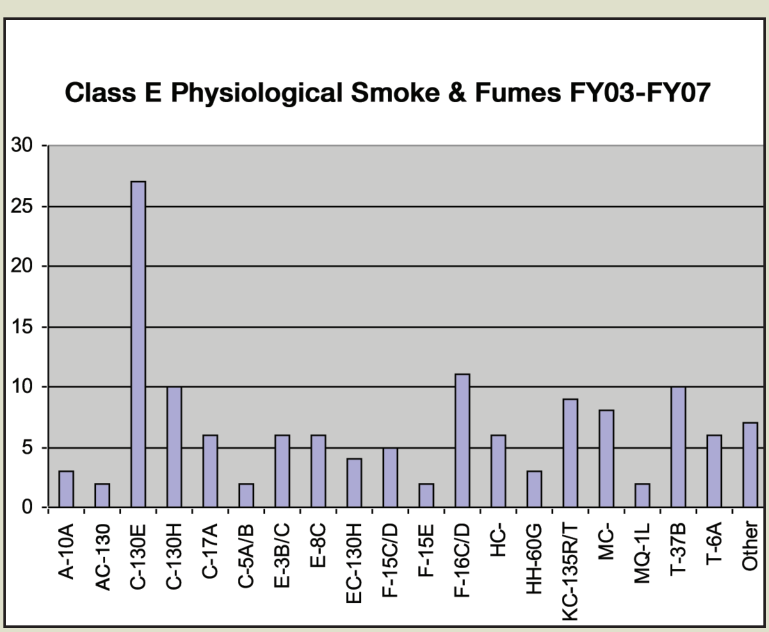
DCS is a known hazard for the U-2 pilots and they receive additional training on DCS and take preventative measures prior to flight. What about the other 19 cases, though? The majority of the cases occurred in fighter/trainer aircraft, but there were five reported DCS cases within the Tanker, Transport, Bomber category. One reported incident involved a C-130H. The aircraft departed a deployed location and enroute to their destination at FL240, the crew noticed cabin pressure rising through 4,000 feet. The flight engineer (FE) was unable to maintain or control the rising cabin pressure. As the pressure rapidly passed through 7,000 feet, the co-pilot told the crew and passengers to go on oxygen, and the aircraft commander initiated an emergency descent. By FL230, the aircraft pressure equaled the outside air pressure. The crew diverted to a base with a Navy dive chamber to treat suspect passengers. The crew landed uneventfully, and all 72 personnel onboard the aircraft were seen by a Navy flight doctor. Of the 72 passengers and crew, 8 had experienced ear or sinus blocks or other symptoms. Three personnel had symptoms that warranted a precautionary Table VI hyperbaric dive. No delayed symptoms were observed. This event demonstrates the importance of crew members understanding the physiological factors of flight, and the crew should be commended on their response to this emergency situation. Another physiological concern for aircrew is trapped gases in the ears and sinuses.

"Ears" What I'm Talking About. There were 143 Class E (Physiological) mishaps related to ear and sinus pressure issues reported during FYs 03-07. Once again, aircrew experience pressure change in the hyperbaric chamber during physiological training and are taught how to compensate for this change. We all know the number one way to prevent trapped gases in the ears and sinuses is to avoid flying with a cold or congestion, but much to my chagrin, 43 percent of the reported ear and sinus pressure issues said something along the lines of "Crew member felt sick prior to flight, but thought he could make it." When's the last time you were questionable and flew anyway? One particular incident involved a crew member on an AC-130 who presented sinus pain shortly after takeoff. During a descent from 6,000 feet, the instructor fire control officer requested a shallow descent for an ear block. Once at 1,500 feet, he used Afrin to clear his ears, and the crew landed the aircraft. The fire control officer reported having very mild cold symptoms prior to the flight, but had been able to easily valsalva on the ground. However, upon evaluation, his left ear had some clear fluid present and both eardrums did not move adequately. Despite flying with cold symptoms, this crew member and others involved in ear and sinus trapped gas incidents should be commended on their use of Afrin in-flight to clear symptoms reducing injury to the ears. Another flight involved a crew member in the backseat of an F-16. During a rapid descent from FL400 to 15,000 feet MSL, the crew member was unable to keep up with pressure changes. He felt pain and pressure in his left ear, but didn't inform the pilot of any ear problems, as he didn't want to interrupt the flow of the flight. If this guy had notified the pilot in a timely manner, it would have prevented or minimized his injury. After landing, the crew member still didn't report any ear problems! In fact, he waited approximately 24 hours before seeing a flight surgeon. During examination, the flight surgeons discovered blood behind an intact left eardrum. The crew member had no indication of pre-existing medical conditions (like a cold) that could have contributed to the barotrauma. The fluid was cleared over 5 days with systemic medication. A follow-up examination 5 days later showed a full recovery and the crew member were returned to flight status. This report also mentioned that due to



a couple of barotraumas within this wing, awareness training for local aircrew would be worthwhile as they approached the flu season. Training should discuss communication of physiological issues between the aircraft commander, as well as crew members and passengers. Early recognition in any physiological incident is crucial to proper treatment. This individual could probably have avoided pain and DNIF by leveling the aircraft and providing himself time to adjust to the pressure change. Don't be afraid to mention a problem … because let's face it, you're only human.

The Smokin' Gun. The final category discussion is smoke and fumes. A smoke and fumes incident should be reported as a Class E (Physiological) mishap if there are "symptoms or health effects caused by toxins, noxious, or irritating materials such as smoke, fumes (including carbon monoxide) or liquids." If there are no symptoms or health effects, but "a member of the crew executed any portion of an emergency checklist in response to smoke and fumes," then the incident should be reported as a Class E (Miscellaneous) mishap. There were 135 reported Class E (Physiological) mishaps related to smoke in fumes during FYs 03-07. About 75 percent of the incidents involved heavies (non-fighter/attack/trainer aircraft) and about 25 percent of the total involved various C-130 models. Although a fair number of C-130 smoke and fumes incidents were caused by a dirty water separator sock, some resulted from other causes. In one incident, fuel began to leak from a generator located in the cargo compartment of a C-130 departing from the deployed location. The crew leveled off and the loadmaster contained the fuel after approximately two gallons had leaked. The aircraft commander directed the crew to don their oxygen masks, declared an emergency, and landed the aircraft. Initially there were no injuries; however later, the loadmaster reported to the flight surgeon complaining of headaches and other symptoms. He was subsequently brought to the base hospital and treated for symptoms resulting from inhaling fuel fumes.



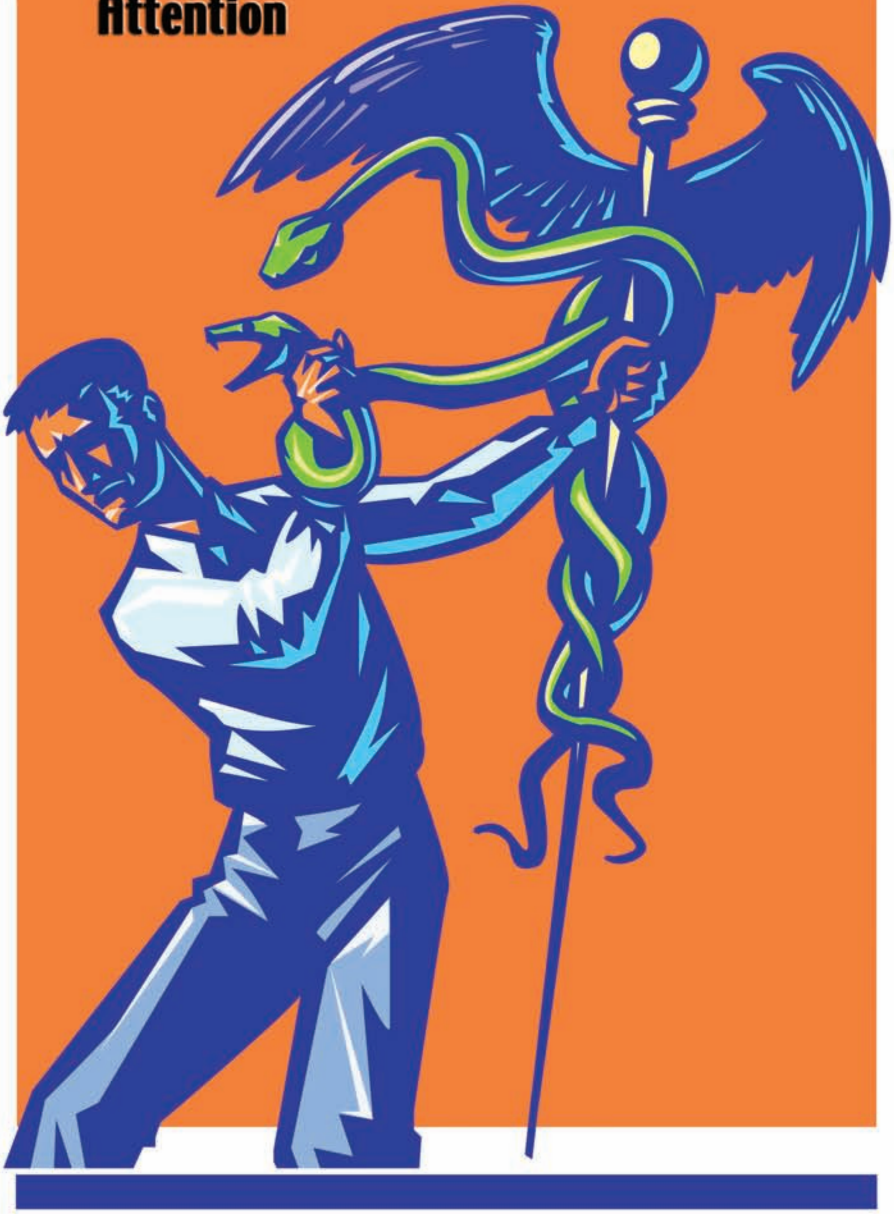
Another incident involved an F-16. As the pilot prepared for takeoff, he noticed a faint smell in the cockpit, lowered his oxygen mask briefly, and noticed the smell had gotten much stronger. He described the odor to be similar to "turpentine." The pilot put his mask on, selected 100% oxygen, and taxied clear of the runway. There were no caution/warning lights or abnormal indications from any instruments, and there was also no smoke present. As he taxied back into the arming area, he executed the "smoke/fumes in cockpit" emergency checklist. As soon as the pilot shut down and opened the canopy, the odor quickly dissipated. As the pilot egressed, he started to feel "light headed." Simultaneously, the fire department personnel noticed "significant" smoke coming from the engine intake, and the aircraft continued to smoke for several minutes after engine shutdown. Inspection of the Environmental Control System (ECS) revealed gun lubrication inside the turbine exhaust duct and throughout the immediate area. Further inspection of the duct revealed that the gasket was worn, allowing residual lubrication, which dripped down from the gun system components, to enter into the ECS and cause the fumes experienced by the pilot. Maintenance personnel followed all T.O. guidance correctly, but this problem is all but impossible to completely eliminate due to the design of the F-16 (the aircraft simply does not provide complete isolation of the two systems).

Finally, the T-6A had three separate reported incidents where the electrical attitude direction indicators (EADI) failed causing smoke and fumes. The crew reacted appropriately in all three situations. Appropriate reaction to these incidents prevented further problems. The USAF will continue to experience smoke and fumes incidents, and crews should remain vigilant and study their smoke and fumes EPs.

Aerospace Physiology original and refresher training provides valuable information to assist aircrew in preventing mishaps. This article covered several of the Class E (Physiological) mishap categories, but is not all inclusive. There are other physiological concerns in aviation that still require training and discussion. All physiological manifestations discussed during chamber training are ever-present in aviation. What are your hypoxia symptoms? Are you drinking enough fluids? What did you eat for lunch? How much sleep did you get last night? Do your passengers understand how to compensate for pressure change? What will you do if you recognize smoke and/or fumes in your aircraft? What flight conditions set you up for spatial disorientation? These are important questions you must ask yourself in continuing your career as an AF crew member. The answers may very well prevent pain, DNIF, or the next mishap. Fly safe!

(Major Brian T. Musselman served as an Aircraft Maintenance and Munitions Officer from 1994-1999. He cross-trained into Aerospace Physiology and served a tour at Beale AFB before being assigned to the Life Sciences Branch at the Air Force Safety Center.)

The Reluctance Of Aircrew To Seek Proper And Timely Medical Attention



CAPT CAMILLE A. CHIGI
3 AS/SE
Dover AFB DE

The inherently dangerous world of aviation comes with risks and hazards not found in the average workspace. Aviators, by their own choosing, are tasked daily with the safeguard of their passengers, the safe arrival of their cargo, and the welfare of the civilizations miles below them. In conjunction with these responsibilities, military aviation has its own set of unique stressors that it imposes on men and women that accept that mission, sometimes allowing hazards into their lives. Often, these professionals neglect or ignore the care of their own physical health in the name of mission accomplishment. The reluctance of aircrew to seek timely medical attention can compound or exacerbate aircraft mishaps or personal medical conditions. The reason for this reluctance lies in one of three places: the aircrew culture, a fear of going DNIF, or a lack of education in aerospace medicine.

Aircrew culture. Those of you that have been professional aviators know exactly what I'm referring to.

You don't wander into the world of professional aviation by accident. Most career aviators begin early, are very much vested in their decisions, and demand achievement from themselves.

This level of personal commitment, fueled by an environment that requires precision, accountability, and performance, creates what we affectionately refer to as the aircrew culture. We are a competitive, intelligent, and sometimes stubborn community. We harass, embarrass, and take cheap shots at one another's folly; therein lie the ties that bind. Aircrew are tight because we have to be, aircrew sometimes come across as cocky because we have to be, and aircrew are "8 ft tall and bulletproof" because we have to be.

What does that mean in a practical sense? If aircrew members are on profile because they twisted an ankle, they'll hide it from everyone they work with. When they go to squadron PT, even though they're on profile, they'll run anyway. They would rather stumble their way around the track than let anyone think they're not 100%. In the end, this attitude is both constructive and destructive. The airman shows his peers that he is strong and capable, yet he's also re-injuring his hurt ankle.

An apple a day keeps the flight doc away. The second reason aircrews are reluctant to seek medical attention: they're afraid of going DNIF. Most of us have found ourselves in a predicament similar to this: you're scheduled to go on a good deal trip, and then catch a nasty head cold from one of your kids. While your ears are still clear, you've definitely got some sinus pressure, and have been coughing up rainbow-colored phlegm all week. What's the right thing to do? Go see the flight doc.

What do we usually do? Buy the Shoppette out of Afrin, take some vitamins, and hope for the best. Aircrew members won't go to the flight doc because they know they'll be DNIF'd for at least a week, and miss out of flying the mission. In the long run however, blown sinus cavities will DNIF you for months.

In the last four years, between FY 2003 to FY 2007, there were 753 reported physiological incidents. Of those reported physiological incidents, 143 involved the inner ear or sinus. Of those ear/sinus physiological incidents, 43% of the crewmen had symptoms before their flight, but never went to the doc. Instead, they knowingly stepped to their jets and potentially endangered themselves, their crew, and their passengers.

Self-medication is a tempting solution to everyone during cold and flu season. Walking the aisle at any grocery store, you're confronted by dozens of miracle cure, over-the-counter medicines. These are not options for aircrew members, with good reason.

Ignorance is bliss. I bet that got your attention! The last reason for the reluctance of aircrew to seek proper and timely medical attention is ignorance. As a community, we are overwhelmingly misinformed when it comes to aerospace medicine. From the beginning of our careers, we have had to project physical perfection. "I feel great, never felt better," was the response I was coached to always give the flight doc. This may seem similar to my previous theory, the fear of DNIF, but this goes much deeper. DNIF is a temporary, acute condition. Let's talk about conditions that can affect fliers for the duration of their lifetime. When utilized to its fullest extent, aerospace medicine can elevate the total quality of our lives.

I have friends in the flying world (and so do you!) who are genetically predisposed to certain medical conditions (cancer, hypertension, diabetes, macular degeneration, etc). They know they're vulnerable to these conditions, but they keep that to themselves. We have been conditioned to think that the continuation of our careers depends on being perfect specimens of human anatomy. Not only is that untrue, but it's impossible! We are not the 18-year-old kids that passed our flight exam years ago. Life happens, and we shouldn't miss out on it because we're too scared to ask questions.

You would be surprised to know just how many conditions the flight doc can work with you on. Yes, many of them require a waiver. But isn't it better in the long run to have the doc work a waiver (the docs don't mind; it only takes a couple of hours) than to risk the quality of your long-term health? If you take a look at the Aerospace Medicine regulations, specifically AFI 48-123V2, *Medical Examinations and Standards*, you can see for yourself what is disqualifying. This regulation is daunting by itself, but if you follow up that reading with the official Air Force-approved aircrew medications list, I promise you will be pleasantly surprised.

We all know that Motrin (Vitamin M) is allowed. But did you know that you can take certain medications that treat cholesterol, hypertension/high blood pressure, ocular hypertension, acne, birth control (now a 7-day DNIF, not 30 days), acid reflux, hyperlipidemia, rhinitis, sprue, benign prostatic hyperplasia (enlarged prostate), allergy medicine, eczema, gout, infertility, and even some ulcers? That's right … you no longer have to be anatomically perfect to fly for the United States Air Force. With the proper diagnosis, waiver, and treatment, fliers can be successfully treated for conditions they would have hid just a decade ago.

In the end, the mission goes on. Life marches along, with or without us. But it's high time for the flying community to acknowledge that we are not robots; we are not flawless; we all have imperfections. For some of us, it's believing that we're Superman, and hurting our own bodies to save face. For some of us, it's stepping to the jet with a stuffy nose and a silent "I probably should just stay home" thought to ourselves. And for those of us with long roads to hoe, it's knowing that our family history predisposes us to long-term medical conditions. The good news for all of us is that aerospace medicine is changing. Our flight surgeons really do bend over backwards to keep us in the air. The best day for them is a day when working with their aviator, they can find a way to keep you airborne.

If you have a medical condition that you're keeping to yourself, please go to the following link: ***https://kx.afms.mil/aircrew_med_list_jun07/***. It lists all medications approved for aircrew. There are many conditions that can be treated today that even three years ago were disqualifying. While many of them require a waiver, you can treat your condition and still fly your jet. Fly safe.

One Dark And Moonless Night

CAPT LAURA NEALON
4 FS/SE
Balad AB Iraq

Like most pilots, I never really gave much thought to how I would react to an in-flight emergency (IFE) outside of the monthly emergency procedure simulations. That all changed one night when I suddenly found myself facing a serious engine problem, which is really serious when you only have one engine to begin with. Add to that the complications associated with a low illumination night, a strange field, and new checklist procedures, and I was in for a lesson in what kind of preparation and forethought I should have been giving to potential emergencies.

When it was initially conceived, the sortie was simple enough: fly as red number two for an opposed surface attack upgrade ride. The mission was a night vision goggle (NVG) upgrade for the blue flight lead, a rather demanding sortie for him; but for my flight lead and I, it was to be a short, easy flight to reset our night currency. In the end, the sortie was quite short, but became anything but easy, when I found myself alone and unafraid.

The first big change that occurred prior to the sortie in question was when I arrived in the squadron to find a major checklist change. This particular change involved a complete change to the handling of several engine emergencies. The checklist changes were so significant that the alterations required more than a half hour of cut-and-paste changes prior to flying. Because of all the additional duties required of me that day, I hurried through the update with only a quick scan of the new procedures.

Change two for the sortie came just prior to the brief when the two-ship split into separate singletons to support another upgrade sortie in separate airspace. As a fully qualified NVG wingman, this was completely legal for me to fly single-ship red air. This change did drive up the ORM rating for the sortie quite a bit, but was approved through the appropriate squadron leadership.

Takeoff and departure to the area occurred during civil twilight, so cockpit illumination was not much of a concern, until we were in the midst of "the war." By the time I was setting up the egress presentation, the sky glow had faded and the moon was not to rise for another 3-4 hours. The extremely dark night would have made formation flying difficult, but was not much of a concern for me as I was on my own.

This particular presentation involved a preplanned turn and descent from one red air altitude block to the next lower block. Little did I know that this tactic was going to alter the rest of the sortie to my great benefit. Thirty seconds after executing this maneuver, I was called dead and began flowing back toward home. I was sure that the excitement was over for the night … until the master caution lit up. This alone isn't enough to get much of a reaction from Viper

USAF photo by SSgt Josef Cole

pilots, as the jet has many nuisance warnings that are experienced on many sorties. Imagine my surprise when I glanced at the pilot fault list display and saw the dreaded "ENGINE LUBE LOW" fault.

I was even more surprised to see that the fault disappeared after clearing the master caution. A quick look at my oil pressure, and I was feeling better as pressure was well within normal limits. Since things didn't appear to be going south too fast, I took a deep breath, wound the clock, and started working through the checklist. As I started flipping through the checklist at night with nothing but a dim finger light to illuminate the pages, I discovered that the checklist didn't match what I had remembered. Apparently the latest changes affected just the procedure that I needed and I hadn't taken the time to become familiar before flight.

Now for a little background information on the F-16 oil system. There are two basic malfunctions: a loss of oil quantity indicated by an ENGINE LUBE LOW fault, and a loss of oil pressure as indicated by the pressure gauge and a low pressure light. There is a slight chance that a faulty quantity indication can be caused by maneuvering and sloshing of oil. These false indications are relatively rare because of a 30-second delay built into the fault reporting system. To rule out a false warning, the checklist originally called for the pilot to maintain straight, level, unaccelerated flight for approximately 45 seconds, clear the fault, and see if it reoccurred. If the fault didn't reoccur, this was cause for a precautionary landing, but was not a land-as-soon-as-possible condition. An oil pressure malfunction was considered an absolute indication of a problem, and required jettisoning stores and landing as soon as possible.

To complicate matters, the wing had recently experienced several oil pressure gauge problems where pressure was indicating low or zero, without any associated low pressure or low quantity lights, when there was no problem with the system. Guidance at the time was that any low pressure indication unaccompanied by warning lights was still to be treated as a critical fault, while the low quantity indications were to be treated differently. On the morning of my IFE, the checklist changes altered these procedures.

That night, I struggled to reconcile what I knew about the systems and the checklist with what I was reading. My first thought was that I was misreading the checklist or was possibly on the wrong page. After all, I couldn't find any mention of the possible false indication caused by maneuvers. Having just completed a 360-degree spin while descending 10,000 feet, I was sure that my problem was just oil moving around in the tank. There was no way that I had a serious emergency, at night, by myself, far from the home field.

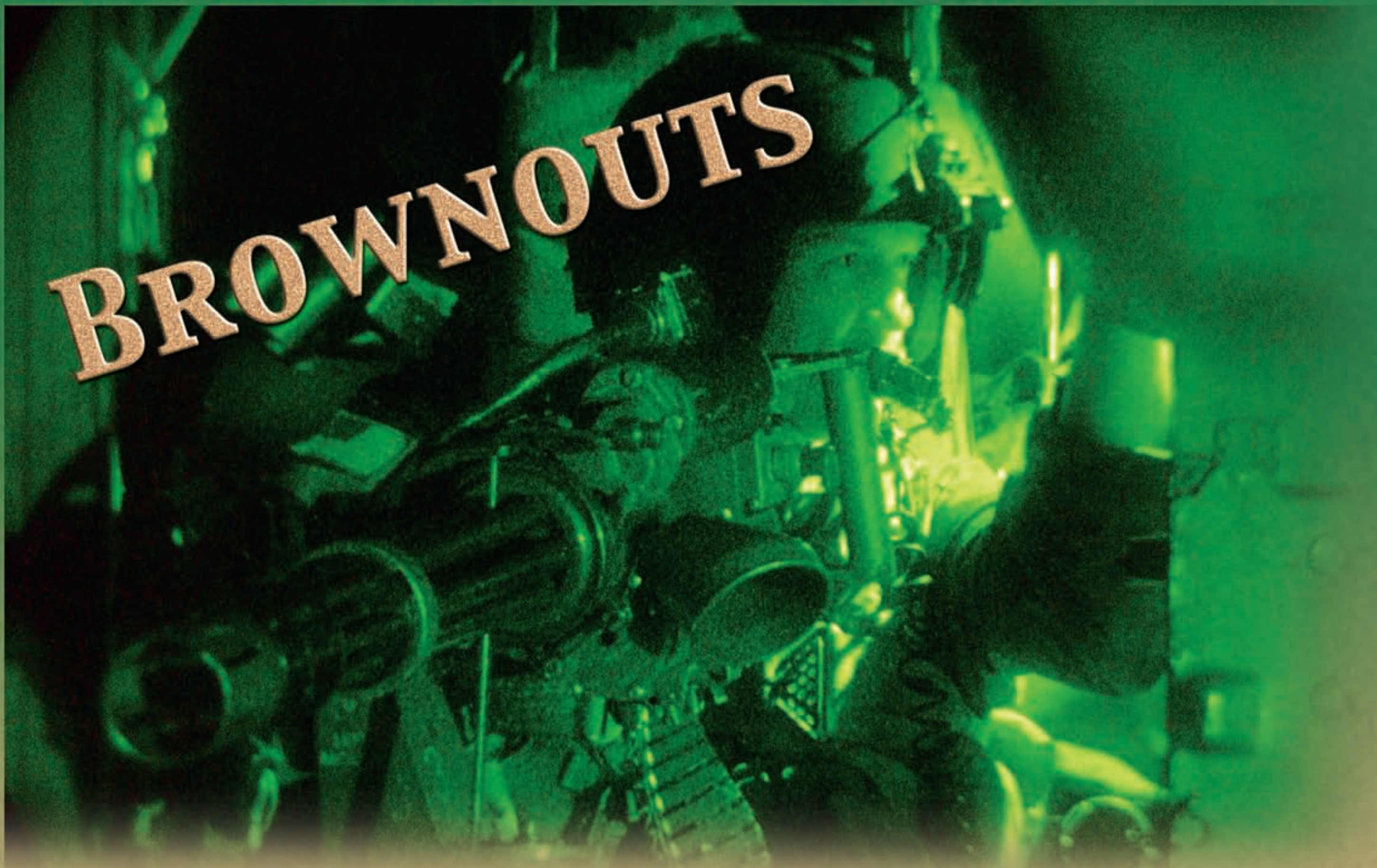
Hesitant to do anything drastic like jettison my tanks without another pilot to back me up, I contacted my original flight lead on the radio and discussed the problem with him. We both felt that this was most likely a faulty indication that would allow me to fly back to home base. Just to be sure though, we contacted the supervisor of flying who was able to review the technical orders and recommend an immediate landing at a nearby divert field from a simulated flameout (SFO) approach.

About this time, my blood pressure begins to rise. We practice SFOs all of the time, but never at night and always with the reassurance that there is a "go around" option. Now I was being asked to fly a very steep approach into a divert field, without the normal daytime visual references. This particular field has a much shorter runway than the home field, as well as fewer approach and runway lights.

Luckily, the approach went well. I was able to fall back on the excellent simulator training that I had received, and judged my round out and flare based on a few visual cues and the use of the radar altimeter. After getting the jet stopped and verifying with the fire department that I didn't have hot brakes, I began to relax. Up until that point, I was afraid of messing up the approach and highlighting what I thought was a false indication.

All my concerns were to disappear and my gratitude for the supervisor of flying assistance greatly increased when I saw the large amount of oil covering my centerline fuel tank and the trail of oil down the runway. As it turns out, the new checklist procedures were implemented for a good reason, and I was just minutes away from becoming a "glider pilot."

USAF photo by SSgt Bennie J. Davis III



CAPT JENNIFER SHERER
66 RQS/DOT
Kadena AB Japan

In the Air Force, we focus on a lot of fixed-wing safety issues, such as mid-air collision avoidance, aerobatics, and bird control for runway operations. But for helicopters, the safety concerns are much different. Operations for the combat helicopters, such as the HH-60G PaveHawk and the MH-53 PaveLow, focus in the extreme low-level arena—200 feet and below. Threats, ground hazards, and weather are much different animals in their regime. The most dangerous aspect of flying in combat helicopters today, however, has become the task of landing in desert environments.

Takeoffs and landings are the most dangerous part of flying for all aircraft; they are also the most critical. Helicopters are most useful because they can land in many places that fixed-wing assets cannot. This has always been the advantage of the helicopter. Since beginning operations in the desert, however, helicopters are finding their all-aspect landing capability in jeopardy. In all services, helicopter pilots have had to revamp their landing profiles to accommodate for what is known as brownout landings. These landings occur because of the dust and dirt that helicopter rotors kick up during their last 20 to 30 feet of an approach that reduces their visibility significantly, sometimes causing them to go pop-eye. These are landing profiles that require a lot of skill and proficiency to do well, and possibly the most challenging part of helicopter flying.

Have you ever had to land in zero visibility conditions? Imagine shooting an approach to an undefined landing area in the middle of the desert on a low illumination night based on GPS coordinates alone. Add to that sandstorms and talcum powder dust that begins to pick up at 50 feet and envelopes your cockpit and cabin at 20 feet above the ground. In fact, the best way to describe a true brownout approach is to ask you to close your eyes at 25 feet above the ground with near zero air speed and try to land. Now you have an idea of what a brownout landing is.

Because brownout landings are relatively new to the Air Force helicopter community, there have been many adjustments to standard landing procedures and practices. The helicopter

USAF photo by TSgt Justin D. Pyle

community has had to flex a great deal and reattack traditional landing styles in order to accommodate for multiple new factors involved in brownout style landings. This has been especially difficult for the HH-60G community. The placement of modifications made to the PaveHawk, such as the FLIR (Forward Looking Infra-Red) and infrared countermeasure equipment, as well as several radio antennas, create a challenge for executing a brownout. Although one of these modifications, the FLIR, does improve some of the approach visibility, it hangs from the bottom of the aircraft and has proven the most vulnerable to being crushed in a brownout approach. Even the most experienced pilots are not immune from breaking FLIRs or rolling an aircraft due to a brownout approach. But it's not only the helicopter and its equipment that are vulnerable to a bad approach—so is the crew.

There is no easy or present solution to making brownouts safer. It isn't possible to avoid brownout approaches completely, because of the realm in which helicopters operate. Both the HH-60G and the MH-53 execute operations that require landing to unsurveyed sites during combat that very often become brownout approaches. The community has taken some steps to reduce the risk taken by executing these approaches. The first control that has been implemented is to require helicopters to land to a prepared landing zone (LZ) as much as possible. Prepared LZs mostly exist at Air and Army bases in the AOR, as well as FOBs. But it isn't very often that the operations helicopters are involved in occur near prepared LZs. Multiple techniques are taught. Sorties focused solely on practicing the approaches are encouraged, and many restrictions have been put on pilots and their crews concerning how brownouts will be executed. But that is just part of the solution. Technology and aircraft modifications must evolve in order to assist our pilots in what has become the most difficult skill to master.

The recent mishaps concerning brownouts have ranged from broken FLIR balls and severe aircraft damage to crew member deaths. This has really brought a lot of attention to the helicopter community and has forced MAJCOMs to re-evaluate how to improve helicopter survivability in brownouts. There have been ideas from all over. Some have proposed a technique that is used in the Army. Some Army helicopters have found that removing the cabin doors during missions where brownouts are expected

have increased their visibility tremendously. The unfortunate trade-off with that technique, however, is a significant loss in protection from threats. The Air Force hasn't adopted that technique due to the desire to minimize threat risk. Other ideas include an updated FLIR that takes pictures of the LZ when the helicopter first arrives at an LZ. This is called the "see and remember" solution. The simple explanation is that a camera on the aircraft takes a series of 3D topographic pictures while the helicopter is airborne. If a brownout occurs, the image can be synthesized onto a heads-up display to help the pilot safely land the helicopter. Another engineering idea is to create a radio wave system that can "see through" the dust cloud. One final idea is to add a system to the helicopters that will spray potential brownout LZs with liquid to dampen the earth. This system has been patented as "Rhino Snot" and has been getting mixed reviews. The idea behind it is that a ground vehicle in the intended landing zone area can spray a polymer solution onto the ground, and it will adhere to the sand, enough to make it more landable. It is a very controversial idea, but one that some Army helicopters have started to use. All of these ideas at this point are only on the drawing board; our helicopter community has a long wait until the risk of brownout landings is reduced.

Until helicopters have technology that improves their survivability, the community must focus on

USAF photo by TSgt Cecilio M. Ricardo

USAF photo by MSgt Terry L. Blevins

good piloting, solid crew resource management, and strong techniques. The only drawback is that brownouts are very dangerous, in peacetime and in combat, and it's hard to have training control measures that won't hamper good crew training for these types of approaches. How does an aircrew train to improve their ability to land in brownout conditions if multiple restrictions are placed on how much they can practice these approaches? Brownout landings have become the number one safety concern in combat helicopter flying. As we struggle to find a way to reduce the dangers of brownout landings, we as leaders must ensure that on every mission, the benefit of the mission outweighs the risk we place on our elite helicopter crews.

Can You Answer The Mail?

CAPT JOSEPH GOLDSMITH
390 FS/DOC
Mountain Home AFB ID

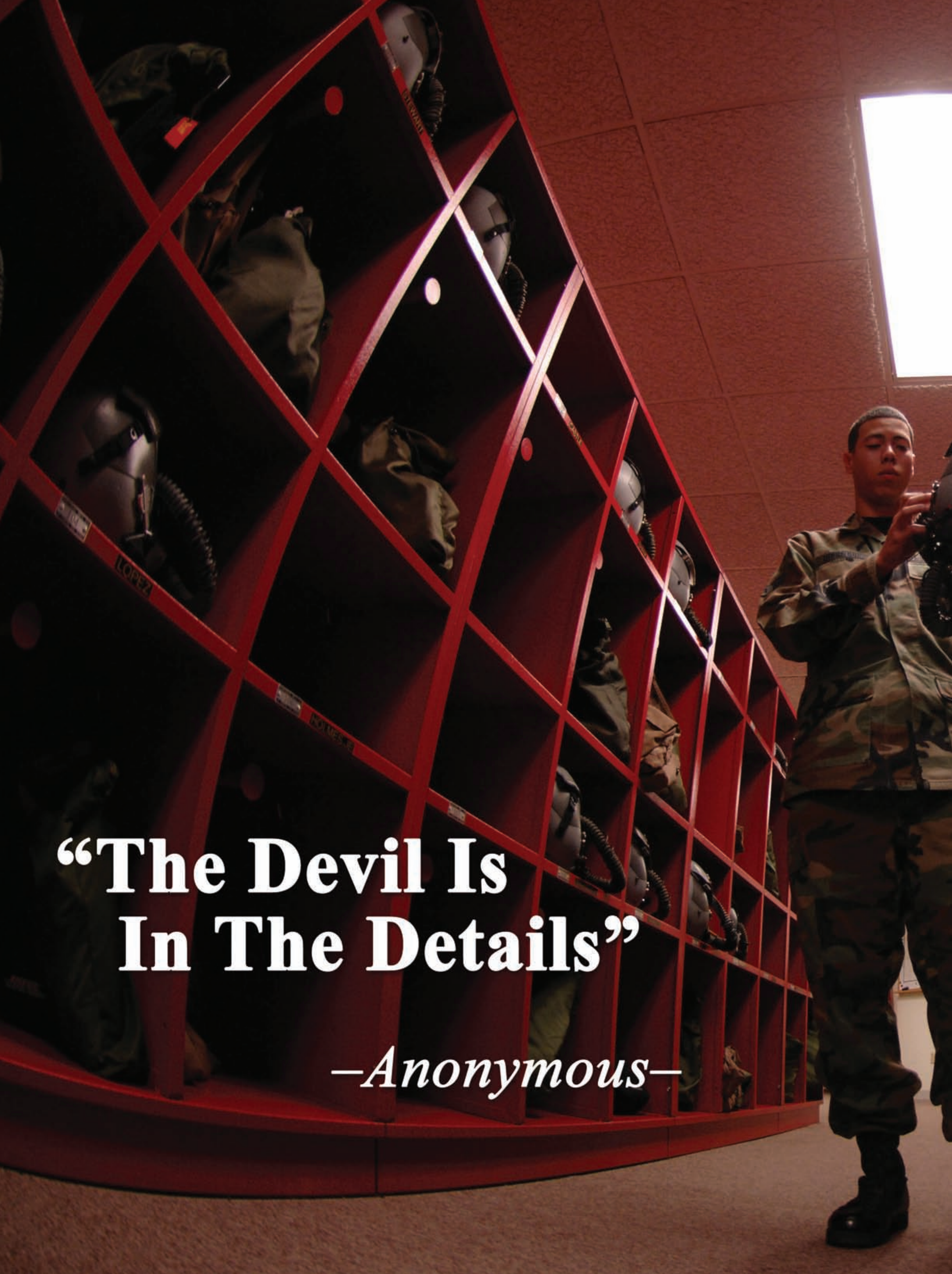
Just prior to graduating from the F-15 schoolhouse, my fellow students and I were very concerned about the qualities that made a good wingman in an ops squadron. There is only one thing I remember specifically from "Wingman 101." Our squadron commander gave us a briefing, and the overall theme was how to balance the desire to complete the mission versus the safety of bringing both ourselves and the jet home in one piece. He told us that when we got to our squadron, we would eventually find ourselves in a position where we weren't comfortable with the situation, or didn't know if what we were doing is what we should be doing. His litmus test was whether he could explain himself after the fact to his commander: "Can you answer the mail?"

One of the corollaries to Murphy's Law is that the more exciting the mission and the more effort you personally put into planning, the greater chance that your jet will break. Deciding on the go/no go decision in the Eagle is usually pretty easy: either the jet flies or it doesn't. However, the smaller malfunctions that would be dismissed in a combat situation are not so easily dismissed during a training mission. So there I was on takeoff roll when the master caution and the roll Control Augment System (CAS) lights came on. For those not familiar with the Eagle, things have to go rather badly rather quickly to warrant an aborted takeoff. A single failure of the CAS is not a situation grave enough to risk hot brakes and/or a cable engagement; the jet will fly just fine without that system. This mission was an LFE (large force exercise) that guarantees a large amount of red air assets, in this case dissimilar assets, and we were practicing a defensive counter-air scenario simulating actual, real-world adversaries. While we have used this scenario in the past, this was the first time that I got to see lane operations with the numbers of adversaries expected. The day prior, I had spent the whole day helping the flight lead prepare for this mission, and I was excited to actually fly. Once safely airborne, I had the option of telling my flight lead about the CAS malfunction or shutting up and flying the mission, and talk about the malfunction during RTB. This was my chance to apply the litmus test my old commander imparted to us. My decision was that if I got supersonic or got into a close dogfight (two conditions where the rules of stability change dramatically) and the jet departed, then I could not honestly look my DO or CC in the eye and say I was not a moron. Upon maintenance debrief, I learned that the jet lost the signal from one of my AOA probes, and the pitch control was also suspect and most likely would have fallen off-line at a very inopportune moment. Of course it was likely that I could have flown the mission with the observed malfunction and experienced no problems, but I feel that I made the right call.

That's not to say that I have never screwed up in the air. My call sign is a direct result of a more exciting sortie. This is a perfect example of the extra vigilance required when you are doing something dumb, different, or dangerous. My second MQT sortie was an offensive BFM ride during a surge, which meant I flew three sorties in a row without leaving the cockpit. While the process of hot-pitting in the Eagle is nothing new, it was new to me. The first two sorties were uneventful and were fortunately good enough to pass the ride. However, during the second round through the pits, the crew chief asked me to lock up the left side ramp. This action is not required by the checklists, but ensures the movable inlets on the non-operating engine are forced in the up position. The maintenance troop wanted to make sure that nothing was going to allow the ramp to lower and injure anyone on the ground. There are a few problems with this procedure. First, when there is an asymmetric condition in the ramps and you enter a dogfight, the Eagle is unstable. Second, since you commanded the ramp to be in the up position, the warning light does not illuminate; the ramp is doing what you told it to do. As advertised, about five seconds into my first dogfight, the jet didn't quite depart, but didn't quite do what the stick and throttle inputs would suggest. I called the "knock it off" and assumed the jet had a malfunction. The rest of the flight was boring: burning down gas and landing, although I did figure out what happened while halfway back to the home-drone. Expectedly, my flight commander and weapons officer were waiting for me in debrief to review the tapes and see what happened to properly write up the jet. I could have stuck to merely the factual information: "I followed in the vertical and the jet wrapped up on me." But this is a case where I could answer the mail: I made a simple mistake with somewhat serious implications and felt no need to hide my error. My first words were "I screwed up" and the worst that happened was I missed out on a few BFM fights.

These last cases are both training sorties, but they shed a little light into the balance between completing your mission and bringing the jet back in one piece. I'm sure that everyone reading this has been in a questionable situation before and will be in questionable situations again. Hopefully when a few of you take the time to step back, you can use the test that has been passed to me: "Can you answer the mail?"

USAF photo by SrA Miranda Moorer


"The Devil Is
In The Details"
–Anonymous–

USAF photo by SrA Christopher Boitz

Are You Privileged?

MAJ ERIC "DOG" DOPSLAF
AFSC/SEFL
Kirtland AFB NM

Sounds like a strange title, but when it comes to "safety" mishap investigation, you might be. If current trends continue, the promise of confidentiality (safety privilege) might be eroded to the point that we as safety investigators are no longer able to grant it. Interim Safety Board (ISB) members, Safety Investigation Board (SIB) members, and first responders have not been doing a very good job of utilizing, granting, or protecting this right.

What is safety privilege, or more appropriately, military safety privilege? It is a government evidentiary privilege that gives the government certain powers in court proceedings, both criminal and civil. Simply put, military safety privilege empowers SECAF to restrict the release of information, subject to a federal judge's review. It allows safety investigators to promise witnesses that their statements will be kept confidential, or contractors that their reports will be treated in the same manner.

Because there is no statute, the courts can tweak this privilege when they deem it necessary or when challenged in court. For example, several years ago, the cockpit voice recorders (CVRs) were treated as privileged. But since then, there has been some erosion to this right, possibly due to improper use, unauthorized release, or court challenges; as a result, the courts now consider transcripts from CVRs as factual information, not privileged.

We need to take reasonable precautions to protect information from unauthorized release. The unauthorized release of information is one way that the sanctity of military safety privilege can be compromised. In today's electronic era and the ability to easily access information, we must be on guard even more so than in years past. One recent example of this was the release by unknown persons of privileged C-5 animated mishap re-creation. One day it showed up on the web for the entire world to view. We must also protect from some individual walking by the copier and thinking that it would be cool to share mishap pictures and information with their buddies. We must actively guard against these types of events, because if the courts view us as not protecting and taking privilege seriously, we may lose it all together.

Another trend that has been identified is the improper use of privilege. There are a number of cases where privilege has been either blatantly disregarded or improperly applied. In one case, the board granted privilege to everyone that it interviewed, including the witnesses in a nearby park that just happened to observe the mishap. In other cases, it has been given to home station maintainers (not directly associated with the mishap), spouses, firemen, and the list goes on. These are all gross examples of misuse of privilege. If it had been properly applied, only the individuals who had direct knowledge or involvement in the mishap and were reluctant to cooperate should have been granted privilege.

One area that has recently become problematic is of the actions of first responders (doctors, medical technicians, and firemen). It is only human nature to want to know "what happened," but these individuals need to be hesitant with their questions. If you are a first responder, your primary mission is to treat the individual and not to ask specific questions relating to the mishap. There are many differences and nuances between Privilege, HIPAA, and Privacy Act, and if not applied correctly, could impact the validity of the mishap investigation. **Do not** give the impression that you are allowed to give privilege, **do not** offer privilege, **do not** even think about giving privilege … you're not authorized to do this! Once the flight crew has been treated and stabilized, then the determination will be made by the ISB president when and to whom privilege will be given.

As it is currently written, AFI 91-204, *Safety Investigations and Reports*, only allows members of a designated ISB and SIB (and Single Investigating Officer (SIO)), when authorized by the board president, to make the promise of confidentiality. NOT the Wing Commander, NOT the Ops Group Commander, and NOT the Squadron Commander. This also includes the flight safety officers, life support officers and flight docs, unless they are part of the board and have been authorized to do so by the board president.

What is covered when privilege is provided? Covered under the military safety privilege are the statements, given under the promise of confidentiality, and the findings, conclusions, and recommendations of the safety board. When the promise of confidentiality is given, it **MUST** be documented. It is just as critical to document when the witness is **not** given the promise of confidentiality. AFI 91-204, provides examples of this documentation. Additionally, for recorded interviews, the privilege or non-privilege statements must be read on the recording preferably before the interview.

The military has worked hard to keep this privilege. This allows us to get critical safety information to commanders in the quickest means possible, thus minimizing the impact of accidents on national defense resources, in addition to saving lives. If we need to ground jets for safety reasons, we want to know right away and not have to worry about getting the whole truth. We have to protect the deliberative process to encourage open, honest, and full evaluation of mishap causes, and to get accurate recommendations. Additionally, privilege helps keep safety investigators and reviewers out of depositions and court hearings.

During the past year, the Air Force Safety Center has been rewriting AFI 91-204. During this process, one of the goals was to more clearly define who and when the promise of confidentiality can be given. The proposed wording will only allow the ISB/SIB President, ISB/SIB Investigating Officer (IO), or SIO to authorize ISB/SIB team members to offer promises of confidentiality to specific individuals. Limiting the persons authorized to make the promises of confidentiality does not mean the SIB President or the IO must be present at all witness interviews. We hope the proposed wording will eliminate many of the gray areas that arise, ensuring the promise of confidentiality is correctly applied.

In closing, we, as Air Force members, never know if and when we will be a part of a safety investigation, but it is our responsibility to understand and properly apply the use of privilege. Privilege is ours to use or lose. We must apply it properly and protect this privilege. ⚖

Tracking Raptors In Raptorland

LT COL LAWRENCE SPINETTA
1 FW/SE
Langley AFB VA

Imagery Courtesy of Author
Photo Illustration by Dan Harman

(Editor's Note:** This article is the opinion of the author, and not the official position of the Air Force Safety Center.**)

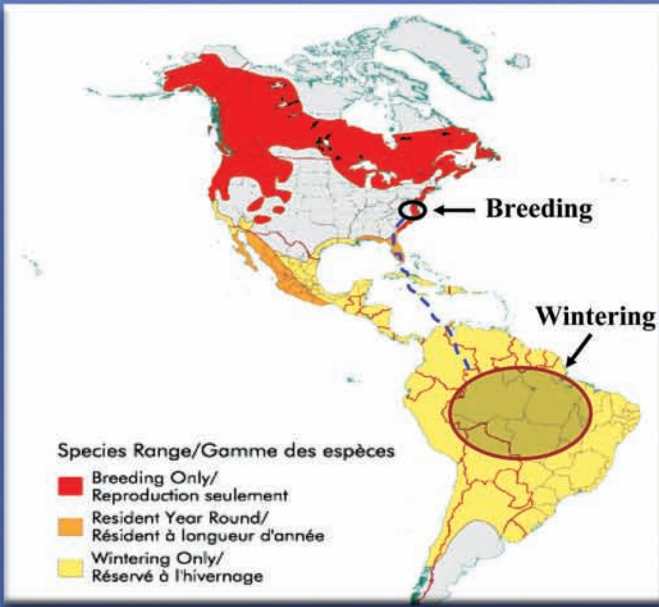
The F-22A Raptor is a formidable bird of prey that strikes fear into the heart of many adversaries. However, another bird of prey can be just as lethal when it comes to military aircraft. The Osprey, whose scientific name is *Pandeon haliaetus*, is a type of raptor that has been responsible for 25 bird strikes on USAF aircraft, resulting in excess of 1.3 million dollars in damage. The National Wildlife Research Center ranks the Osprey as the fifth most hazardous bird species to aircraft.

In 2000, a Langley F-15 collided with an Osprey, causing over $750,000 in engine damage. Fortunately, the pilot was able to successfully complete an emergency landing. In contrast, Raptor engines cost $10.2 million dollars each; a single bird down the intake can cost the Air Force millions.

Osprey populations have shown dramatic increases in the past two decades, particularly in the Mid-Atlantic Chesapeake Bay Region. Researchers estimate a 7.54% increase per year for each of the past 20 years. Langley has identified more than 72 Osprey nests within a 20-mile radius of the airfield. Visual observations of the airfield noted an average of more than three Osprey sightings per survey. What's worse, Ospreys are tolerant of human activities and traditional hazing techniques.

To combat this growing danger, the 1st Fighter Wing partnered with NASA Langley Research Center and the US Department of Agriculture (USDA) Wildlife Services to study the breeding and migratory patterns of Ospreys. Captured birds were fitted with GPS-capable transmitters that relayed data through the ARGOS satellite network. The device transmits the altitude, speed, and direction of travel of each bird every two hours. The 1st Fighter Wing Safety Office, as part of its BASH program, aggressively uses the data collected from this study to compile trend information, adjust flight times, and educate its aircrew.

In 1999, the 1st Fighter Wing Safety Office signed an interagency agreement with the USDA to integrate experienced USDA wildlife experts into its staff of safety professionals. "Tom Olexa and Jared



Osprey Migration Patterns

Kwitowski are literally worth their weight in gold," said the 1 FW Commander, General Mark Barrett. "Their bird expertise is indispensable." Langley has enjoyed a 98% reduction in costs associated with BASH. Similarly, Colonel Patrick Marshall, the 1st Operations Group Commander, echoed the wing commander's sentiments. "Unity of effort is an important principle in war fighting. Here is a perfect example of interagency cooperation which protects our aircrew and advances the mission."

The Osprey study has produced some interesting insights. Migrating Osprey, on average, flew approximately 35 miles per hour and at an average altitude of 1,150 feet. Osprey typically flew during daylight hours and roosted at night. One Osprey flew more than 3,600 miles in 31 days to its wintering roosting grounds in Peru. Another flew 2,800 miles to central Venezuela. The study revealed the location of many Osprey nests and movements that overlapped with local area flight paths and thus, potentially put aircrew at risk. As a result, Langley has been able to pinpoint nests and focus its reduction, suppression, and prevention efforts to eliminate many Osprey hazards.

"We practice zero tolerance when it comes to wildlife endangering Langley pilots," remarks Tom Olexa. Langley employs a combination of lethal and non-lethal control measures, to include dispersal operations, habitat modification, and a relocation program. Since 2001, Langley has relocated more than 98 nestlings between 5-7 weeks of age to various wildlife areas to mitigate the danger to aircraft.

There are many resources available for bases to leverage for their BASH program. Langley has found that its partnership with USDA wildlife experts is particularly beneficial, and as a result, both the F-22A Raptor and its namesake are able to share the skies safely.

Local Movements Of Breeding Osprey

Crash Protection For Mobile Aircrew

MR. MARK RUDDELL
AFSC/SEFE
Kirtland AFB NM

(Editor's Note: *This article is the opinion of the author, and not the official position of the Air Force or Department of Defense.****)***

From Fiscal Year (FY) 1991 through FY 2007 the USAF has had nine crewmen inadvertently exit the cabin of H-53 and H-60 aircraft during Class A survivable crashes. All of these crewmen were performing crew duties while wearing a gunner's belt. Of these nine inadvertent exits, three were fatal, one of which was from improper use of leg restraints on a survival vest. Of the other six, five resulted in major injury, two of which were life threatening. There has been only one inadvertent exit where the individual was lucky enough to walk away with only minor injuries.

Pop Quiz Question 1 (yep, another one is coming): If you are a crewman wearing only a gunner's belt and inadvertently exit the cabin of a helicopter during a survivable crash, what is your chance of a major or fatal injury? At the risk of doing math in public, by my calculations, 89%.

During the same time period as above, seventeen crewmen wearing gunner's belts remained in the cabin of H-53 and H-60 aircraft during Class A survivable crashes. Of these seventeen, two were fatal, one had a major injury, and fourteen had minor injuries.

Pop Quiz Question 2 (I told you it was coming): If you are a crewman wearing only a gunner's belt and remain in the cabin of a helicopter during a survivable crash, what is your chance of a major or fatal injury? By my calculations, 18%.

The obvious conclusion is that remaining in the cabin during a survivable crash decreases the chance of a fatal or major injury. The gunner's belt we now use depends on the crewman manually adjusting the belt length to accomplish this. The problem is that this limits the distance a crewman can reach, and constant readjustment of the belt length is needed to reach further. This is not very practical in a high demand tactical or training situation. What if there was a device that would pay out enough webbing to allow full reach and would automatically lock during a crash sequence, keeping the crewman in the cabin?

There are currently a couple of such devices that are in various stages of development. Referred to as crash protection for mobile aircrew, the system incorporates an MA-16 inertia reel that will pay out webbing as the crewman moves around the cabin, but will lock when the webbing pay out is too fast or when the reel senses a vehicle impact. Another device employs an energy attenuating mechanism that will similarly lock and attenuate the energy from the "leash jerk" when the crewman reaches the end of the tether. Either of these devices has the ability to prevent a crewman from inadvertently exiting the aircraft during a crash without the need to manually adjust the webbing length. I'll go one step

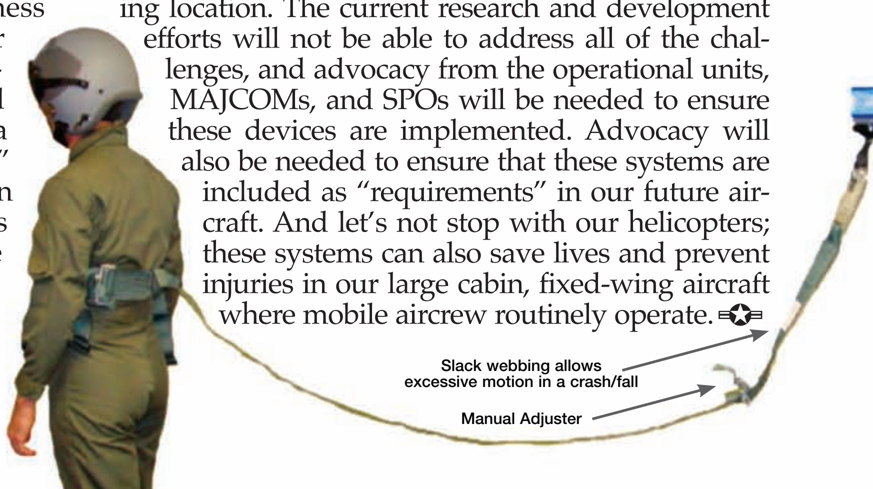
USAF Photos by Mark Ruddell

further and say that these restraint systems will also decrease the chance of fatality or injury for crewmen that remain in the cabin during a survivable crash.

During any crash impact, a mobile crewman will continue moving when the aircraft suddenly stops. Injuries can be caused by impact with the floor or other structure, and the degree of injury will increase with higher velocity impacts. The locking/energy attenuating devices described above will, in many cases, either prevent this impact or decrease the velocity of the crewman prior to impact. This will minimize injury and can make the difference between being incapacitated or having the ability to self-egress from an aircraft that is susceptible post crash fire, or having the ability to escape and evade if in a hostile area. Another benefit of the reel devices is that the excess slack that was dangling from the ceiling or dragging around on the floor is no longer an issue. The excess slack is automatically retracted as the crewman moves around the cabin.

An additional improvement we can make to our current restraint system is to integrate a harness that will distribute impact loads over a larger area. The current gunner's belt is approximately six inches wide and is worn around the upper chest area or abdomen. During a crash sequence, the loads from the "leash jerk" are focused on the small contact area between the belt and the chest or abdomen. If the loads are high enough, this can break ribs and cause other internal injuries. If the belt slips down around the abdomen and is not supported by any bones, the loads can cause damage to vital internal organs. Ideally, a harness will distribute the loads over as broad an area as possible while taking advantage of hard bone structure for support. It must also stay in place no matter what the direction of impact, and a helicopter crash can be a very dynamic event.

Researchers at the 77th Aeronautical Systems Group and Air Force Research Laboratory have been working with industry and our sister services to develop solutions to improve mobile aircrew restraint. There have also been testing and open house forums held with test and operational units at Kirtland AFB, Nellis AFB, Hurlburt Field, and Langley AFB. This has provided an opportunity for you, the mobile aircrew, to provide input on how these systems can best be optimized to meet your needs. There are challenges that remain. Integration into the airframe may require modification of the support structure. In some aircraft, there is limited real estate, and the effectiveness of the restraint system is related to the mounting location. The current research and development efforts will not be able to address all of the challenges, and advocacy from the operational units, MAJCOMs, and SPOs will be needed to ensure these devices are implemented. Advocacy will also be needed to ensure that these systems are included as "requirements" in our future aircraft. And let's not stop with our helicopters; these systems can also save lives and prevent injuries in our large cabin, fixed-wing aircraft where mobile aircrew routinely operate.



Special Ops Training With The Newest NVG Technology

USAF Photo by SSgt James Harper

CAPT KEITH D. HIGGINBOTHAM
58 SOW/SEF
Kirtland AFB NM

In the 58th Special Operations Wing (58 SOW), aviators are "training the best to lead the rest." Night operations present some of the most dangerous flying situations a crew will experience, but this is a familiar scenario for the UH-1 crews and the battle-tested M/HC-130, HH-60. To successfully and, more importantly, safely train the best, integration of human factors into advancements of aircraft and night vision technology are paramount. The 58 SOW fixed-wing, rotary-wing, and tilt-rotor crews fly using the latest in night vision goggle (NVG) technology and in the CV-22, the latest in aircraft technology.

The CV-22 Osprey's mission is to execute infiltration and exfiltration, resupply missions for special operations forces, and to be able to quickly respond to worldwide contingencies. The aircraft has the unique ability to takeoff, land, and hover like a helicopter, and it can tilt its nacelles to fly like a conventional, prop-driven aircraft. The CV-22 mission will generally involve low-visibility, clandestine operations involving deep penetration into hostile airspace. CV-22 crews can rapidly deploy at high altitudes and speeds and have the capability of operating low level, under conditions of minimum visibility. During low-level operations, the CV-22 can be converted to helicopter mode, locate a small landing zone, and land under the cover of night with little illumination.

CV-22 crews train and operate using state-of-the-art technologies that enhance operations under the cover of darkness. Terrain following/terrain avoidance radar and forward looking infrared radar (FLIR) night imaging technologies, combined with the Osprey's fully NVG compatible cockpit, allow the crew to use terrain masking and other low-level tactics during nighttime operations. In addition to proven aircraft technologies, new life support technologies are available to enhance night tactical missions. CV-22 student pilots and flight engineers, as well as other special operations and combat search and rescue crews, train with the latest in NVG image intensifier technology: Pinnacle™ image intensifier tubes. Although 58 SOW aviators are already training and operating with this new technology, many still ask, "What is the difference in technology?" and "What operational advantage does the new technology give?"

Special operations and rescue aircrew members operate in complex environments where air and ground teams interact in a highly automated world. Research by the National Aeronautics and Space

Administration into aviation accidents has found that 70 percent involve human error. Human error can be caused by a number of physiological and psychological human factors such as fatigue, task saturation, poor communication, fixation, distraction, flawed decision making, and perception problems. Visual perception and visual performance, for example, are dramatically diminished during operations conducted in the clandestine environment of darkness. Under twilight and nighttime conditions, many visual abilities such as spatial resolution, contrast discrimination, depth perception, and reaction time are degraded.

One way to improve or at least slow the visual degradation is to improve the nighttime image for the combat aviator. As military operations often occur in the stealthy environment of darkness, NVGs have become a necessity to improve situational awareness, safety, and operational effectiveness at night. There are however, some inherent limitations. Visual acuity with NVGs can be affected by such factors as terrain illumination and contrast effects, flashblindness protection, laser eye protection, incompatible cockpit lighting, as well as the image intensifier tube itself.

A number of studies have been conducted to investigate operational factors that can degrade visual acuity with image intensifier systems. Illumination and contrast effects on NVG-aided visual acuity are well established. It was found that for a given image intensifier generation, visual acuity falls off more rapidly for a low contrast target than for a high contrast target as night sky radiance decreases. As targets reflect less and less contrast and as the night sky illumination decreases, visual performance is degraded, and a sparkling effect in the image can be more pronounced. Improvements to the image intensifier tube allow for improved visual performance under those darker conditions.

NVGs have evolved over the decades and continue to provide enormous benefits to warfighters in a nighttime environment. Technological advances in image intensifier tube design have led to the F4949G-TG Pinnacle™ goggle, addressing problems with illumination and contrast effects and incompatible urban lighting. The F4949G model and F4949G-TG model of NVGs are both third generation goggles, but the differences lie in the design of the intensifier tubes. Two major differences between the intensifier tubes are the auto-gated power supply and the thin-filmed technology designed for the Pinnacle™ model of NVGs.

The auto-gated power supply is designed to allow for voltage to pass through the microchannel plate (MCP), even when exposed to incompatible light sources inherent in urban environments. The tube voltage is rapidly pulsed on and off to prevent significant loss of scene detail due to image blackouts or hot spots. The power supply automatically varies depending upon how much energy is passing through the MCP (see Figure 1). At low light levels, the power is applied 100 percent, while at higher light levels it is limited, almost shutting down for a few microseconds to allow the flux of electrons to exit the MCP before applying power once again. As a result, an incompatible light source does not cause image quality to significantly degrade, thus reducing the negative effects that incompatible lighting has on the NVG-aided image. The alternative, offered with the F4949G tube standard direct current power supply, allows full voltage to pass through the tube in low light situations and no voltage in the highly lit environments. With voltage turned off due to incompatible lighting, energy will not be intensified, leading to a severely degraded NVG-aided image.

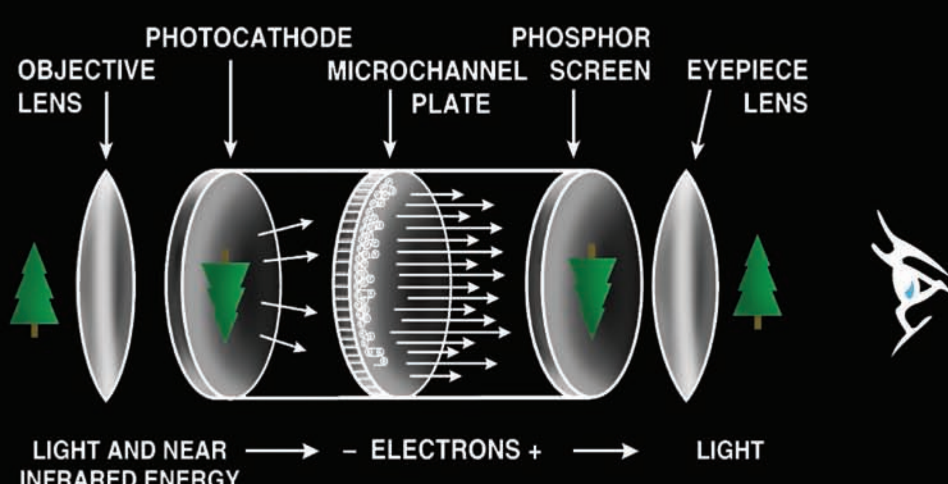


Figure 1. Diagram of the basic principle of image intensification. (Antonio, Berkley, Fielder, & Joralmon, 2004)

Not only does incompatible lighting cause the NVG image to be severely degraded, it also will produce a "blooming" or halo effect surrounding the incompatible light source. The auto-gated power supply and decreased spacing between the photocathode and MCP of the Pinnacle™ goggles help reduce the size of the halo effects. The F4949G NVG model has a halo size of 1.25 mm in diameter. The F4949G-TG NVG model has a halo size of 0.70 mm in diameter. The bottom line is the halo size surrounding an incompatible light source will be almost 50 percent smaller, allowing for greater detail in the image (see Figure 2).

The addition of a film coating over the input side of the MCP had been the technological difference between the second and third generation. The photocathode, without a film coating, was not resistant to ion damage, so the film coating was essentially used to increase the tube life. Tests later revealed that thinning the film coating could increase the performance of NVGs. ITT Industries Night Vision Division found that significantly thinning the protective film would protect the photocathode structure while still allowing decreased spacing between the photocathode and MCP, resulting in the improvement of the NVG signal-to-noise (SNR) ratio.

Figure 2. NVG images showing a comparison in the reduction in halo size with F4949G-TG goggles (ITT Industries, Night Vision, 2006).

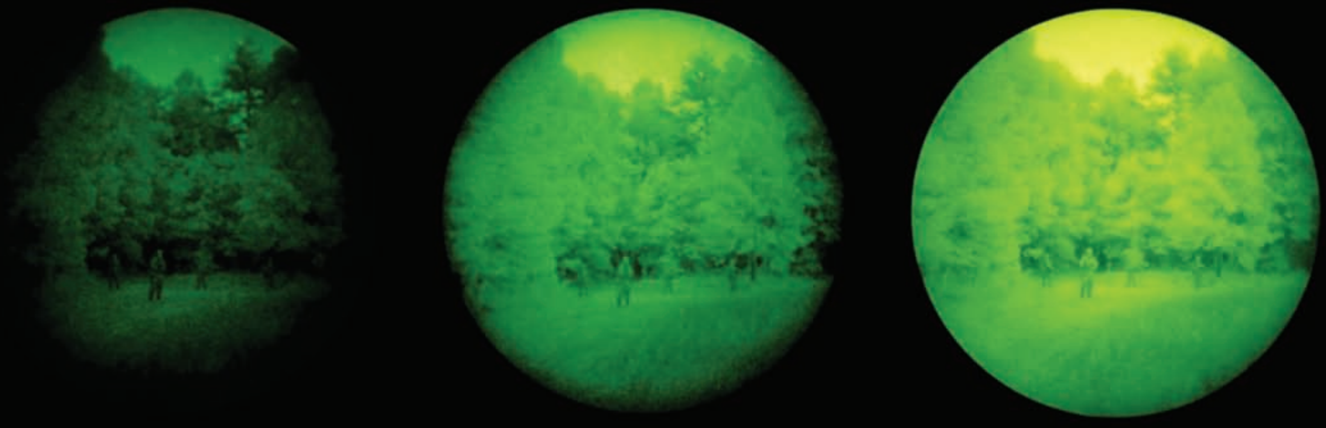
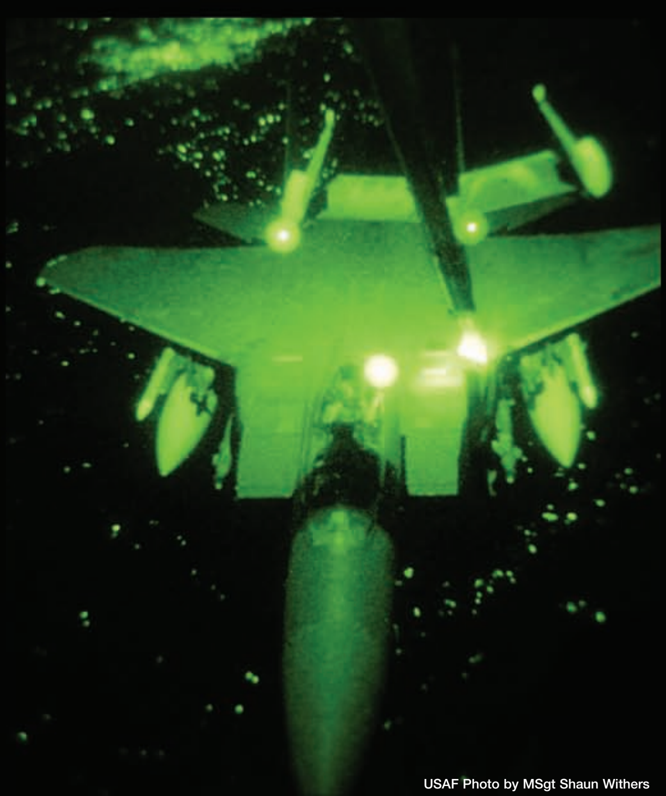


Figure 3. Brightness and image clarity progression comparison at clear starlight conditions (ITT Industries, Night Vision, 2006).

A tube's SNR determines the low-light resolution of the image intensifier tube; therefore, the higher the SNR, the better the ability of the tube to resolve objects with good contrast under low light conditions, thus reducing that amount of video noise or scintillation from the user's view. The SNR is an indicator of video noise or scintillation. Scintillation is a faint, random sparking effect throughout the image area. Scintillation is a normal characteristic of microchannel plate image intensifiers and is more pronounced under low light level conditions. Turpin contends that the signal-to-noise ratio is arguably the single most significant factor in determining a system's ability to see when it gets dark. The SNR specifications for the F4949G and F4949G-TG tubes are a minimum of 21:1 and 26:1, respectively. The result of the F4949G-TG image intensifier tubes' improved SNR is a superior ability to see under increasingly darker conditions as compared to the F4949G image intensifier tubes (see Figure 3).

NVG-aided visual acuity data showed that the increase in the signal-to-noise ratio demonstrated a statistically significant but small increase in NVG-aided visual acuity, especially as illumination conditions become darker. Special operations and combat search and rescue aircrew training in dark desert or mountainous environments present ideal conditions for the F4949G-TG NVGs to be utilized. With more than 50 percent of their tactical flights at night, special operations and rescue crews routinely train in low illumination and low contrast conditions during mountainous and non-mountainous remote and tactical missions. More importantly and believed to be of greater operational impact, 58 SOW special operations and combat search and rescue crews employ the F4949G-TG NVG technology while operating in low level culturally lit nighttime environments, contributing to greater situational awareness and increased safety. Due to decreased halo size and improved gain and photoresponse, special operations and rescue aviators benefit from an enhanced image quality and increased visual performance in urban settings. The CV-22, HH-60, UH-1, and M/HC-130 aviators from Kirtland AFB train with the technologically advanced Gen III Pinnacle™ NVGs to provide students the greatest probability for success, not only in low illuminated clandestine tactical missions, but also in missions that expose the crew to close combat and culturally lit urban environments.


USAF Photo by MSgt Shaun Withers

The Interim Safety Board:

Laying The Groundwork for a Successful Safety Investigation Board

LT COL JEFF THOMAS (USAF, RET.)
HQ AFSC/SEME
Kirtland AFB NM
Reprinted from FSM June 2006

It's Friday afternoon. You've just arrived home, anticipating a kickback weekend to re-energize, when the phone rings. On the other end is the Command Post telling you one of the Wing's jets has crashed short of the runway during recovery. You breathe a sign of relief as the Command Post tells you the pilot successfully ejected and the Fire Department has responded to the scene. Heading back to the base, your mind begins to race with all that will need to be accomplished. Not only will the Disaster Response Force be standing up to respond to the mishap site, but an Interim Safety Board (ISB) will be convened to preserve evidence for the Safety Investigation Board (SIB) that the MAJCOM will form.

Fast forward to arriving at the Wing Safety office and breaking out the Wing's Mishap Response Plan (MRP). How will it play out? Have you covered everything that the SIB will need when they finally arrive to pick up the investigation? Push the pause button and let's have a look at some of the basics an ISB is chartered to accomplish.

At the risk of over simplifying, the ISB has three primary duties:

- Preserve perishable evidence
- Accomplish initial reporting
- Prepare for arrival of the SIB

As noted, one primary function of the ISB is to preserve evidence for the imminent arrival of the SIB, which, depending on where you're located, typically occurs approximately 72 hours after the mishap. But what evidence should you preserve? And what does it mean to preserve evidence?

Enter the wing's MRP. Contained in the MRP you should find checklists for all appropriate wing personnel with responsibilities following a mishap, such as: Wing Commander, Operations Group Commanders, Maintenance Group Commander, Civil Engineers, Public Affairs, Judge Advocate, Medical Group Commander, Support Group Commander, Security Forces, Safety, etc. These checklists provide the guidance on what each individual is tasked to accomplish and what evidence should be collected, if applicable. Also included in the MRP are specific checklists for each member of the ISB.

The purpose of the ISB is to preserve evidence, not to investigate the cause of the mishap.

USAF Photo by Doug Curran

The ISB typically mirrors the composition of the inbound SIB. Members include an ISB President, ISB Investigating Officer (a misnomer we'll discuss later), ISB Pilot Member, ISB Maintenance Member, ISB Medical Member, and a Recorder. AFPAM 91-211, *USAF Guide to Aviation Safety Investigation*, Chapter 2.3, details the basic composition and qualifications of the ISB. Not mentioned in AFPAM 91-211 with respect to the ISB are other personnel who have data collection responsibilities important to the ISB's preservation of evidence. Also included should be checklists for the Weather Officer (weather at the time of the mishap will need to be ascertained), Air Traffic Control Officer (ATC tapes will need to be impounded), etc.

So, what should the ISB members' checklists include? Well, it depends on the role they are filling. Have a look at AFPAM 91-211, Attachment 3, for what should be included in the detailed checklists. (Technique: Compare this to what's written in your wing's MRP).

With that direction, let's cover a couple of items the checklists should not include. Remember, this is called the Interim Safety Board, not the Interim Safety Investigation Board, hence the misnomer on assigning an Interim Investigating Officer. The purpose of the ISB is to preserve evidence, not to investigate the cause of the mishap. Although most ISBs understand this, MRP checklists oftentimes don't reflect this. For example, while doing HHQ-level evaluations of various wings' MRPs, I've come across the following direction embedded in the ISB checklists:

- Evaluate adequacy of planning, preparation and execution of the mission – Pilot member
- Determine what technical representatives or assistance may be required to accomplish the investigation – Investigating Officer/Mx Member/SE
- Remove from the site for detailed examination those components that failed before impact – Maintenance Member
- Review and analyze ATC training qualifications and experience of personnel in contact with mishap aircraft – Airfield Operations Officer

Bottom line: ISB checklists should never direct any member of the ISB to evaluate or analyze anything. That is the job of the SIB. (Hint: Look for these types of issues in your MRP.) You might be asking, "What does it matter if the ISB lead turns the analysis?" Remember, one charter of the ISB is to preserve perishable evidence. Stated another way, the ISB is to "impound and seal without alteration" items used in planning the mission, training/qualification records, aircraft maintenance records, the equipment involved in the mishap, etc. Depending on how you interpret "evaluate or analyze," valuable evidence could be altered before the SIB arrives. For example, on the ISB, the Maintenance Member decides to pull and reset circuit breakers on a mishap aircraft trying to "simulate the malfunction." This has the possibility of giving the SIB an altered starting point with regard to what began the mishap sequence, possibly misdirecting the investigation. Conversely, if a mishap pilot has the opportunity to review a HUD tape prior to the ISB impounding it, this could lead to a skewed recollection of events when the SIB conducts interviews with the pilot. So, the ISB is to "impound and seal without alteration" items relevant to the mishap.

Several years ago, the problems with ISBs accomplishing the mandates of the above paragraph had become so diluted that a MAJCOM Commander released the following guidance to his Command: "*… At no time prior to the hand-over of evidence to the SIB Board President should any piece of evidence be reviewed, copied, tampered with, or modified. The integrity of each piece of evidence is crucial to the success of the investigation and the Air Force's Mishap Prevention Program. …*"

Going hand-in-hand with preserving perishable evidence and preparing for arrival of the SIB is the accomplishment of initial interviews. Although this would seem to be a rather straight-forward process, common weak areas reoccur from time to time. First among them is not reading the privileged (or non-privileged) statement as found in AFI 91-204, *Safety Investigations and Reports*, to those being interviewed by the ISB and ensuring the statements are recorded onto the interview tape. AFI 91-204, paragraph 3.2.6.2, directs, "*If a promise of confidentiality is offered and accepted, it must be documented. Use the sample witness statement format in Figure A3.2 for written statements. Read, record, and transcribe the statement in Figure A3.3 for recorded interviews of witnesses.*" The same is also true for non-privileged interviews, with the guidance found in paragraph 3.2.6.3.

Second, when accomplishing the initial interviews, as a technique, just let the interviewee talk. Turn on the tape recorder, make sure the privileged (or non-privileged) statement is read onto the recorder and just say, "Tell me what happened." Let them tell their story uninterrupted. If you do have questions, hold them until the end of the interview. The participant's best recollection of the event for SIB analysis will most likely come from this initial interview; hence, the desire to let them tell the story in its entirety and without interruption.

However, all the above with regard to interviews is meaningless if the interviews don't successfully make it onto the tape. Too often, ISBs fail to pre-flight the recorders to see if they can actually pick up audio or they may fail to determine the best distance to place the recorder from those being interviewed to record the conversation, etc. So, pre-flight the audio equipment! Nothing is more frustrating to an SIB than a box of initial interview tapes that contain nothing more than static, or every third word captured simply because the ISB didn't properly record the interviews.

Lastly, with regard to interviews, keep track of who was interviewed when, and which tapes contain what interviews. Document it on an Excel spreadsheet for turnover to the SIB. Interviews can be done on analog recorders (mini-cassette tapes) or on digital recorders. If done on analog recorders, a good technique is to use one tape per interview. Again, label the tape with the interviewee's name and the date the interview occurred. This makes it much easier for the SIB to figure out which interviewees are on which tapes, which interviews have been accomplished, and when transcribing, where the tapes can be found. Similarly, with digital recorders, download compiled .wav files for each interview onto a CD-ROM or similar media, and label each interview with the name of who was interviewed and on what date. Again, asking the SIB to wade through multiple interviews listed only as DWA-0002.wav, DWA-0003.wav, etc., is not helpful. Lead turning this issue for an SIB will help free up valuable time during the 30-day investigative process and may preclude ISB members from having to return to sort out the mess for the SIB.

Bottom line: What the ISB does or does not accomplish immediately following a mishap will have a significant impact on the SIB and their investigative efforts. Referencing the same MAJCOM Commander message we looked at above: "*Mishap prevention affects combat capability. The ability of the Safety Investigation Board (SIB) to reconstruct the sequence of events leading to a mishap is critical in mishap prevention, preservation of combat assets, and most importantly, the safety of our people. Initial actions taken by those responding to a mishap before the arrival of the permanent SIB are crucial to the success of the board to accurately determine what happened and to recommend actions to prevent a recurrence.*"

USAF CLASS A FLIGHT MISHAPS

FY08 Aircraft Flight Mishaps
(Oct 07 - Nov 07)

5 Class A Aircraft Flight Mishaps
0 Fatalities
3 Aircraft Destroyed

FY07 Aircraft Flight Mishaps
(Oct 06 - Nov 06)

5 Class A Aircraft Flight Mishaps
0 Fatalities
3 Aircraft Destroyed

Flight Rate Producing

1 Nov 07	F-22A		No. 2 engine FOD discovered during post-flight walkaround
2 Nov 07	F-15C	✈	Crashed on training mission: pilot suffered minor injuries
28 Nov 07	T-6	✈	Mid-air 2 x T-6s; 4 x successful ejections

- A Class "A" aircraft mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF 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.
- Air Force safety statistics may be viewed at the following web address: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 5 December 07).**

U.S. GOVERNMENT PRINTING OFFICE 2008-760-498-41039


NO STEP
Coming in January 2008
Year In Review