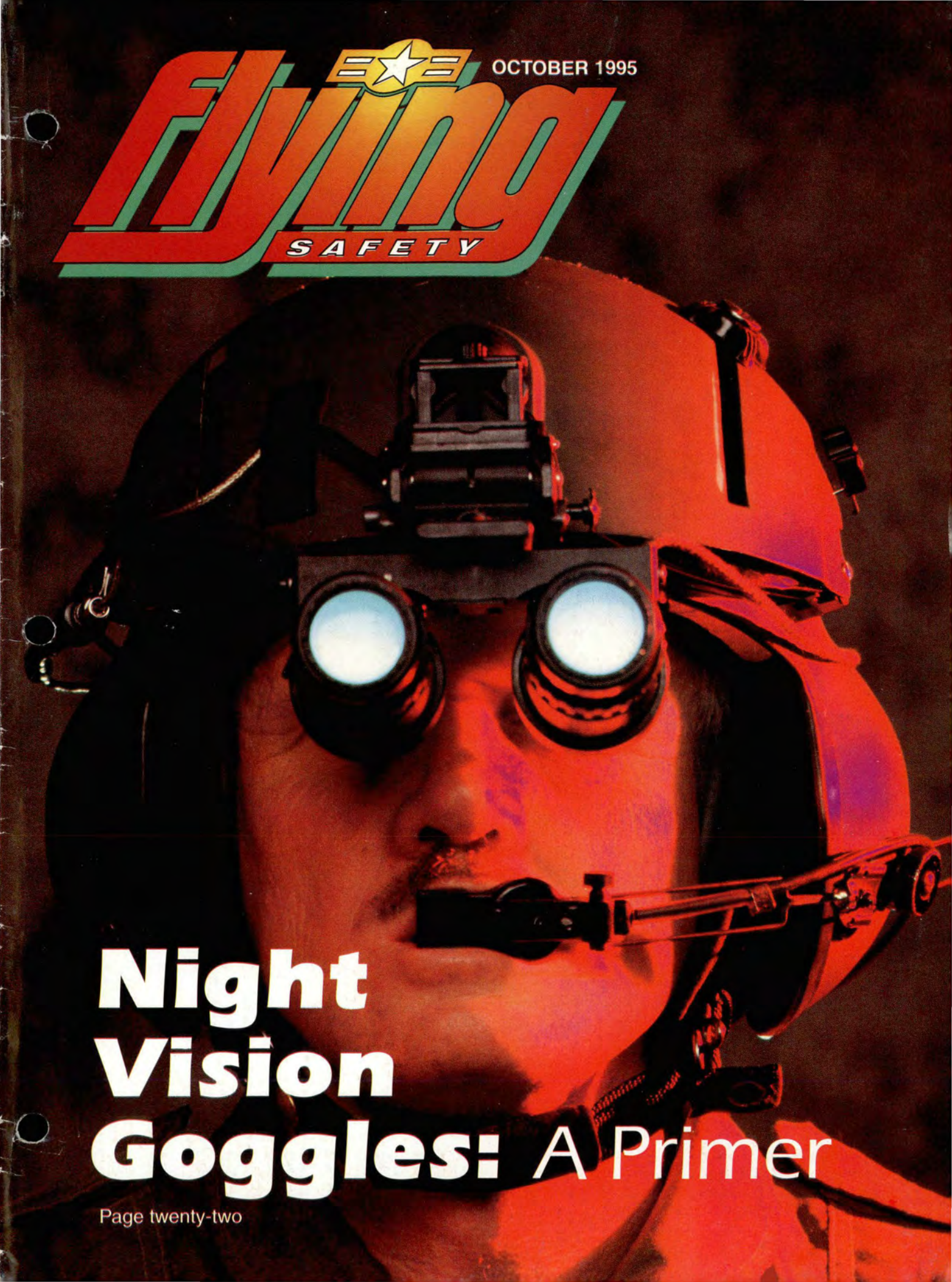
Flying Safety
OCTOBER 1995



Night Vision Goggles: A Primer

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SAFE AIRPLANES AND SAFE FLIGHTLINES

LT GEN GEORGE T. BABBITT
Deputy Chief of Staff/Logistics
HQ USAF

■ Lots of things have happened in the last few years that have changed the way we do maintenance in the shops and on the flightline. Rivet Workforce grouped skills together in single AFSCs. This recognized the talents and ability of our outstanding enlisted workforce but, at the same time, increased the challenge of maintaining technical proficiency. The Objective Wing put on-aircraft maintenance in the flying squadrons. This increased opportunities for teamwork and mutual understanding with operations, but also eliminated layers of oversight in the Aircraft Generation Squadron maintenance supervision and in the Deputy Commander for Maintenance staff. Quality Air Force emphasized process improvement and empowerment and deemphasized "compliance" type inspections. The end of the Cold War led to a downsizing of our Air Force, but it also led to significantly more operations-other-than war. OPTEMPO has been high.

I hear these issues discussed wherever I go. That's good, they should be discussed. The Air Force will continue to grow and evolve and, in the process, organizations and policies will change. What's not good is when I hear these issues connected to concerns about safety of airplanes and safety on the flightline — I don't accept these as the cause of any decline in safety or maintenance discipline. To do so would be backing away from our responsibilities as professional maintainers.

But what's really changed? In my mind — not much. Under any organizational structure, in any location, in any operation, we cannot forget the basic principles and responsibilities of flightline or backshop maintenance activities...***safety and discipline***. Our aircrew depend on us, place their trust in us, to maintain aircraft and generate sorties in a safe, disciplined manner. **What we do *is not routine*** — supervisory involvement at all levels is extremely important!

Senior maintainers — both officer and noncommissioned officer **leadership** — must ensure our people have the **training, time,** and **discipline** to do their jobs correctly and safely. We must avoid the mentality of "been there, done that" and keep in mind the hazards of the business of flying and fixing airplanes. Supervisors need to instill discipline and avoid complacency, especially for those rotating into contingency locations for the second or third time. Supervisors need to make the tough calls — extending downtime to ensure the proper fix, grounding a jet when things aren't right, decertifying a mechanic when quality and training are in question — in short, whenever safety and discipline may be compromised.

One of the toughest calls to make is to "knock it off" — but remember, the role of a leader is to make those tough calls — we have the professional responsibility to do so. Our young maintainers are very educated and motivated folks, and they want to do a good job. We need to make sure they have the "tools" to do their jobs "by the book" — instill in them we can't afford to cut corners or do things incorrectly. How do we do that? Now, as always, we get back to the maintenance principles that made us good in the past and will keep us great in the future — back to basics: **Training, Adherence to Tech Data, Attention to Detail, Leadership, Responsibility...and Accountability**. It is our professional responsibility. ■

Our 51st Year

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SPECIAL FEATURES

REGULAR FEATURES

FRONT COVER: "Night Vision Goggles" by TSgt Perry J. Heimer. Model: CMSgt Don Bennett

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SURVIVING A CRASH...

AND CONFRONTING THE COLD

CW4 FRANKLIN C. HARRISON
CW2 DANIEL R. SMEE
Courtesy *Flightfax*, September 1994

■ It was a routine night recon into the mountains, and the mishap crew was Chalk 3 in a flight of four AH-64s flying in staggered-right formation. They had been airborne for 32 minutes when they encountered unforecasted snowshowers. The air mission commander announced he was starting a 180-degree left turn to return to station. As Chalk 3 turned left to exit the weather, it crashed at the top of a 7,000-foot mountain.

The cold of winter can make it difficult to perform routine, simple tasks even though you are fully prepared to face the risks associated with operating in adverse conditions. If you aren't prepared, or if you fail to identify and control the hazards, exposure to extreme cold for even a few hours can become a struggle for survival.

Their Story

The following accounts by CW4 Franklin C. Harrison and CW2 Daniel R. Smee (Company A, 2d Battalion, 229th Aviation Regiment, Fort Rucker, Alabama) tell what happened after the crash and their actions until they were rescued more than 2 hours later.

CW4 Harrison:

"I'm alive," was my first thought when the aircraft stopped rocking from side to side. I tried to call Dan, my front-seat pilot. No answer. During the crash sequence, his helmet mike cord had come unplugged. He

was trying to call me, I was trying to call him, and neither of us could hear the other. Obviously, some very unpleasant thoughts about each other's condition flashed through our minds in those first few seconds.

I immediately shut down the engines. As I was exiting the aircraft, I saw Dan. When the aircraft started vibrating and rocking from side to side, Dan had ducked down as low as he could in the seat to avoid any rotor blades that might come through the cockpit. He could hear the fuel escaping from the ruptured auxiliary tank that had been mounted on the right wing, and he climbed out through the opening where his left canopy had been broken away.

Much relieved to see each other, we quickly moved about 25 feet away from the aircraft and did a quick appraisal of our physical condition. I thought I had broken my left arm on the armor seat during the impact. However, on examination, we found that it wasn't broken — just banged up pretty good. Dan had a small cut on his right cheek and scratches on his right arm. All in all, we were in great shape considering what had just happened.

Assessing the Situation

I was told when I started flying helicopters in 1968, "If it's not on you at the time of a crash, chances are you won't get it out of the aircraft." We were lucky. There was no postcrash fire, and we were able to return to the aircraft and retrieve our Gortex parkas and sleeping bags from the wreckage.

By then it was snowing very hard on the mountaintop, and the wind was blowing at 20 knots or more. We heard an aircraft circling to our south clear of the snow shower. It was our lead aircraft — the company commander. I attempted to contact them on my PRC-90 survival radio to let them know we were down safe, but our aircraft was destroyed. I got no reply, so I changed over to the beacon mode. Still no reply.

We assessed our situation and realized that due to the weather conditions on the mountain, it was going to be difficult for a rescue aircraft to get to us. Knowing that we would not be rescued where we were until hours later when the weather cleared, we decided to climb down to the valley floor about 700 feet below to better our chances of being picked up sooner. We did a quick inventory of what we had and decided to take our sleeping bags and wear our survival vests under our Gortex parkas. I had two flashlights and Dan had one. I was wearing my Nomex gloves. Dan had a pair of inserts he could pull on over his Nomex gloves.

COLD WEATHER TROUBLE!

As "Surviving a Crash...and Confronting the Cold" describes, there are some cold weather conditions that are real threats and can kill you. The following is some information that might be helpful this winter.

Hypothermia is a threat and can kill you real fast! It is the lowering of the body's inner core temperature. Any time a person is exposed to severe cold weather conditions for a long period, they are going to suffer some degree of hypothermia. Signs of hypothermia include muscular weaknesses, stiffness of limbs, fatigue and an overpowering drowsiness, sight growing dim, staggering, falling, and eventually unconsciousness. The respiration and pulse may become almost undetectable. Obviously, you will want to prevent hypothermia in the early stages.

Remember: Gortex is supposed to keep you dry...but in this case it didn't. Thermal underwear (issue) is cotton and no good if wet. Lighters are almost mandatory in winter survival plus available tinder to get a fire going. Crawling into a snow cave (if you don't get picked up) with wet clothes is asking for a *long* sleep. Radios and beacons have, and will, fail. Remember, weather changes fast in winter climates at 7,000 feet (and less).

Descending the Mountain

Prior to flight school, Dan had been an Army Ranger School instructor with extensive mountain training. He led out. I felt that if anyone could get us down that mountain, he was the guy who could do it.

As we started down, the going was very slow due to the steepness of the terrain. It was still snowing, and we were soon soaking wet. As we moved, Dan would throw his sleeping bag down the path about 20 feet, and I would keep my flashlight on his path. He would stop, I would throw my sleeping bag down to him, and he would keep his light on me until I caught up with him. We knew that just one misstep could mean a broken ankle or worse, and it might be all over.

The cold was really starting to take its toll on me by the time we got to the halfway point. I could no longer feel my fingertips or toes. I would take my wet gloves off, wring the water out of them, place my hands inside my parka until the feeling returned, and then I would put my gloves back on.

No Turning Back

At each stop, we would try both of our PRC-90s. We still got no reply. Then we came to a dropoff of about 25 feet. It was like a kick in the chest. I just didn't think we could make it back up the mountain, and it looked like we couldn't continue down. The terrain was too steep to even allow us to set up our sleeping bags.

Things were looking pretty grim. Just as I was thinking that I was going to die on that mountain after surviving the crash, Dan casually asked if I had ever seen the movie *Alive* in which the survivors of an airplane crash had been forced to resort to cannibalism to survive. That got me moving.

Dan surveyed our location and found that if we moved laterally about 15 feet, we could hang from a ledge and drop only 7 feet and con-

continued next page

Flying Safety

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tinue down. Before we had a chance to talk ourselves out of it, Dan's sleeping bag was over the edge. We were committed. Dan reached his bag with no problems. Then it was my turn. I threw my bag to Dan and started. It took only a couple of minutes, but it seemed more like an hour. I was physically drained. Fortunately, the terrain shallowed out, and we wandered into a small streambed and followed it to the valley floor.

It had been 2 hours since we started down. It was still snowing, the wind was still blowing as hard as ever, and we were soaking wet and cold. This was it. We weren't going any farther. We would set up camp and wait for rescue.

For Want of a Fire

Our first priority was to get a fire going. As Dan surveyed the area for possible landing sites for rescue aircraft, I gathered sagebrush to build a fire. We knew we had matches in our vests because the vests had been inspected before our deployment. The problem was locating them and getting them out of the vests. My hands were so cold it took both of us to operate the zipper on my parka. Using paper I had torn from my kneeboard, we tried every match in both vests — none ignited. Next we tried the emergency fire-starter kit. It ignited, but the wood and paper were too wet to burn. Next Dan tried the magnesium fire starter, using his survival knife to shave it and to strike the sparker — too windy.

About that time, I would have given a hefty price for a cigarette lighter. Bad timing. I had stopped smoking just 3 months before.

A Welcomed Flash of Light

Lucky for us, an Air Force UH-60 search-and-rescue bird had seen the flash from our attempt to start a fire and headed our way. When we heard the aircraft, we called them and asked them to flash their landing light twice if they could hear our emergency transmission. They responded with two flashes of light

that were about the prettiest sight we had ever seen. We used my two flashlights to mark our position. By the time we were extracted, it had been more than 2½ hours since our aircraft went down — 2½ of the coldest and wettest hours we had ever known.

Lessons Learned

In retrospect, I know we made the right decision when we decided to move down the mountain. The crew of the rescue aircraft (and this crew was trained and prepared for mountain rescue operations) told us they had twice tried to make it to the top of the mountain to find us but were forced to turn back due to the low ceilings and snow. It was during their third attempt they had spotted the spark as we were trying to light a fire.

In addition to learning the benefit of doing everything possible to enhance your chances of being rescued, we also learned the importance of:

■ Having a thorough understanding of the weather. What you get in the weather briefing may not be what you encounter.

■ Preflighting your survival vest and knowing the location of all components. It's hard to find them in the dark.

■ Taking the right equipment — food, water, clothes — with you when operating in adverse environmental conditions so that if you end up on the ground for whatever reason — crash or precautionary landing — you can survive.

■ Preparing for the environment you are operating in. It may be hot when you depart, but it can get awfully cold in mountainous terrain at night.

■ Coordinating with your ATC personnel to test your survival radios at some distance, not just in the bench test set. Following the mishap, we checked 10 of our unit's survival radios, and all 10 were good for only a 1-mile range.

■ Having good batteries and carrying spares for your flashlight and liplight. During those first few minutes following the crash, the liplight on our helmets was the only source of light we had to help us find our flashlights, parkas, and sleeping bags stored in the cargo bay.

■ Testing the matches in your survival kit.

■ *Making sure your copilot is a mountain ranger instructor* — you might need those skills before you get back to station.

CW2 Smee:

When I realized we were going to crash, my immediate thought was very simple: The ORT (optical relay tube) is going to cause pain. I was right. During the crash sequence, my head was thrown forward, and that was where I elected to keep it until the engines wound down and the blades were finished beating themselves to death. The ORT hurt, but I thanked God for giving McDonnell-Douglas the talent to make the AH-64 a crashworthy machine. That was my religious experience during the crash.

Things were looking pretty grim...Dan casually asked if I had ever seen the movie *Alive* in which the survivors of an airplane crash had been forced to resort to cannibalism to survive. That got me moving.

You can only imagine the jumble of simultaneous thoughts racing through my mind. Because of this "chicken" position I was in, my intercom system cord had come undone, and I was unable to communicate with Frank.

Since Frank and I had crewed together for just short of a month, we had been working together on our communication and our teamwork, even during our spare time. Frank is an experienced aviator with nearly 7,900 rotary wing hours. I was new to the unit and still learning stateside flying, having been previously

continued next page

The AH-64 helicopter — Chalk 3 — that crashed at the top of a 7,000-foot mountain.

Photo courtesy U.S. Army

stationed in Germany. In my opinion, I couldn't have had a better teacher than Frank. Yet with all the mission planning and all the rehearsals, there I was crawling out through a huge hole where the canopy used to be of what, just moments before, was a perfectly good aircraft.

Assessing the Situation

As I was climbing out of the aircraft, I saw the glow of Frank's liplight and I knew he was at least conscious. My adrenaline was pumping like crazy. I walked around the aircraft and saw Frank's door open, and out he climbed. We walked away from the aircraft and assessed our physical damage. Outside of a couple of scratches and bumps, we were basically intact.

We could hear an aircraft circling to the south and tried to reach them on our PRC-90s but were unable to establish voice communication. Frank went to beacon. Still no luck.

We were fortunate to have brought our Gortex parkas and our sleeping bags with us because we knew how cold it could get in the desert at night. We gathered our gear and secured our helmets and kneeboards along with the rest of our gear in our bags and placed them away from the aircraft because we knew the accident board was going to need them. Still unable to raise voice with the other aircraft, we then decided to proceed down the hill.

Descending the Mountain

The climb down was interesting to say the least. I had been in snow before but never on top of a mountain in the middle of the night. I knew this was going to be good. Our objective was to make our way down to where the weather was better and the terrain conducive to safe rescue. For an "old guy," Frank surprised me. He really didn't have any serious problems keeping up on the descent. The going was slow, and the distance down to the next drop was hard to judge due to the darkness and the snow. We would drop our sleeping bags from one level to the next and use them as a reference to judge distance. Slow, but it worked extremely well.

For Want of a Fire

When we reached a streambed, we followed it to the valley floor and then we decided to build a fire and wait there for someone to pick us up. The weather was still bad, and we were not sure if it would permit a pickup that night or not.

In my survival training, I had never had a hard time starting a fire when needed. Not now. First the radio hadn't worked, although we had just checked it a few days prior, and now the matches in our survival vests were inop. Our luck seemed to be running kind of thin. Magnesium fire starter was the next weapon of choice. My fingers were pretty cold from the climb down, and we were both wet to the bone. A fire was sure going to feel good, just as soon as I could get one going. Well, the magnesium didn't work either. No matter how hard we tried to build a windbreak, the wind was too strong for it to contain the shavings.

A Spark of Light

Finally our luck began to change. An Air Force search-and-rescue aircraft had seen sparks of the fire starter and was able to visually hone in on our position. When we heard them, we were able to establish contact with them for pickup although we still didn't have two-way communication.

Lessons Learned

These events took place in a period of 2½ hours — 2½ long, miserable hours, and plenty of time to think about premission planning and the importance of it. If we had not brought our parkas and our sleeping bags, it is very likely we could have been cold-weather casualties to some degree. As it turned out, the search-and-rescue aircraft had made two previous attempts to reach the crash scene and had been forced to turn back. On their third attempt, they had spotted the spark of light as we were desperately trying to get a fire started.

Frank and I both have a better appreciation for the survival vest than we did before the mishap. I know that if I'm going to have to wear it, I'm going to ensure things work as advertised. Regardless of current inspection dates and the presence of matches and other required items, if they don't work or you don't know how to use them, they can't be of much help to you when you really need them. From now on, I'll check *everything*. ■

CREW RESOURCE MANAGEMENT TRAINING: A FRESH LOOK

USAF Photo by TSgt Dave Nolan

MAJ CHUCK PHILLIPS
AMC/CRM Program Manager

■ Although the Air Mobility Command completed a record flying safety year in 1994, owing in part to the command's continued emphasis on Crew Resource Management (CRM), there is strong evidence the scope of the current initial and refresher CRM training needs a broader focus and would also benefit from additional reinforcement at the unit level.

AMC leads the Air Force in the development and implementation of CRM training for its aircrews. The AMC CRM training is, for the most part, imbedded in Aircrew Training System (ATS) contracts. Our current foundational programs are a one-time initial CRM course and an annual refresher for each of our AMC crewmembers. *The six fundamental subjects of AMC CRM training are group dynamics, effective communication, assertiveness, decision making, stress management, and mishap prevention.*

The focus of current CRM training is on crew interaction occurring during typical in-flight mission scenarios. However, an analysis of several recent incidents has indicated that decision making by the aircraft commander **before** the mission needs some additional emphasis. In addition, pressures and attitudes **external** to the crew may impact in-flight decision-making processes. These, too, need to be addressed.

In the first incident, an aircraft commander accepted an aircraft with a known, but uncorrected, fuel systems malfunction — a malfunction that led to a fatal crash.

In another scenario, an aircraft commander and his crew failed to maximize their crew rest prior to a night mission. Although the duration of the flight was only 1 hour and was flown as scheduled, the crew was tasked with an additional mission after landing. The second mission could have been easily completed within the limits of their crew duty day, but the crew had not planned for this contingency and declined to accept the mission in the interest of safety, since they were not properly rested.

Although the decision to not fly the second mission was a sound one, the initial decision to not take proper advantage of scheduled crew rest was not. The crew failed to consider some of the other situations that could also have lengthened their crew duty day: extended maintenance delays, adverse weather en route or at the destination, an unscheduled runway closure, diversion to a strange field, or the occurrence of an in-flight emergency. The crew was essentially unprepared to cope with any of these contingencies.

In yet another incident, a crew's in-flight decision-making process was hampered by a "lean forward" attitude fostered by their assigned student training unit. This particular crew was delayed 2 hours on the ground by the late return of their aircraft from another training mission. However, they were able to successfully make up time during the preflight and took off

continued next page

USAF Photo by John K. McDowell

only 1 hour after the originally scheduled departure. Because they had worked so hard to "catch up," when they did discover some engine problems in flight, some of the crew felt obligated to do whatever they could to continue.

Others felt the malfunction didn't warrant mission termination. Unfortunately, this "lean forward" posture affected their proper analysis of the malfunction. Communication between the aircrew specialties broke down, and when the technical orders were not consulted, the abnormal procedures were improperly executed. Consequently, the crew continued the mission without having really addressed the problem, and the affected engine eventually failed.

The management of the attitudes and pressures I've discussed, especially as they relate to decision making, are a key element of effective CRM. And we must ensure our current contracted CRM training includes scenarios that address these external issues. But ironically, these types of situations are not easily addressed in a 3- to 4-hour aircraft simulator refresher session. Nor can we expect our contracted trainers to be responsible for the development of healthy **risk** management attitudes in our units — attitudes that affect decision making through all the phases, ground and in-flight, of our AMC missions. Infusion of the cornerstones of CRM — such as inquiry, advocacy, assertiveness and leadership — into a unit's "culture" is the "blue suit" responsibility of every person who serves as an aircrew member, from the commander on down.

Right now many units give primary responsibility for CRM training to the ATS contractor. And our contracted programs provide an excellent foundation in CRM principles. But in order for CRM to be fully effective, it must be more than just another ground-training event. Instead of being treated as an annual training "inoculation," it must become an inherent aspect of aircrew discipline. Much the same as unit emphasis on important topics, such as threat awareness and safety, CRM must be inculcated as a culture at all levels. It must not be the sort of topic, as it is in many units, that requires a "crash" program just prior to an IG or NAF inspection visit.

Instead, the major concepts embodied in CRM need daily visibility, application, and reinforcement. We cannot afford to let the system gradually "evolve" and let years go by before we recognize the important contributions CRM has made. Granted, the full acceptance of CRM may take some time. For many, it requires a shift in attitudes — attitudes that may be deeply ingrained. But we must take action at the unit level to ensure effective CRM becomes a way of life.

There are many things a commander can do to reemphasize contracted training: "hangar flying sessions" that specifically highlight mishaps with significant human factors implications; the integration of CRM principles in crew planning sessions and post- mission debriefs; effective instructor critique of crew CRM performance on training and evaluation sorties; discussion of CRM topics or related incidents in Stan/Eval newsletters or the like; development of CRM read files/libraries that support a CRM "topic of the month," etc.

Logically, the forum for this type of emphasis already exists in wing safety programs. One of the primary goals of the Air Force CRM program is the reduction of human factors aircraft mishaps and incidents, which has a direct flying safety tie-in. And wing safety offices have direct access to a wealth of mishap and aviation human factors data that can be extremely useful in the development of unit-level emphasis on CRM.

The reality is that CRM is not going to fade away. The Air Force recently released an instruction that mandates CRM training throughout an aviator's career from undergraduate training to instructor, including commander-level CRM. This instruction and its accompanying AMC supplement, will drive changes in our CRM training for years to come. It demands a change in our mind-set of CRM from "nice to have" to "must have," a change that will only come from aggressive "blue suit" involvement at the unit level. ■

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THERE I WAS X 2

USAF Photo

■ Someone once said it is more likely you will be struck by lightning than win the lottery. If that's the case, I should be a billionaire! I have been struck by lightning two times, in two different aircraft, in two different countries, and in two different flight conditions. Do you get the picture? It may not be good to stand near me in a thunderstorm.

The first time, I was flying an F-111 in England. My wingman had a frozen ADI, and we were the fourth flight out of the IAF on an approach to our home field. At 3,000 feet AGL and 1,000 feet below the freezing level, the weather was standard thick cumulus everywhere from 500 feet to 14,000 feet.

The clouds were getting darker, and it started to rain — not really heavily. But a beautiful, green glow started to show up on the pitot tube, and my hair started to tingle. BANG! It entered through the radar nose cone, fried the radar system, and exited out the right wing.

My wingman went lost wingman (his ADI was now working — probably jarred free by the static discharge). My WSO and I ran through the checklists and came back in 1,000 feet lower. I didn't get struck again, but I did see the dark clouds and rain.

The second time was in a T-38 in Texas. I was solo flying at FL260 and 10,000 feet above the freezing level. The weather was thin stratus clouds. I could just barely see blue sky above me. I started to enter some light rain and asked Center if they were painting any large buildups in my flightpath. No reply.

The rain started to increase in intensity, but I could still see the blue sky above. I asked Center for vectors around any buildups in my flightpath. Again, no reply.

I then told Center I was turning to get out of the heavy rain, and suddenly I saw lightning off my right wing. I started a hard left turn away from the lightning — too late. BANG! The second lightning bolt got me. Within a minute, I was in the clear because it was a strong cell imbedded in the light stratus. The lightning entered the nose near the battery door. We never found the exit point. I flew back maintaining VFR.

Lessons learned:

■ Lightning can strike at any altitude, no matter the freezing level, the weather conditions, or the time of day.

■ Try to use all available services (Center, if they will talk to you, WX radar, etc.).

■ If the weather starts getting ugly, **GET OUT OF THERE!** Divert if you need to.

■ If you have a weather scope available, check it out before you step.

■ Buy a lottery ticket every week. You can't win if you don't play. ■

DID WE LOSE SOMETHING OUT THERE?

USAF Photo by SrA Andrew N. Dunaway

CMSGT DON A. BENNETT
Technical Editor

■ **An aircraft technician is injured and an aircraft damaged. Why? A quick survey of the mishaps leads to obvious conclusions: no use of tech data, no clear lines of communication, no training for the key mishap participant, no pre-ops briefing. How could this happen? The answer: Because there was no task boss. There's no excuse for all these violations!** ***Did we lose something out there?***

Preface

There are many aircraft maintenance tasks accomplished every day throughout the Air Force requiring the expertise of several different specialties. This **"coordination and cooperation"** aspect of the aircraft maintenance business has served us extremely well through all these years. In fact, it should be considered a critical element for successful, quality aircraft maintenance activities and mission accomplishment.

However, besides quality tech data and responsible qualification training being available for each task participant, there's another important factor that's absolutely necessary in making this **"team effort"** a professional, uncompromising aircraft maintenance entity: a quality, qualified task supervisor — **"a boss"!**

An Example of "Nobody's in Charge"

Here's an excellent example of what happens when the **"Someone has to take charge!"** rule is seriously violated.

An aircraft parked on the flightline required the spoiler actuator adjustment checks be performed. Two repair and reclamation technicians and two troops from the pneudraulic shop were assigned the task. After the checks were completed, they repaired a discrepancy they had found earlier. One of the technicians then had to leave before the writeup's controllability ops check could be performed.

Of the three remaining technicians, Worker No. 1 was fully trained to do the task. Worker No. 2 had witnessed the task being accomplished once and then had actually done it another time. Worker No. 3 **didn't have any task training whatsoever!**

Worker No. 1 went up on the wing to check out the movement of a spoiler. Worker No. 2 was stationed under the wing to work some linkage on a hydraulic metering valve. And the **"untrained, never been there"** mechanic, Worker No. 3, was situated in a gear wheel well to operate the ground service test hydraulic pump switches. **None of them had tech data or a checklist!**

Tech data requires the ops check be performed while on the aircraft's interphone system, but the interphone wasn't utilized. Other technicians were using the interphone

system at the time the ops check was started. As an alternative, portable radios were available, but they weren't used either. The method of communicating with each other was decided to be either verbally and/or hand-signaling. (NOTE: There was significant noise around the mishap aircraft at the time. Other work was being done on the aircraft, and two other nearby aircraft were preparing for launch.) The team wasn't given a complete crew briefing before the task began because no one was appointed or assumed the critical role of the task supervisor! So confusion was bound to happen among these task participants!

The stage was now set for the mishap. Nobody could have worked harder than these three individuals to make this mishap happen. However unintentional, they continued violating tech data and safety standards until the conditions were just right for a mishap. It was just a matter of minutes before the trap was sprung!

The Stage Is Set for the Mishap

Worker No. 2 started the task by telling Worker No. 3 to flip the ground test switches. Then he cycled the spoilers with the metering valve linkage. Soon Workers 1 and 2 determined the spoiler corrective action work and the ops check were both satisfactorily completed. Worker No. 2 then verbally (remember the nearby noise?) told Worker No. 3 to release the ground test switches. Worker No. 2 had simultaneously followed up the "system off" verbal instructions by hand-signaling (flat hand across the throat). He also signaled the ops check was successful with the well-recognized "thumbs up" hand signal.

Well, as expected when you depend on Murphy's Law to govern your maintenance activity, Worker No. 3 didn't hear what Worker No. 2 had to say nor did he correctly interpret Worker No. 2's hand signals! Still Worker No. 3 released the switches to go and find out personally what Worker No. 2 meant, but Worker No. 2 had left his station to go up on the wing. Still confused, Worker No. 3 went back to reactivate the ground test switches, fearing he wasn't supposed to deactivate them yet!

The Mishap Trap Is Sprung!

Soon Worker No. 2 (and probably the whole flightline!) heard Worker No. 1 screaming after getting caught under the spoiler! Of course, the spoiler actuated after the confused, untrained Worker No. 3 reactivated the ground test switches. It took a few minutes to do a couple of "rescue" maintenance actions. The injured technician was finally freed, smarting a little, but alive — *THIS TIME!*

Stepping Up to the Plate

There are tons of maintenance tasks and activities which don't specify in writing that a job supervisor is required. Mostly, this requirement is an unwritten rule. But just stop and think about it for a minute. **Does it *really* have to be written down somewhere?** What happened to good judgment and common sense, self-discipline, and individual integrity?

All three of these technicians were at the supervisor/trainer level of duty and responsibility, including the untrained, unqualified Worker No. 3. Easily, Worker No. 1 should have assumed the task supervisor role because he was totally qualified, plus he outranked the others. By **neglecting** to step up to the plate and assume the task supervisory role, insisting on tech data adherence, establishing a solid, effective line of communication, or providing a pre-ops team briefing, Worker No. 1 pretty much set the stage for his own injuries.

Where Was the Aircraft Crew Chief?

Another interesting question is **where was the aircraft crew chief?** There was a time when **nobody** walked on **any** aircraft without first checking in and coordinating any and all task activities with **"the aircraft crew chief"!** Then he or she would decide if the conditions were right for multiple shops to safely work (in this mishap, two shops needing to use the aircraft interphone system) multiple tasks, etc. This **"coordination and cooperation effort"** was accomplished through *each* lead technician from *each* specialty needed for a multiple shop writeup or through the overall task supervisor. The old **"this is my aircraft — don't do anything until you check in with me first!"** system worked great. It kept all task technicians informed and organized so they wouldn't hurt or kill each other. I wonder what happened?

In answering the titled question, Did we lose something out there? Yep, we sure did all right!

Do you know what it is? ■

There's another important factor that's absolutely necessary in making this "team effort" a professional, uncompromising aircraft maintenance entity: a quality, qualified task supervisor — **"a boss"!**

Don't Forget the Forms!

CMSGT DON A. BENNETT
Technical Editor

■ *"What did you say, sir? You want to see the aircraft forms so you can write up your FOD'd out engine? M-m-m-m. Uh, uh, well, sir, uh, would you believe the forms are what got sucked up into the engine?"*

Sad fictional humor? The dialogue is fictional, but the FOD'd engine result isn't! Sad, yes. Humorous, no way! Such an *improbable* mishap could, and *did*, happen, and this isn't the least bit funny!

In short, both the launching crew chief and the pilot got "wrapped around an axle" during launch preparations and forgot all about the aircraft forms lying there bigger than life on the engine's intake! The "hows and whys" of this mishap aren't pretty, but then neither are the twisted guts of an expensive FOD'd out jet engine!

While starting his preflight duties, a fighter pilot looked into the cockpit to find the ground safety pins for the ejection seat and the canopy jettison handle hadn't been removed prior to his arrival. He climbed back down to inform the crew chief, then performed his walkaround.

After the crew chief had finished removing the pins, the pilot climbed back up to the cockpit to discover some more cockpit preparations that hadn't been done properly. The crew chief was summoned up to the cockpit again so the pilot could conduct an impromptu orientation on proper cockpit preparations and their importance. Minutes later, the pilot realized it was now time for the planned engine start. He next told the crew chief of his intentions to begin engine start and launch.

The crew chief performed the rest of the pre-engine start and launch duties and gave the pilot the okay to start engines. Moments after the pilot started the first engine, the crew chief saw some sparks coming out of the engine and told the pilot to shut the engine down. *It didn't take long for the maintainer to find what was left of his aircraft's forms in the mishap engine intake!*

What's the first thing you do, whether you're a maintainer, a pilot, or an aircrew member, when you arrive at an aircraft to perform your maintenance duties or to fly a mission? CHECK THE FORMS! And an informal survey of pilots here at the Safety Agency seems to indicate this time-honored, mostly unwritten law of aviation is still valid. Regardless, how could anybody even begin to perform their duties without first knowing if the aircraft was operationally safe to fly or perform repair or inspection duties?

Had a quality preflight been performed by **both** the pilot and the crew chief, then it's safe to assume the forms would have been discovered on the engine intake. And again, if the crew chief had handed the forms to the pilot or the pilot even asked to see them, this mishap wouldn't have happened. Additionally, had the crew chief been adequately trained to properly prepare the jet for launch, the pilot wouldn't have been preoccupied with the ill-prepared cockpit. And, naturally, because the pilot's routine was busted up by dealing with the cockpit problems, he seemed to have lost his concentration and timing during the prelaunch phase. Unfortunately, the last-chance opportunity for the forms to be discovered was the crew chief's (fireguard) clearance to the pilot to start engines!

High operations tempo? Inadequate training? Inadequate supervision and management? Individual personal problems? Unsafe organizational environment, e.g., since **both** exhibited a lack of checklist discipline? One-time brain dumps for both mishap participants? Who *really* knows for sure what caused this mishap? However, at the conclusion, there is at least one concrete fact and one major, disturbing question that arises.

■ *Fact*: An expensive engine was damaged, and it will cost over half a million dollars to repair it. This is an extremely high figure when you consider the increasing shortage of depot and O & M funds.

■ *Question*: **Who would ever place or store an aircraft's forms on an engine intake — for any reason — in the first place?** Talk about setting yourself up for a foreign object damage mishap!

This Class C mishap was human-caused (times two) and, therefore, preventable. It highlights many problems which can surface in the day-to-day execution of flight operations. But it also serves as a costly reminder to all of us the next time we arrive at an aircraft to fly it or repair it — ***"don't forget the forms!"*** ■

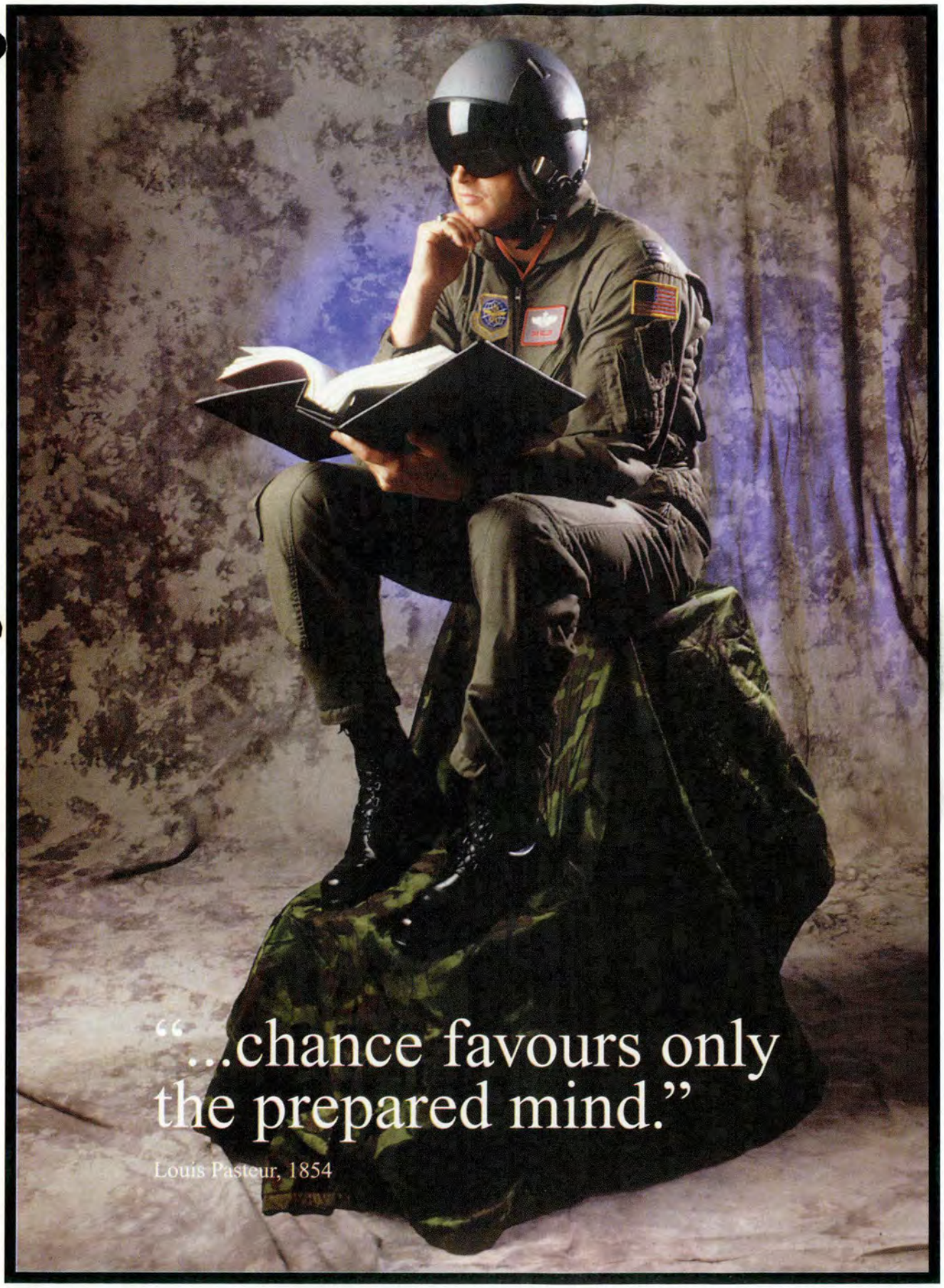


Photo by TSgt Perry J. Heimer

THE AIR FORCE BLUE RIBBON PANEL ON AVIATION SAFETY

■ On June 23 of this past year, Air Force Chief of Staff, General Ronald R. Fogleman, convened a "Blue Ribbon Panel" to review aviation safety in the Air Force. This review came about in light of recent allegations concerning the quality and objectivity of the Air Force safety program and the number of Class A mishaps occurring in the first half of the calendar year.

The panel, headed by retired Navy Vice Admiral Donald D. Engen, was specifically asked to look at the "organization, staffing, and investigative procedures which support current Air Force aircraft mishap prevention efforts." It was also given the latitude to look at "any safety-related area, which in its judgment, may yield recommendations that will improve the Air Force's ability to prevent mishaps, and investigate and follow up on mishaps in ways that will prevent them from happening," according to General Fogleman.

Comprised of senior retired military and civilian officials, the panel possessed a broad knowledge of how both military and civilian mishap prevention programs operate. Vice Admiral Engen was a former member of the National Transportation Safety Board and a past administrator of the Federal Aviation Administration. Other members included retired Air Force General Robert C. Oaks, former USAFE commander and currently the vice president of operations at US Air, and former Air Force Secretary Dr. Hans Mark, who is currently a professor in the department of aerospace engineering and engineering mechanics at the University of Texas in Austin. The Panel was rounded out by retired Brigadier General Robert T. Hall, who was a former director of aerospace safety for the Air Force.

The panel released its report in early September to General Fogleman. Although the panel cited specific areas which needed improvement, Vice Admiral Engen said of the Air Force Mishap Prevention Program, "It's a valued program that works." **The following excerpts were taken directly from the panel's report:**

"The Panel conducted a thorough review of the Air Force safety philosophy, the use of privileged information in mishap investigations, safety organization and staffing, the availability of adequate resources, human factors, and other safety-related matters.

Two major conclusions emerged from this review.

(1) The organizational structure of the Air Force Safety effort — both in the prevention and in the investigation of mishaps — is appropriate for a military organization. Combat efficiency must have first priority for the Air Force, and this means that the responsibility for flight safety must be lodged in the military command structure.

(2) The Safety Investigation Board (SIB) process must be strengthened to ensure that the report of the Board reflects precisely the results of the investigation and cannot be changed by the people in the chain of command. It is the strongly held view of the panel that the integrity of the process depends upon the independence of the SIB and an open command endorsement process."

As part of the panel's review, the "...Military Personnel Center (AFMPC) responded to a Blue Ribbon Panel request to determine attitudes towards safety within the Air Force. A Mishap Prevention Program questionnaire was designed to deter-

mine experience, attitudes, and opinions regarding safety among those in safety positions, those in command positions, and Air Force members at large. The panel also examined the experience of SIB members, solicited their views on the effectiveness of the SIB, and measured the confidence of the operating forces in the safety process. This telephone survey was conducted among 600 Air Force people...

"Regarding the issue of the credibility of the mishap investigation process, a vast majority of those polled believed that all relevant data is collected, considered, and reflected in the board findings, and a large majority felt that the SIB recommendations were properly acted upon.

"Notwithstanding this overall positive perception regarding the mishap investigation process, there are too many service members who believe that SIB results are occasionally driven by factors outside of the Board process. The fact that a significant portion of those holding these views have had SIB experience is an important consideration in developing recommendations.

"The fact that some respondents felt that being honest with a SIB could have negative career implications highlights the importance of giving greater protection to the Safety Investigation Board process and specifically the importance of privileged testimony. On the positive side of this issue, 95 percent who had served on boards responded that they had felt free to express unpopular or contrary ideas as a Board member.

"A positive survey finding that should be highlighted is that over two-thirds of the respondents believed that serving in safety positions can be career enhancing. Reinforcing this perception will ensure a continual flow of high-quality people into safety slots. This reinforcement can, in part, be accomplished by ensuring that the appropriate safety training is provided to each individual assigned to safety duty early in their tour.

"With respect to the general safety atmosphere in the Air Force, a large majority felt that personal safety is appropriately considered in Air Force basic planning functions. However, significant numbers felt that in mission execution, such factors as operations tempo, additional duties, and pressures to obtain advanced degrees all have an adverse impact on safe mission accomplishment...

"In summary, the panel believes the survey results reflect general perceptions of a solid, respected mishap prevention and investigation program, with useful direction in areas that need attention..."

With respect to the use of privileged information, "...the thorough investigation of mishaps that has been so critical to mishap rate reduction demands a free flow of testimony from all individuals with any relevant information. This will only happen if those individuals are not inhibited by fears of punishment or reprisal for their testimony, opinion, or actions. The use of 'privileged information' to elicit complete testimony has been very effective. However, some recent incidents have undermined Air Force members' confidence in the real protection provided by the privileged information status. While these incidents were, in some instances, a confusion over SIB and AIB (Accident Investigation Board) results, the net effect is a loss of confidence in the privileged information process.

"The loss of this powerful investigative tool of privilege would clearly be detrimental to the effectiveness of the mishap investigation process and could well result in increased mishap rates..."

While there were other areas of significance addressed in the report, the following summarizes the panel's recommendations to the Air Force:

"(1) Continue to vigorously protect privileged information as applied to the SIB process.

(2) Combine and collocate AF/SE and AFSA.

(3) Consider making AFSA/CC a Major General.

(4) Provide means and accountability for ensuring human factors integration into the acquisition of new weapon systems.

(5) Establish a centralized Air Staff responsibility for the integration of the CRM program.

(6) Make mandatory AFSA training courses for SIB presidents and members.

(7) Update AFI 91-204 which defines Class A mishaps to:

(a) reflect 1990's aircraft cost data

(b) redefine mishap classification criteria

(8) Require the SIB report reflect precisely the results of the investigation to preserve the integrity of the process.

(9) Designate the MAJCOM commander as the Class A mishap SIB convening authority.

(10) Require an experienced AFSA representative to serve as a voting member on each Class A SIB.

(11) Establish a comment and endorsement process for those in the chain of command above the squadron or wing level.

(12) Review the safety impact of reduced manning and aircraft numbers while there has been no change in the operational requirements." ■

In the coming months, *Flying Safety* will keep you updated on the Air Force's progress toward implementing the panel's recommendations. The current feeling within the safety community is that this independent review enforced the critical nature of our safety process and made recommendations which will strengthen the Air Force's ability to prevent future mishaps. — The Ed.

Air Force Flight Standards Agency

DUE REGARD — WHAT'S THAT?

CAPT KEVIN JONES
HQ AFFSA/XOFD

■ It was August of 1990, and my crew and I had taken off in our KC-135 from Robins AFB, Georgia, to set up the "air bridge" for the initial waves of Desert Shield. I was a former T-37 instructor pilot, now sitting in the left seat with no overwater experience. My mission seemed simple enough: "Go forth and give them gas!"

I will be the first to admit that I was ill-prepared for my first flight over the Atlantic. By the end of that long night, we were off the chart, dodging thunderstorms, running low on fuel, and considering two words I knew nothing about: **"DUE REGARD."**

Like me, I know many of you have been "trapped" out over the ocean, out of options, and short on ideas, when that quaint little phrase — *"due regard"* — has popped into your head. What does it mean, and how does it work? As anyone who has flown oceanic much can tell you, the "big sky" theory does not apply out over the pond. It's more like the "big bang" theory. Understanding ICAO procedures, and especially "due regard," is crucial to safe and successful operations in international airspace. Hopefully, this brief overview will give you a better idea of what "due regard" means and how the U.S. military implements the concept.

In 1944, 26 nations met in Chicago and formed the International Civil Aviation Organization (ICAO). Today, the ICAO has nearly 200 member nations. The Chicago Convention chartered the ICAO to develop air navigation principles and procedures for safety of air navigation. Although Article 3 of the convention exempts "state aircraft" from ICAO procedures, it requires "state aircraft" to fly with "due regard for the safety of civil aviation."

In response to Article 3 of the Chicago Convention, the Secretary of Defense developed procedures governing U.S. military activities conducted in international airspace. These procedures are published in Department of Defense Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas.* Since most of you don't carry DoD Directive 4540.1 in your pubs bags, most of its information has been reproduced for your use in Chapter 7 of FLIP General Planning (GP). Let's briefly review what's in GP and then we'll apply the guidelines to an actual mission.

First of all, paragraph 7-4c tells us DoD policy is "that all U.S. military aircraft and firings shall operate with due regard for the safety of all air and surface traffic." Additionally, "when practical and compatible with the mission, U.S. military aircraft operating on the high seas

shall observe ICAO flight procedures." However, the DoD policy recognizes that military aircraft cannot always comply with ICAO rules and lists four operational situations which may not lend themselves to complying with ICAO flight procedures:

- Military contingencies,
- Classified missions,
- Politically sensitive missions, and
- Routine aircraft carrier operations or other training activities.

Those operations not conducted following ICAO flight procedures are conducted under the "due regard" or "operational" prerogative of "state aircraft" and are subject to one or more of the following conditions:

- Aircraft shall be operated in visual meteorological conditions (VMC); or
- Aircraft shall be operated within radar surveillance and radio communications of a surface radar facility; or
- Aircraft shall be equipped with airborne radar that is sufficient to provide separation between themselves, aircraft they may be controlling, and other aircraft; or
- Aircraft shall be operated outside controlled airspace.

When we don't follow ICAO procedures, we must follow the conditions listed above in order to provide a level of safety equivalent to that normally given by ICAO air traffic control agencies and to fulfill U.S. obligations under Article 3 of the Chicago Convention.

Now that we've reviewed the rules, let's get specific about flying "due regard." The first big question you have to ask yourself is, "Am I in international airspace?" *If you* ***only*** *remember one thing from this article, remember this — you can only fly "due regard" in international airspace!* In general, the U.S. defines international airspace as the airspace over the ocean farther than 12 nautical miles from the coast. Although some countries claim their sovereign airspace extends farther than 12 miles, the U.S. recognizes territorial sea claims only up to 12 nautical miles. (Remember Libya's "line of death"?)

The next question you must answer is, "Why would I not follow the ICAO procedures?" Can the mission be categorized as a military contingency, a classified mission, or a politically sensitive mission? Are you involved with U.S. Navy carrier operations? If your flight doesn't fit into any of these categories, you probably should not fly "due regard."

Another question you might ask yourself is, "Was I briefed prior to the mission that I would be using 'due regard' procedures?" The decision to fly "due regard" is not one to be taken lightly. FLIP tells us that flights exercising "due regard" are "deviations from normally accepted operating procedures and practices and shall not be undertaken routinely. Except for preplanned missions, pilots or commanders exercising 'due regard' authority shall record the details in writing, and upon request from higher authority, furnish a detailed report." If you were briefed prior to your mission that "due regard" procedures were to be used, then you can probably be assured the nature of the mission is important enough to justify flying "due regard." If the idea of going "due regard" is a decision you made on the spot, make sure your situation is serious enough to warrant deviating from ICAO procedures.

Another question you might ask yourself is, "Was I briefed prior to the mission that I would be using 'due regard' procedures?" The decision to fly "due regard" is not one to be taken lightly. FLIP tells us that flights exercising "due regard" are "deviations from normally accepted operating procedures and practices and shall not be undertaken routinely."

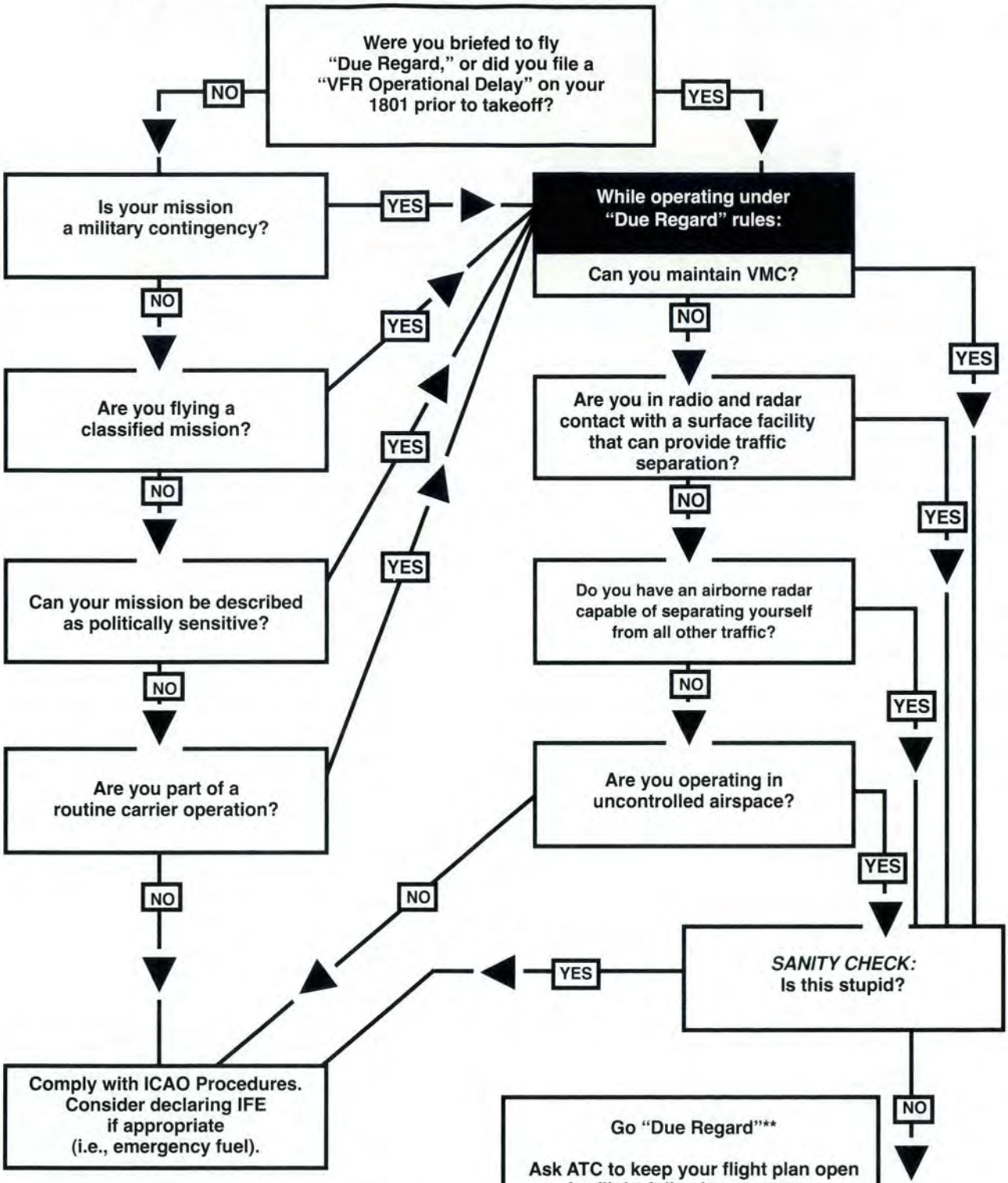
Assuming your mission does qualify as one of the four exemptions, you must satisfy one more set of conditions. When you fly "due regard," you are guaranteeing the world that you can act as your own air traffic control and separate your aircraft from all others. In order to meet this stringent requirement, you must be in VMC, or within radar and radio contact of a surface facility providing radar separation, or your aircraft must have a radar capable of separating your aircraft and the aircraft you may be controlling from *all* other traffic (if you're not flying an E-3 AWACS or E-2C "Hawkeye", you probably don't qualify), or you must be in uncontrolled airspace. Since most airspace over the oceans is controlled above 5,500 feet MSL, most "due regard" missions must be flown in VMC.

In addition to all of the other requirements listed above, when you go "due regard," you have to be aware of the responsibilities you have taken over from ATC. Essentially, flight under the "due regard" or "operational" option obligates the military aircraft commander to be his own air traffic control agency and to separate his aircraft from all other air traffic. It is also the aircraft commander's responsibility to ensure the appropriate military authority provides flight following and assumes responsibility for search and rescue.

Finally, there are those nagging questions about your flight plan. Flights planning to operate "due regard" normally file a normal flight plan with a delay indicating the point and time the mission plans to go "due regard" or "operational." Prior to going "due regard," it's important to make the appropriate arrangements with ATC for your return. Your clearance on the ground will only be to the delay point. Once you reach your clearance limit and

continued next page

INTERNATIONAL AIRSPACE "DUE REGARD" Decision Guide*



* Refer to DOD Directive 4540.1; FLIP GP, Chapter 7; AFI 11-206, Chapter 1, and MAJCOM directives which may provide additional specific guidance. This guide assumes you are NOT in sovereign airspace.

** NOTE: When communicating with ATC, the use of terms "Operational" or "Due Regard" is okay, but *AVOID USE OF THE TERM "Going Tactical"* with civilian ATC.

DOD Photo by TSgt Russ Pollanen

tell ATC you are going "due regard," you will lose your IFR clearance, and your flight plan will drop out of the system unless you coordinate with ATC to keep it open. If feasible, tell ATC when and where you would like to pick up your IFR clearance again and coordinate a "pop-up" frequency if you'll reappear in another sector. Declaring "due regard" out of the blue will cause you to lose your IFR flight plan as well as ATC's flight-following function. A little coordination before going "due regard" can save you a lot of headaches later.

Now that you know everything there is to know about "due regard," let's apply what you've learned to a flight that happened not too long ago. A KC-135 crew was scheduled to redeploy back to Loring AFB, Maine, after a fun-filled 3-week trip to Puerto Rico. Before heading up the east coast of the U.S., the crew was scheduled to refuel some local fighters. As usual, the receivers needed more gas than scheduled, so the tanker offloaded more fuel than planned and then headed north back to Loring.

As they flew up the Atlantic, just off the east coast, ATC gave them a final altitude lower than what the crew had planned. After some quick calculations, the tanker crew realized they would not be able to make it back to Loring with the fuel they had remaining. After ATC denied numerous requests for a higher altitude, the aircraft commander declared "due regard," quit talking to ATC, and climbed up to the higher altitude he had requested. At their new altitude, the tanker disrupted the international arrival flow from Miami all the way up to New York. Fortunately, the aircraft was close enough to the east coast that ATC could see them on radar and deconflict their flight from all of the oceanic arrivals. When the wing commander met the crew back at Loring, do you think he congratulated the crew or not?

Let's look at the facts. First of all, was the tanker in international airspace? Yes, the flight was conducted more than 12 miles from the east coast of the U.S. in international airspace.

Next, did the aircraft's mission qualify as one of the exemptions from flying under ICAO rules? The answer to this question is "no." Not having enough fuel to make it back home is not a military contingency, a classified mission, or a political necessity. A more appropriate avenue may have been to declare "minimum fuel" or to land at another base along the east coast and refuel.

Since the aircraft commander did declare "due regard," did he satisfy the other conditions required to fly "due regard"? Yes, as long as he remained in VMC. He was in controlled airspace, he was not in contact with a surface facility providing him with separation, his on-board radar was not sufficient to separate himself from other traffic, so the only way the tanker could fly "due regard" legally was to remain in VMC.

Finally, did the aircraft commander ensure the appropriate military authority assumed responsibility for flight-following and search and rescue? The answer to this question is "probably." Both the departure and arrival bases knew the aircraft's itinerary and would have started looking for the flight had it not arrived as scheduled.

I hope this article has helped clarify some of the questions surrounding "due regard." The concept of "due regard" is complex and requires careful planning to ensure successful results. Used wisely, it allows us to accomplish our worldwide mission, but used poorly, "due regard" creates confusion and endangers many lives and aircraft.

Fly safe, fly smart. ■

Sources of information about "due regard" and ICAO procedures:

- DoD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas*
- AFI 11-206, *General Flight Rules*
- FLIP General Planning
- FLIP Area Planning
- Foreign Clearance Guide
- FAA Order 7110.65, *Air Traffic Control*

The FSO's Corner

SOME LESSONS ON SLEEP DEBT

MAJ DALE PIERCE
919th Special Operations Wing/SEF
Eglin AFB, Florida

■ Last year, I attended the NASA Fatigue Countermeasures Certification Course at NAS Moffett Field, California. It was a very interesting course, and I am pleased to have gone. Since that time, I've conducted training sessions for about 180 aircrew members, using the information in the Education and Training Module I received from the NASA folks.

Based on the questions asked during and after the classes I taught, I learned some of the concepts are not only new to many Air Force aircrew members, but are readily accepted and applied both to themselves and to processes associated with aircraft operations. Most also see these as risk factors which must be managed in their daily activities.

The areas of greatest interest include sleep cycles, sleep debt, and aircrew scheduling. I'll discuss each of these in turn.

Sleep Cycles

Everyone has a sleep cycle. Your sleep cycle includes rapid eye movement (REM) and nonrapid eye movement (non-REM) sleep. We cycle from REM sleep to deep sleep and back to REM sleep repeatedly during the night. The longest part of our deep sleep occurs in the first 4 hours of sleep, and we dream most frequently during the second 4 hours.

REM sleep is dream sleep. Everyone dreams regularly, even if you don't remember dreaming. Studies show that after about 40 hours of REM sleep deprivation, your brain will start dreaming. If you are asleep at the time, you will "dream." If you are awake at the time, you will hallucinate. Either way, your brain will dream. I recommend being asleep when you dream. It doesn't upset your fellow aircrew members as much as watching you hallucinate.

Non-REM sleep is divided into four categories of sleep depth, simply labeled 1, 2, 3, and 4. Categories 1 and 2 sleep can be thought of as light sleep, and categories 3 and 4 sleep can be thought of as deep sleep. You can easily tell whether you were in light or deep sleep. You wake up from light sleep alert and refreshed — from deep sleep, groggy and disoriented. Most people pass from light sleep into deep sleep after about 40 minutes. This makes 40 minutes the logical limit for a combat nap (or scheduled crew nap).

Sleep Debt

Sleep debt is a new term for most fliers. *Simply, sleep debt is an accumulation of sleep loss.* While we all know sleep loss makes us tired, the mechanics of sleep loss and recovery are elusive to the casual observer.

Let's say you normally require 8 hours of sleep to wake up rested. When you set your alarm clock to wake up with 7 hours of sleep, you add 1 hour to your sleep debt. Five hours of sleep adds 3 hours to your sleep debt. (You get the picture.) After several nights, you can easily accumulate 8 hours of sleep debt.

Sleep debt makes you tired, irritable, and reduces your mental and physical performance well beyond your personal estimations. Studies show that aircrew members who are actually falling asleep in the seat will report they are fairly alert and performing well.

A true story is told about three airline pilots (pilot, copilot, and engineer). It seems they were feeling a "little groggy" and decided to take preventive action. The pilot sent the engineer back to ask the stewardess to come forward to talk to them a while, figuring that would help them stay awake. When asked, the stewardess replied, "No way! I was just up there for 10 minutes, and you all ignored me." Talk about a disparity between reality and perceptions.

Eliminating your sleep debt is simple. Get some sleep! If you are 8 hours behind, you will not be able to recover your debt in one night.

However, it won't take an extra 8 hours of sleep to make it up. Your body will sleep deeper during sleep debt to try to recover the debt. As a result, it may take only 6 extra hours of sleep, three 10-hour sleeps, to recover 8 hours of debt. Note: The older you are, the slower you recover.

During Desert Storm, I accumulated a significant sleep debt over a period of months. During a 2-week trip, I slept for 10 out of 12 hours of my crew rest for 10 days before I zeroed out my sleep debt and felt human again.

Your body does not keep a sleep savings account from which to draw. Your sleep account is either zero or in debt. The best you can do prior to a trip is to zero your debt. With few exceptions, fliers on trips sleep less and drink more alcohol than they do at home. Because of this, they continue to accumulate sleep debt until they return home, where they report how drained they feel and proceed to sleep and to recover their sleep debt. The best you can do during a trip is to maintain your "at home" sleep schedule to the extent possible and lay off the alcohol. Alcohol reduces sleep efficiency and, thereby, adds to your sleep debt even if you get your 8 hours of sleep.

Aircrew Scheduling

What does sleep debt mean to schedulers? Whether schedulers sit at a desk at home base or serve as mission or aircraft commander, it means when 12 hours is not sufficient to enable everyone to get their 8 hours of sleep, adding to the 12 hours is appropriate.

Studies show scheduling an early takeoff usually cuts into sleep time. This occurs because people sleep on their "home" clock, especially during short trips, and usually can't go to sleep early because of a physiological wakefulness period that occurs during their "evening" (normally from 1800 to 2100 hours).

Poor scheduling practices can add to sleep debt and, thereby, degrade the mental and physical performance of aircrew members. This is extremely poor risk management in this era of demanding missions and reduced resources.

In Summary

Sleep cycles, sleep debt, and aircrew scheduling are significant risk factors we can choose to manage as individuals and as management processes. The benefits of such efforts are optimum mental and physiological performance, reduced risk, and enhanced mission capability. ■

MAJOR DALE PIERCE EARNED AIR FORCE TOP SAFETY AWARD

Photo by SSgt Ricardo R. Clifton

Air Force officials recently named Maj Pierce the person making the most significant contributions to Air Force safety for 1994.

Maj Pierce, Chief of Flight Safety for the 919th Special Operations Wing, is the recipient of the Air Force Chief of Staff Individual Safety Award. Officials recognized Pierce for managing an effective flight safety program while his unit was heavily tasked and undergoing a mission change. They lauded him for developing a crosstell program that enhanced unit safety programs across the Air Force and in other government agencies. Pierce is a two-time winner of this award, also receiving it in 1985.

Pierce collects safety program ideas, creates some of his own, applies them to his own program, and distributes these ideas to anyone who asks. "I find good safety ideas and adapt them to enhance my safety program. Then I share the wealth with other flight safety officers (FSO)," explained Pierce. He uses magazine articles to share his finds, and interested people call him for details — and they do call him. In the past 12 months, he responded to dozens of requests from Air Force bases worldwide, all from those who read his articles.

As a vehicle to obtain and share safety program ideas, Pierce established a crosstell program in 1985 using the *Air Force Safety Journal*. His articles, written under the header "FSO's Corner" were immediately popular, and ideas poured in to him from across the Air Force. After 2 years, the FSO's Corner moved to the Air Force's *Flying Safety* magazine where it continues as a forum to share safety program ideas. "There are a lot of people out there with a lot of wisdom to share, and we all can benefit from their good ideas," he explained. "Crosstell has been the life blood of my program." Pierce has authored more than 60 articles for *Flying Safety* magazine.

—The Managing Editor

Night Vision Goggles: A Primer

CAPT BRUCE FIELDS
Armstrong Laboratory
Aircrew Training Research Division
Mesa, Arizona

■ Night vision goggles (NVG) are on the way to your squadron. If you're an Air Force crewmember and you haven't flown with them yet, chances are good you soon will. Air Force policy directives now state all platforms will have NVG-compatible lighting, and MAJCOMs want the crews, *you*, capable of flying with NVGs.

There's a lot of new and old information out there about NVGs, what they are, and what they can do for you. This article, hopefully, will give you a better understanding of what is available to you and, perhaps, clear up any misconceptions you may have.

The Basics

Image intensifiers are the heart of the NVGs and have been around for many years. First generation (Gen I) tubes were large and cumbersome but they did enhance night operations, particularly for ground troops. Occasionally, an infrared (IR) light source was used to make the scene brighter to the intensifiers and, therefore, easier to resolve. A few of these devices were taken into the air in observation or forward air controller airplanes.

In the early 1970s, Air Force crews took a second generation (Gen II) NVG, PVS-5s, into the air and tried night flying. The PVS-5, while effective, was designed primarily for ground crews. Several modifications were made to its design in order to allow the crews to fly safely. Even so, the solution was less than desirable. One of the biggest problems with the PVS-5s was that the goggle's supporting structure blocked much of the crewmember's vision below and around the intensifier tubes.

These days, the most common goggles flown by Air Force crewmembers are either the AN/AVS-6 or the newer F4949. Both types fall under the designation Aviator's Night Vision Imaging System, or ANVIS, and they look much like small binoculars. Actually, they are more similar to television tubes.

NVGs work by intensifying the ambient electromagnetic energy, which exists in the night environment, by at least 2,000 times. What that really means is, under most circumstances, they brighten up the night. For years, the AN/AVS-6 has been extensively used by helo and C-130 crews, most commonly in Air Force Special Operations Command (AFSOC).

What happens inside the NVGs, or "nogs," can best be described as mirrors and magic. But if you want a little more technical description, here goes.

When you power up the NVGs, they begin collecting light, or photons, from the outside scene. These photons knock electrons loose when they strike a photocathode (a plate coated with gallium arsenide) that's sealed in a vacuum. These electrons are then funneled through a very thin glass wafer (the microchannel plate) consisting of roughly 2 million microscopic tubes. Each of these tubes is tilted at approximately 8 degrees, so collisions between those electrons and the tube walls are inevitable.

For each electron that goes in the front end of this plate, approximately a thousand or more come out the back. Behind the microchannel plate is a phosphor screen that glows when an electron hits it, converting the electrons back to light. The phosphor glows green, and this is the image you see when you look into the NVGs. All this is helped along by different lenses, so what you see is really what's out there. A power supply aids this process by introducing a differential of several thousand volts during the image intensification process. Not to worry, though — the amperage is extremely low.

Lighting Issues and Filters

Cockpit lighting is possibly the most misunderstood issue related to NVG use. Even terms are often misused. For instance, NVG-compatible lighting refers to light, or energy, that the NVG *cannot* see. If compatible light is used to light cockpit instruments, the NVGs will not suffer any degradation, and you will be able to view the outside scene. On the other hand, if a cockpit light is incompatible, the NVGs will intensify it, and the outside scene will be less visible.

The intensifier tubes installed in NVGs are very sensitive to light, ranging from the yellow-green part of the spectrum out to the near-IR. Without filters blocking the visible colors (light) in your cockpit or cargo compartment, the NVGs would intensify any light having these colors which entered their front lenses. All you'd be looking at would be a too-bright, fogged-over image of the scene. This would make the NVGs unusable for flight.

When you fly with NVGs, you're using them to view outside the cockpit, but you look under them to see instruments, charts, and switch positions. The NVGs, because of their design, will do their job and intensify the light from any sources they can "see," including those inside the aircraft, unless they

are made "blind" to them. The manufacturers put filters in the front lenses to make the goggle blind to visible colors.

This gets a little technical, but hang on. Soon it will all make sense.

The filter that's inside the "nogs" (a *minus-blue filter)* is designed to block out all the light below either 625 nanometers (nm) (reddish orange) or 665 nm (deep blood red). (Which number will depend on the *class* of filter being used, but that's another article.) Only colors "redder" than these colors, out to about 900 nm in the near-IR, get intensified by the nogs.

For instance, with a filter that blocks all the energy below 625 nm, cockpits lit with properly filtered green light (550 nm, remember?) will actually look black to the nogs. This is good because, as we said above, you don't want to intensify the light inside the cockpit, and you're not trying to look inside with the goggles. The filter blocks the "compatible" light, or light below 625 nm.

One thing you must understand, though, is that just because it's green doesn't mean it's compatible. Even light which appears

continued next page

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green to the eye may contain infrared energy, and this has to be filtered to block it from reaching the intensifier tubes in the nogs. If not, while you may not be able to see the infrared light, the goggles will, and, again, you'll degrade the outside scene. That's a bad thing.

How is the night world illuminated? The majority of the energy in the night sky is near-IR; however, some is supplied by the moon — if it's up — or cultural lighting — if you're near it. Still, starlight and ionization in our upper atmosphere account for most of the light that's out there. All that stuff is around 700 to 900 nm, and there's plenty of it out there for the NVGs to intensify, even though people can't see it with the unaided eye. On the other hand, green light is around 550 nm.

By this time, it should come as no surprise that the goggles are very sensitive to incompatible light inside the aircraft. In fact, any incompatible light (light the NVGs *will* intensify) near the goggles will degrade the image you see. In some cases (such as a red fire light directly in front of you), the NVGs may become completely useless. In other cases (such as a red light on a side panel coming on), the amount of degradation may not be as noticeable. The problem is, as a crewmember, you may not know how much goggle efficiency you are really losing, and this can put you into a dangerous situation.

So why aren't all your cockpits lit with compatible light? In a perfect world, they would be. But this is not a perfect world, and changing all the lights in a cockpit to NVG-compatible lighting is a very complicated and expensive modification. Until those modifications are complete, there are temporary solutions available. Consult your MAJCOM or your unit tactics representatives regarding current options.

Questions and Answers

What follows are some common questions about using NVGs and some answers. If we don't answer all your questions, feel free to contact us using the information at the end of this article. Remember, the final say on how NVGs are used in your aircraft depends on your MAJCOM and unit directives.

Q. What's the most important thing to remember when using NVGs?

A. Focusing. Period. Everything else is secondary. If your goggles aren't focused properly before you go out to the aircraft, you're setting yourself up. Everything that happens between the time you leave the focusing lane and the time you put the goggles

on in the aircraft works to degrade your visual acuity. Cockpit lights, windscreen transmissivity problems, clouds over the stars — all these things cut down on your ability to see what is outside. You owe it to yourself, your wingman, and your crew to be as good as you can be. Focusing your goggles properly is the first step to getting there.

Q. Can I use all my daytime tactics at night when I'm wearing NVGs?

A. Not really. On most nights, the NVGs will help you see the horizon and the terrain at night more clearly than you can now, but new skills need to be learned. City lights, car lights, the moon, and the stars all give you some light to work with, but the only thing that can turn night into day is the sun. Never assume your daylight tactics will be the same at night, or that just because there's a full moon, there is enough illumination for your low-level operations. You will also have a more limited field of view when looking through NVGs. Current goggles have only a 40-degree field of view, and you'll have to learn new scanning techniques to overcome this limitation.

Q. My eyes are 20/18 now. Will I be able to see that well at night?

A. Maybe in the future, but right now the best visual acuity (VA) with NVGs is roughly 20/30 or less. While some of the older NVGs being used right now may not even do that well, some of the newer ones can provide a VA as low as 20/25 in a controlled environment, such as an eye lane. A lot depends on how well you focus the goggles. *Again, proper adjustment prior to flight is critical, and this can be done only in a controlled situation.*

What you need to know is that the acuity you get in the focusing lane will always be better than what you will get in the airplane. HUDs, windscreens, and windows all absorb some of the energy the NVGs use, and the acuity you get in the airplane depends on many things. Contact your local NVG training center for information on setting up a focusing lane. Or, as always, you can contact us.

Q. You said we could cover incompatible lights with duct tape. But if I cover the lights in the fire handles, or a canopy or door warning light, will I still be able to see it if it comes on in flight?

A. We're not advocating covering emergency lighting. This is a decision that must be made by the aircrews and your command. But be aware, if an incompatible fire light does come on right in front of you, your ability to see outside will be very poor, and the appropriate actions must be taken.

Q. Can't I just turn down the lights in the cockpit or cargo compartment so they're really low but still bright enough to see the instruments?

A. Sorry. All this will do is make it hard for you to read the instruments. Remember, while you can't see near-infrared light, the goggles can. A worst-case situation would be where your lights are so low you can't see anything inside with your unaided vision, but because the incompatible light degrades the NVG image, you can't see outside either.

Q. Since color in the cockpit degrades the NVG image, does this mean I can't have things like color radar or moving map displays in the cockpit?

A. No. It simply means that any incompatible light should be minimized, and, if possible, the component's location should be out of the field of view of the NVGs.

Q. How much illumination do I need to fly?

A. That question has several different answers. The easiest answer is "some." NVGs intensify light that is already out there, so they don't work when it's completely dark. During your training, you'll find out a full moon isn't always better than a crescent moon and starlight. And your illumination requirements will probably be different during training than they will be operationally. The amount of light the goggles need can also vary based on the contrast of the terrain you're flying over.

Q. Does all this mean it's unsafe to fly with NVGs?

A. Not at all. It just means you need to understand the night environment as well as you do the day. Knowing what illusions are common with goggles, and understanding that flying at night will always be different and more difficult than during the day, will go a long way toward making NVG-aided flight much safer.

Q. How can I find more information about NVGs and their use?

A. Call or write us.

Armstrong Laboratory (AL/HRA)
Attn: Night Vision
6001 S. Power Road, Bldg 558
Mesa AZ 85206-0904
DSN 474-6561, FAX -6560
Commercial (602) 988-6561 ■

So why aren't all your cockpits lit with compatible light? In a perfect world, they would be. But this is not a perfect world, and changing all the lights in a cockpit to NVG-compatible lighting is a very complicated and expensive modification. Until those modifications are complete, there are temporary solutions available.

AIR FORCE FLIGHT STANDARDS AGENCY

MAJ BOB FOWLER
AFFSA/XOFD

■ It's that time again — time to rack your summer-fried brain and return to that reality of no leave until Christmas. To get you started right, your boss has given you permission to travel to the lesser-known and often-avoided northern tier. Leaving your home base in south Texas, and multiple-hopping to Las Vegas to get gas (it's only 80 degrees there, so it must be northern), you decide to fly to Grand Forks AFB, KRDR for the night.

Let the questions begin. Oh, yeah, there are no NOTAMs in effect, and the airfield is 3SCT80BKN/6000/17015/998.

1. Having flown NRP (National Route Program, for those of you who haven't read *Flying Safety* lately) to Pierre VORTAC, about 240 miles SW of RDR, you decide to arrive in the low structure. In answer to your request for lower, ATC gives you: "Roger, descend to 5,000 feet, proceed direct JMS V561 GFK; at GFK cleared for the ILS RWY 17 at Grand Forks AFB; Grand Forks altimeter is 30.00." After picking your jaw up off the cockpit floor, when can you descend below 5,000 feet?

a. Established on V561 after passing JMS since the MEA for the segment is 4,000 feet.

b. Outbound abeam the holding fix for the holding-in-lieu ILS procedure.

c. Established on the 315 R from GFK.

d. Established on the localizer inbound.

2. Now that you're at the right altitude (don't look here for the answer), what do you do at GLIB IAF.

a. Turn up to 45° from the outbound holding course (or use normal direct entry procedures) to enter the holding-in-lieu for one turn to align yourself and begin the approach.

b. Turn left onto the localizer and begin the approach.

c. I'm not at GLIB. I turned to the RDR 279/12 for the arc approach. I don't think the TERPs guy knew what he was doing when he built the holding-in-lieu.

d. Turn up to 30° from the outbound holding course since 45 is not allowed for a holding-in-lieu.

3. It's a little late now, but what does the title of the approach tell you about equipment you will need to fly the final approach to the ILS RWY 17?

a. Localizer only approaches are not allowed.

b. You need an operating ILS receiver to fly the final approach portion.

c. DME or radar.

d. The dreaded B and C.

4. As you begin to descend on the approach, you notice the 300 SCT weather seems to be a little more overcast than scattered. If you haven't seen the runway by _____, start your missed approach procedure.

a. Based upon the timing chart.

b. When the controller tells you, if you are flying with radar monitoring.

c. 1.8 DME.

d. 1,099 feet on the barometric altimeter.

5. Now go back in time. You get cleared for the Localizer Only, RWY 17, because the glide slope is out of service. Where is your missed approach point?

a. 1.8 DME.

b. You can't fly the approach. The weather of 3SCT is below minimums.

c. Based upon the timing box.

d. A and C above.

Bonus Question: The published TCH of 50 feet means that the aircraft's landing gear will be 50 feet above the runway threshold if the aircraft maintains

the trajectory established by the ILS glide slope.

a. True.

b. False.

c. Don't ask me — I don't need the extra credit. I got the rest right.

ANSWERS

1. **C.** So all of you who didn't answer the bonus question, go back and try again. The reference is AFR 51-37, 10-6e: When cleared for the approach, maintain the last assigned altitude until established on a segment of the published routing or instrument approach procedure.

2. **A.** AFR 51-37, 12-3b: The entry maneuvering [for the Holding Pattern (In Lieu of Procedure Turn)] is the same as for any other holding pattern. In this case, your heading from GFK is not within 70° of the holding course, so a right turn is the shortest direction to parallel or intercept the holding course outbound. You are also "conveniently aligned" for a teardrop entry if you choose.

3. **B.** AFR 51-37, 7-6a(3)(a): ...approaches are identified by the types of navigation aids which provide final approach guidance and the runway to which the final approach courses are aligned. The fact that the approach plate states "Radar or DME required" means that, yes, Radar or DME is required to be allowed to fly the procedure, but you need ***only*** ILS capability to fly the final approach portion.

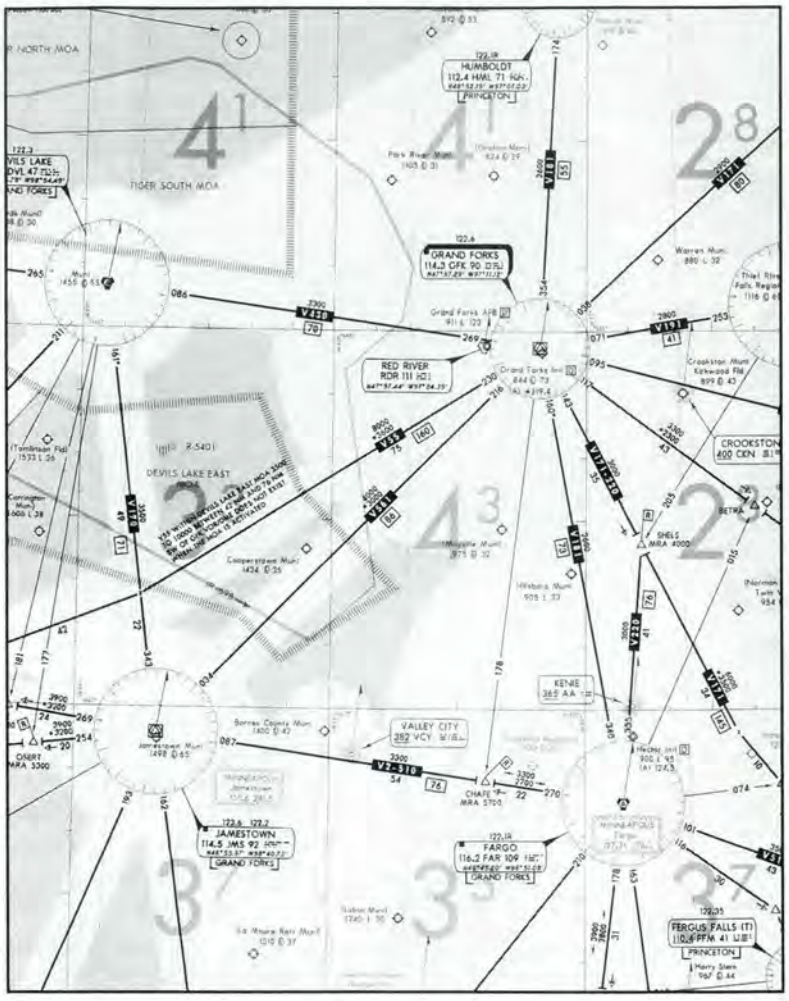
4. **D.** AFR 51-37, 13-1b(2)(e): Maintain a complete instrument cross-check throughout the approach, with increased emphasis on the altimeter during the latter part (decision height (DH) is determined by the barometric altimeter)...At DH, if visual reference with the runway environment is established, continue the approach to landing using flight instruments to complement the visual reference. AFR 51-37, 15-1c. The missed approach point for any precision approach is the point at which DH is reached.

5. **D.** AFR 51-37, 15-1a(2)(b): Timing is required when the final approach does not terminate at a published fix, as is usually the case with VOR, NDB, DME, and localizer... (Timing can also be valuable as a backup in the event of DME loss or other problems which might preclude determination of the MAP). Radar could also be used *IF* the approach plate had it marked as such, like it does for the FAF-6/RADAR.

BONUS: B. AIM 1-10.d.6: The published glide slope threshold crossing height (TCH) ***DOES NOT*** represent the height of the actual glidepath on-course indication above the runway threshold. It is used as a reference for planning purposes which represents the height above the runway threshold that an aircraft's glide slope antenna should be, if that aircraft remains on a trajectory formed by the 4-mile-to-middle marker glidepath segment. AIM 1-10.d.7: Pilots must be aware of the vertical height between the aircraft's glide slope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates the wheel crossing height over the runway threshold may not be satisfactory. Tests indicate a comfortable wheel crossing height is approximately 20 to 30 feet, depending on the type of aircraft.

All done. Hope you had fun and got surprised on one or two of the questions.

The TCH is something that has recently been highlighted by some larger aircraft touching down in or near the overrun, thinking they were on glide slope. Most airports are set up for the aircraft that fly the majority of approaches at the airfield. Just a reminder: If you are on the VASIs, "on the glide slope," and cross the end of the runway at the TCH, ***YOU*** are still responsible if you land short, long, or off the runway, no matter how many visual aids to landing there are on the airfield. Landing is a visual maneuver. Keep an eye out.



Keep the phone calls coming. As noted recently, a couple errors occurred in the articles, and you have been very willing to let us know. At least, we see that you are reading our stuff. Once again, call us at AFFSA, DSN 858-5416, Comm (301) 981-5416, if you have any questions on this quiz or anything else instrument-related. ■

Maintenance Matters

USAF Photo by SrA Andrew N. Dunaway

Two Times Getting It Right Equals One Mishap

■ *Remember when you were 16 or so years old, tore your first car's engine apart, put it all back together again only to discover a bucketful of hardware left over? And you didn't have a clue as to where it was all supposed to go — until the car eventually sputtered to a stop some time later.*

An F-15 pilot was returning from a local training flight when one of his engines started acting up — RPM, FTIT, and oil pressure gauge surges. Despite cycling the erratic engine's engine electronic control (EEC), the surges continued. The pilot turned the EEC off and brought the engine back to idle.

On a single-engine final approach, the mishap engine's RPM decreased, and the FTIT climbed toward an overtemp condition. So the pilot shut it down and continued the no-kiddin', one-engine approach to an uneventful landing.

The mishap unit did a fine job researching this mishap's development. They found the mishap engine's N2 sensor line — which goes between the N2 sensor and the unified fuel control (UFC) — had a crack where a B-nut was welded to the line. The crack had disrupted the fuel flow to the UFC which, in turn, caused inaccurate UFC scheduling and engine surges.

Unfortunately, this mishap engine was involved in another similar incident only a couple of sorties earlier involving only a ground abort. It is believed in this first incident, maintenance changed the N2 sensor line but only installed one of the two tech data-required attach clamps — clamps that prevent the line from vibrating enough to cause fatigue failure!

Do you wonder what the installation maintainer and the task inspector thought about that extra clamp after the first installation? Or is this really the second incident of the mishap line? Could it be possible the missing clamp that caused the second line's fatigue failure also caused the first line's failure? If this is true, there appears to be a "backyard" mechanic's failing to adhere to tech data requirements.

Well, even now in the real-life, adult world, the Air Force still has a few **"immature backyard mechanics"** scratching their heads over that one little clamp, cotter pin, or bolt left over after a task is completed, or they don't follow tech data to discover some other unsafe mechanic's faulty work.

A serious lack of task credibility and personal integrity prevents the mechanic(s) from solving the "leftover or missing hardware" dilemma — until an inspector or a mishap investigation forces him or her to address the origin of the "uninstalled" piece of hardware. Hopefully, one day a supervisor will get their attention (like your dad did when you were young in order to instill and develop your own self-discipline values) and put a permanent stop to this unsafe behavior and lackadaisical attitude — **a behavior or attitude that was *never* condoned in the past and certainly wouldn't be now!!**

The Gremlins Win Another!!

Here's a little mystery. How is it possible to have a Class C ground mishap on a jet, then fly it to the Class C flight mishap category *before* it's fixed?

Prior to a fighter aircraft taking off for an intercept training mission, both the pilot and crew chief performed preflights. Everything looked fine. The takeoff, landing, and the training sortie were uneventful.

The pilot's postflight inspection didn't turn up anything out of the ordinary, but the crew chief's inspection was a different story. There was a 7-inch gash discovered on the bottom, aft tip of a horizontal stab.

It was determined the location and the kind of slice in the sheet metal ruled out the possibility of an in-flight incident causing the damage. However, there had been some sheet

*U.S. GOVERNMENT PRINTING OFFICE 1995-679-016/03019

metal work performed in close proximity to the damaged area the day prior to the flight. It's assumed the damage was done during this maintenance activity. For instance, a maintenance stand could have been run into the horizontal stab.

Well, this "maintenance stand" theory seems reasonable at first, **but a 7-inch gash!** That would mean a **runaway stand** must have gotten up quite a head of steam to hit and tear an aircraft's skin 7 inches. Someone would've had to have forgotten to lock the maintenance stand wheels though.

Now, on the other hand, if a maintainer pushed the stand into the horizontal stab during the maintenance activity, surely the individual would have felt the jarring collision with the aircraft and investigated for any damage! Then a writeup in the forms, a structural integrity evaluation, and repair action would have all taken place — especially if the maintainer working in that area was a sheet metal specialist! So, that scenario doesn't seem to work either.

Nobody stood up to the plate and owned up to the damage, so now the mishap unit won't be able to take the proper action to prevent it from happening again.

The gremlins win another mishap cause!

Torque Values Aren't Based on Brute Strength

A helicopter crew had cranked up their engines, and when the pilots advanced the throttles for further pre-taxi checks, the entire crew smelled an electrical odor. A quick scan of the engines by the flight engineer revealed smoke coming from one of them. The aircraft commander directed an emergency shutdown and declared a ground emergency with the ATC folks.

USN Photo by PHI Charles W. Alley

Maintenance found extensive engine cowling damage due to a broken engine exhaust de-swirl clamp causing hot exhaust gases to enter the engine compartment. The clamp's bolt showed signs of being over-torqued which led to the bolt's eventual failure.

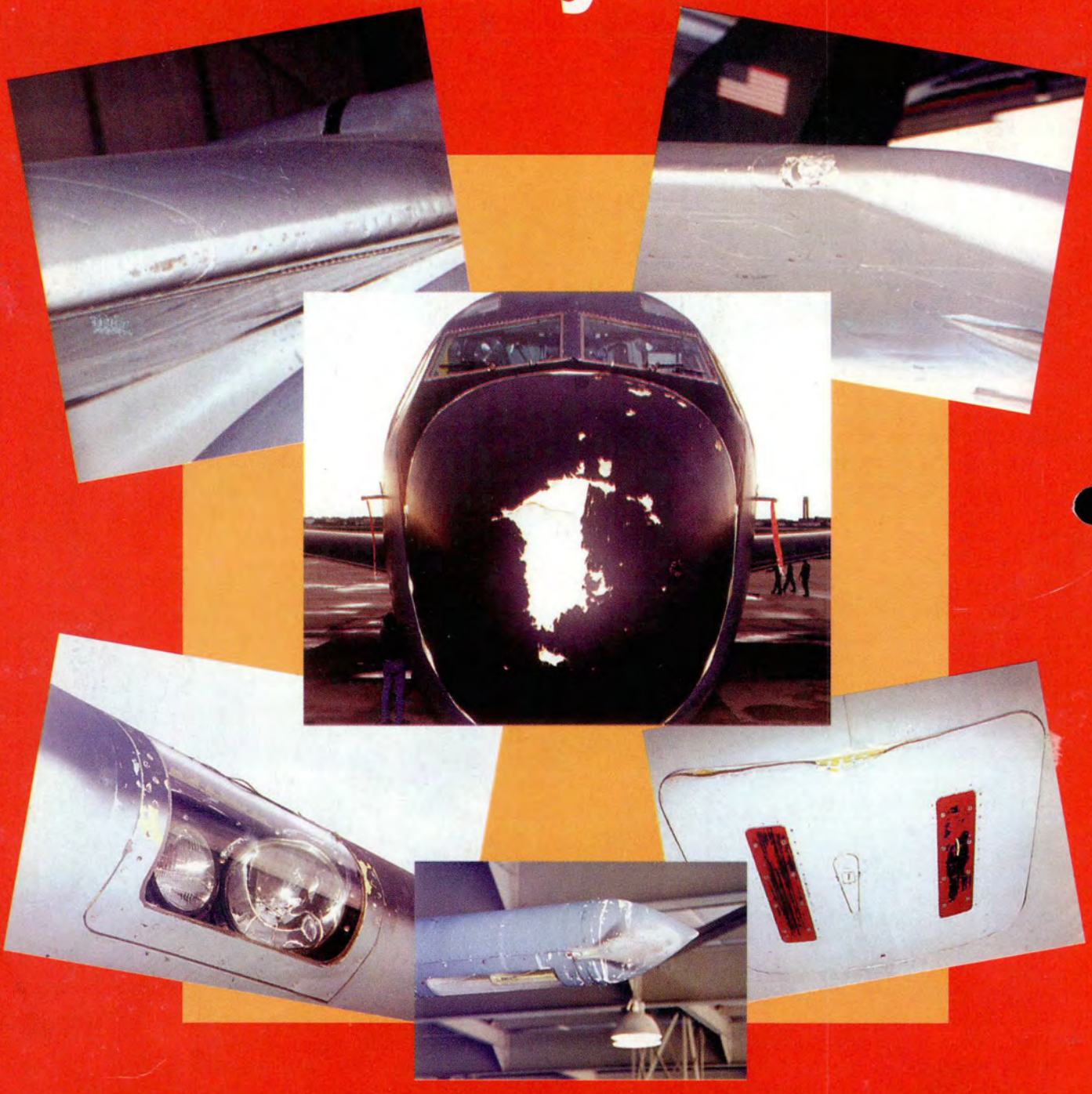
The last known maintenance in the de-swirl clamp area was a depot-level mod accomplished sometime earlier. A one-time inspection of the rest of the unit's aircraft was accomplished with no further discrepancies found.

Weapon system and equipment tech data usually have a torque value for *just* about every bolt used in our aircraft and equipment inventories. If "specific" weapon system tech data doesn't, then generalized hardware tech data might. Regardless — specific or generalized — **no mechanic should be cranking down a clamp bolt until it's bent, distorted, and/or cracked!**

Now just put yourself in the flight crew's shoes and imagine, if you will, that this mishap could have let loose at cruise altitude, over water, a half hour or so from land! Just remember that the next time you want to **"really put the meat"** to that bolt, screw, or nut. Proper torquing is as simple as properly installing a cotter pin, but we still see a mishap problem with these simple little tasks.

Look, folks, this aircraft maintenance business is pretty serious stuff. Believe it or not, its credibility is critical to the Air Force's mission and our national security as a whole. And, yes, even one over-torqued bolt on one aircraft flying one critical mission can have devastating consequences. For this reason and more, maintenance is not for the weak-hearted or lackadaisical! It's a universally recognized professional aviation vocation that has a definitive set of personal and professional ethics and standards and where **torque values aren't based on brute strength!** ■

If you mess with nature, nature's gonna mess with you.



Count on it!