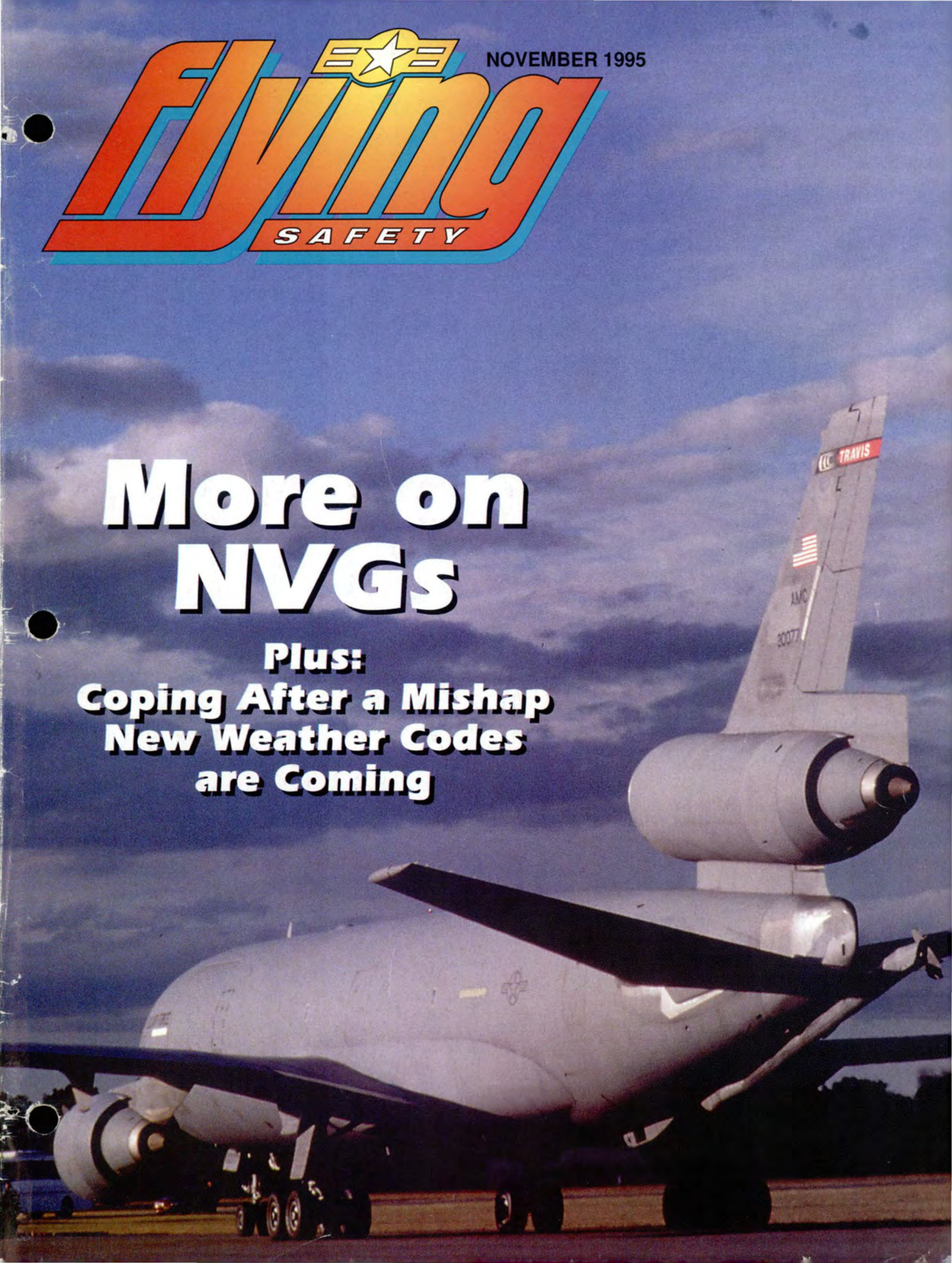
Flying Safety

NOVEMBER 1995



More on NVGs

Plus:
Coping After a Mishap
New Weather Codes are Coming

TEAMWORK AND DISCIPLINE

MAJ GEN ROBERT A. McINTOSH
Chief of Air Force Reserve

■ There is no issue more important to the United States Air Force than the safe accomplishment of our flying mission. The trust and confidence placed in us by the American people rests in no small part on our ability to perform our mission safely and effectively. We in the Air Force Reserve are extremely pleased that as the intensity of our flying operation has increased in response to our ever more vital membership in the Total Force, we have not only answered the call, but responded safely as well. We have reduced our number of Class A flight mishaps from four in FY92, to two in FY93, and finally to just one last year.

Teamwork and discipline are the primary ingredients in this successful achievement. Operating 11 different aircraft types in 37 flying wings, the Air Force Reserve is a valuable member of the Air Force team. As such, the key elements of teamwork and discipline that enable the Air Force Reserve to operate safely all over the world are the same factors that work so well throughout the Air Force. Teamwork and discipline have always been the hallmarks of every successful military operation throughout history.

Past achievements are no guarantee of success in the future. Emphasis on good teamwork and discipline continues to be especially important because almost invariably when mishaps occur, there has been a breakdown in either or both of these human factor areas — by aircrews operating aircraft, maintenance personnel fixing them, the people supporting these activities, or a combination of these.

Teamwork and discipline don't just happen. They are sustained and nurtured through strong and effective leadership. This requires commanders who take responsibility in directing and supporting front-line supervisors so that the only acceptable way to do any job is the right way, in accordance with the tech orders and other formal written guidance. It requires supervisors who don't cut corners and demand the same from their people. Finally, it requires individuals who know their jobs and are motivated to do every task correctly and completely. In short, leadership demands all of this, from all of us, every day.

Commanders' responsibility to uphold discipline is of the highest importance. Teamwork can't exist without discipline because we depend on each other. We can only do our part effectively when we trust implicitly that others are doing their jobs correctly. The consequences can be swift and tragic when we or someone we rely on fails to do their part of the job thoroughly and professionally.

A recent study in AFRES identified complacency as one of the greatest threats to flight safety. Complacency refers to an inappropriate state of well being or overconfidence resulting in a diminished level of vigilance. Our Air Force has the best people, the best training and the best equipment in the world, but even the best of us — perhaps especially the best — are susceptible to instances of decreased vigilance, without even being aware that it has happened. The findings of our mishap investigations bear this out all too often. Although not a cure-all, the best prevention is a disciplined approach to everything we do.

Our intent in the Air Force Reserve is to be a respected partner assisting the USAF as it continues to build a team within a team for America's defense. We contribute to this common effort by supporting the safe accomplishment of the Air Force mission throughout the world every day. Safe mission accomplishment is indeed the most effective mission accomplishment. Teamwork and discipline are the keys to success for all of us. ■

Our 51st Year

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Flying Safety

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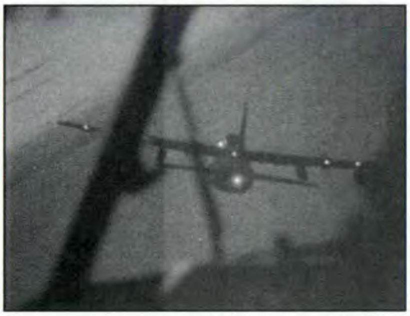

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SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS

Contributions are welcome as are comments and criticism. No payments can be made for manuscripts submitted for publication. Call the Editor at DSN 246-0936 or send correspondence to Editor, Flying Safety magazine, HQ AFSA/SESP, 9700 Ave G, S.E., Ste 282, Kirtland Air Force Base, New Mexico 87117-5670. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning.

THERE I WAS...

USAF Historical Photo

■ ...a fairly new copilot, standing in Whiteman AFB's base operations on a cold Friday morning in January. I was with my aircraft commander and our detachment commander (DETCO) receiving the weather briefing. It didn't look good — 700-foot scattered deck, 1,000-foot overcast, 3-mile visibility with blowing snow, and VERY cold. Takeoff temperature was around -20°C, and the winds were out of the northwest at 20 to 25 knots. This certainly made the wind chill *even colder.*

Snow showers and icing conditions in the clouds were forecast throughout our route of flight. The forecast did call for clearer skies the farther north we got, but it also called for colder temperatures and windier conditions. Not the best weather to be flying in, but, hey, for us helicopter pilots, it was VFR conditions and well within the regulations. Just stay out of the clouds and we would be okay.

This was my first cross-country since arriving at the unit, and the flight from our home base in South Dakota had gone without a hitch. We had brought our DETCO down to our sister unit for a commander's visit, and it gave us a chance to get out of the local area. The weather moved in the day after we arrived, and we'd been stuck on the ground for 3 days. It now looked as if we finally had a break to get back home.

After the weather briefing, I began to have second thoughts. Sure, it was VFR, but was it really smart? Our mission was just to go back home. The DETCO turned to the AC and asked, "What do you think we should do?" The AC (a true mission hacker) said in so many words, "Let's go for it."

The boss then asked me what I thought. I summoned the words and said we shouldn't go. I explained my reasons: (1) The weather wasn't great; (2) and we didn't have a lot of winter survival equipment on board should we have a precautionary landing in the middle of nowhere. His response was we had plenty of stuff on board to start a fire should the need arise. The AC finally decided — WE GO.

As we headed out to our H-1, the pilots from our sister det unit looked at us with disbelief. They couldn't believe what they were seeing. We started the helicopter up and away we went.

The weather did begin to improve the farther north we got, but the winds were picking up as forecast, and it was definitely getting colder. The strong headwinds forced us to make an additional fuel stop. We stopped and refueled at a small airport in Nebraska, grabbed some lunch, and updated the weather. No real changes — just cold.

The second leg was uneventful, and we made our last refueling stop in an extremely small South Dakota town. By now, it was late in the afternoon. We got gas, rechecked the weather, and filed our flight plan with FSS. The forecast en route weather was a 2,000-foot overcast ceiling, 4 miles with intermittent blowing snow and ice fog, and the winds decreasing to about 10 knots.

The temperature was now a balmy -35°C. This was still within VFR unaided night minimums, and besides, we were only a little over 2 hours from home. By now, all we wanted to do was get home. We launched, now dressed in all our cold winter gear, and headed west into the sunset with me at the controls.

FSS had given us a VHF frequency to open up our flight plan. For the next 20 minutes, the AC tried in vain to raise anyone on the radio. He tried both VHF and UHF frequencies and even transmitted in the blind for any radio. A lower-than-expected cloud deck kept us from climbing much above 500 feet, so we kept pressing on westward. Again, to no avail, the AC tried to tune in some NAVAIDs to aid our navigation. We simply weren't high enough to receive a good lock-on. Besides, there aren't many NAVAIDs in the middle of South Dakota.

It started to get very dark, and the AC took the controls. I was straining to find our next checkpoint and realized I no longer had a visual reference with the ground. We had entered some blowing snow. I announced I didn't have a visual reference when the AC calmly said, "I'm transitioning to the instruments."

I quickly reconfigured the cockpit lighting for night instrument flying, realizing here we were, at night, in the clouds, on an unopened VFR flight plan, no NAVAIDs, comm out, couldn't climb due to icing, and couldn't descend because we couldn't see the ground. Hearing the DETCO from the back say, "It's okay. I think I see a light," was no comfort whatsoever.

The AC now asked (with a little more inflection in his voice) for a heading and altitude to keep us clear of any obstacles. Quickly scanning the map, I told him to fly 270° at 3,800 feet MSL. That kept us at 500 feet AGL. (By the way, HH-1Hs at the time did not have a radar altimeter. There was no high-speed navigation equipment like LORAN, GPS, or INS either — just a VOR/TACAN and ILS.)

We pressed on, flying westward toward our home base on the instruments at 500 feet AGL. We finally got clear of the blowing snow and ice fog. Because of the overcast sky and lack of ground lights, we still had no visible horizon. For the next 2 hours, we took turns flying, constantly checking for any signs of airframe icing.

Unfortunately, the helicopter's heater could not keep up with the cold. Both the AC and I began to show signs of cold exposure. We both realized our toes were getting numb, and the AC complained his thighs were going numb.

About 40 miles east of the base, our transponder lit up, telling us approach control was painting us on radar. A collective sigh was heard in the cockpit (and in the cabin). We called approach and told them our position and intentions. There was a long, pregnant pause when the controller called back. "Aircraft calling approach — who are you, where are you, and what do you want to do?"

We repeated our message, asking for vectors for the ILS full stop. The controller, still shocked we were even flying at all, gave us a vector to intercept the final approach course. As we got closer, we could begin to make out the lights of the base. They never looked so good! We lost the ILS signal halfway through the approach, switched over to the TACAN, and landed without further incident. We landed with 15 minutes left on our crew duty day, shut the aircraft down, and spent the next hour or so thawing out in the hangar.

In hindsight, we were lucky. Lucky we didn't have a precautionary or emergency landing. Lucky we didn't get any icing. Lucky the AC had a passion for instrument flying (to this day, he keeps copies of AFM 51-37 and the Airman's Information Manual in his bathroom for a little light reading).

Yes, we were lucky — but stupid. The mission to get home was definitely not a life-or-death mission. We could have stayed at Whiteman until the weather got better. We could have RON'ed anywhere along the route of flight. When we couldn't get our flight plan open, we should have turned around. We had several opportunities to divert to other airports, towns, and even missile launch control facilities, where we could have waited until morning. All we had was get-home-itis. This time we got lucky. The next time, though, we might not be as fortunate. ■

Flying Safety

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HEY! LET'S GET A GRIP ON REALITY

LT COL BOB LEE
HQ AFSA/SEL

■ Two years of reviewing Class A mishap reports and answering inquiries from the field has convinced me that crewmembers are their worst enemies when it comes to proper use of their life support equipment. This article will touch on two continuing problems that need to be digested by all of us who fly in Air Force aircraft: life support training and life support equipment requirements.

Get a Grip Part I

In my job here, I note that almost every mishap has some problem with life support equipment or training. The deficiencies with life support equipment have been fairly well identified, and solutions can be worked as money is found.

The overriding things I see are not related to equipment problems but to training. The two primary problems are crewmembers who are not well prepared for the escape part of the emergency and crewmembers who do not know how to use their equipment properly. I'll give you a fictitious example from the fighter world since these are the most frequent mishaps we have. But trust me — they are not alone in the mistake column. The heavies and helicopter fliers have their share.

Simon 11 was part of a four-ship ground attack mission. The flight was flying an unnamed engine-deficient fighter that was occasionally thrust-deficient. Pulling off the target, 11 experienced a loud bang, and a violent shudder went through the aircraft. Simon 11 was really smokin' after the pass, so he wisely decides to trade some airspeed for altitude and turns toward the nearest emergency landing field.

Our MP notices the RPM is decreasing and the engine temp is going up. Topping out at 12,000 feet AGL, 11 notifies everyone and continues going through the checklist. After several airstart attempts, 11 is descending through 3,000 feet AGL and beginning to think about ejection as the last start attempt is made.

Of course, the book will tell you that even if it did respond at this point, you might not get usable thrust before your jet hit the ground. Simon 11 tells the wingman it doesn't look good, and ejection is imminent. Then 11 gets into proper body position as his jet approaches the 2,000-foot AGL minimum controlled bailout altitude — airspeed 185 knots, both hands on the handle, and pull. We now turn it over to Simon 11 and let his testimony speak for itself.

"Man, I saw a flash, and the canopy left the aircraft, and what an incredible whoosh of air! It was like slow motion, maybe that temporal distortion stuff. The jet just fell away — saw smoke trailing behind it. I felt like I was tumbling, and all of a sudden a sharp jerking as the parachute deployed and inflated. I noticed as I tried to look up that there were several twists in my risers (common problem). I kicked my legs in the bicycle motion and spread the risers with my arms, and slowly the twists came out.

"I remembered that I needed to do my post-ejection checks, so I reached for my visor, but it wasn't there (common problem). I released my mask from the left side of my helmet and let it dangle to the right side. That is when I saw my jet heading for a line of trees. I watched it for several moments to see where it would hit (common problem). Man, what a fireball!

"I knew that I needed to finish my post-ejection checks, so I looked up for the 4-line release red loops, but I couldn't see them (common problem). I remember that in the trainer they were always hanging down by my ears, but no sight of them now. The parachute was oscillating back and forth, and the life raft and seat kit lanyard were wrapping around my legs (common problem). Maybe if I'd jettison my kit and raft, it will stop this oscillation (wrong answer). There they go! Huh? No change.

"Oh, my gosh, I'm about to hit — got to get my feet together and.. [illegible]am! I was hurtin' in all the wrong places. Felt like my leg was broken, and I had hit my head pretty hard as I tried to salvage the PLF. I had forgotten that the surface wind forecast for the range had been 300/15. It took me several seconds to get both of the parachute releases actuated. I had released the left one and noticed that I was still going across the ground. I forgot about the cross-connector strap.

"Finally I stopped. My ankle and leg were hurting pretty bad. I was sure something was broken. I know now that if I had found the 4-line releases between the front and rear risers I could have broken the tackings and released the 4-lines and had the chute stability and steerability. As it was, I landed on some rocks as the parachute was doing its pendulum thing, which essentially accelerated me into the ground. Good thing it wasn't a hostile situation. No way I could have escaped. Had a nasty cut on my face where the dangling mask got me during my parachute drag.

"Simon 12 was flying overhead, and I was sure he could see me waving. But I found out later he could see only the parachute. Something about a green flight suit against the ground. I hobbled and crawled the 50 yards to my seat kit. Stupid for me to jettison all my survival items (happens). I got to the kit, pulled out the radio, and heard the beacon going off. I turned off the switch, but it was still transmitting (common problem). Next, I pulled the external wires off, but it was still blocking my transmission on the survival radio. I finally took the battery out and it quit (common solution).

"I contacted Simon 12 and told him my condition. I grabbed the water out of the rucksack and drank it all. Soon I heard a helicopter coming, so I pulled out a gyrojet and shot it into the air. It was really hard to see in the daylight. The helo didn't see it either. I soon contacted Helpu 21, and he told me to fire a smoke flare, which he saw easily.

"Soon I was back at the base talking to all those investigators on the mishap board. Man, they look into everything (everything, even your darkest secrets!). I was DNIF for 2 weeks until my ankle healed. I did get high marks for my emergency procedures in the air trying to save the jet, but I got poor marks for my knowledge of post-ejection procedures and use of my equipment (common outcome).

"Guess who the new life support officer is now (experienced). I now insist every crewmember in the squadron go through the egress and hanging harness trainers with 'their gear' and demonstrate how to do and use everything. No more putting one guy in the trainer and the rest of us looking on (happens all the time). We also got another parachute to put beside the harness trainer so crewmembers could see how the 4-line lanyards looked when tacked between the risers. We show them how twists in the risers keep the tackings from breaking, but they can do it with their hands and expose the two red loops. We also put elastic bands on the red lanyards so they draw back up into the sleeves to their normal stowed position.

"If I had known about the riser tackings and 4-line problems before, I would have checked the chute, removed my mask completely, and completed the 4-line jettison. Doing the 4-line would have stopped the oscillations and allowed me to retain my seat kit, steer to a better landing area, and turn into the wind to cut my forward velocity for my PLF. I probably wouldn't have hurt my leg or ankle at all. I also grill everyone on that confusing beacon in the seat kit and make sure they can demonstrate how to remove it and turn it off and on. If anyone in this squadron ejects while I'm the LSO, they better not make the same stupid mistakes I did. Descending at 20 to 25 feet per second, it took me only 80 to 100 seconds to cover the 2,000 feet to the ground. **Plenty of time, if you're better prepared than I was."** Will you be?

Get a Grip Part II

Why can't I fly with plastic boots, synthetic underwear, and my custom helmet? Who says we need rafts and parachutes and all that junk on heavies? We never have emergencies where that stuff is a factor. And think about all the resources we can save by getting rid of that life support stuff. Sometimes you think these folks are one burrito short of a combo plate.

I can't argue with their observations of what has gone on during our ***normal peacetime missions***. Statistics will tell you that we almost never have to bail out of a heavy or ditch in the ocean. Statistics tell you there are very few in-cockpit fires during flight that injure crewmembers. So what is the big deal?

What many crewmembers forget is that the operational machines they fly and the equipment they are outfitted with were designed for combat operations, not training sorties over the central United States. The emergencies faced in combat frequently will involve encounters with antiaircraft guns and missiles, something alien to most peacetime/training missions. However, with hostile encounters that put holes in your aircraft, it would be reasonable to expect in-flight fires, multiple system failures, catastrophic in-flight breakups, and ejection/egress.

The recent incident with the downing of an F-16 over Bosnia should give you a clue. That aircraft was coming apart in flight, and the pilot received burns during his ejection that did not come from the egress system. A C-130 flying missions into Bosnia was struck in the fuel, hydraulic, and propulsion systems. The aircraft flew back to Italy. However, the situation could have degenerated into a situation like the C-130 that had an in-flight fire in the cabin and in the wing and eventually crashed into the water. Many casualties resulted. The majority of those who bailed out were fine.

Don't try to superimpose the facts of everyday training mishaps on the possibilities of combat. If you attempt to use pure noncombat statistics (because that's all we track) of how often a particular situation has occurred in the past, you can probably make a case to fly with nylon-sided boots, no gloves, a giant knee board, a nonapproved custom helmet that life support has no parts for, no chem gear, and additionally, in heavies, no rafts, no helmets, no parachutes, and no survival equipment. You can be the hero of saving resources, but you'll jeopardize someone else's chances of survival in the future.

Life support's mission is to train and give you the safest possible tools to survive in and out of the aircraft. We offer hope when everything else falls apart. Help us do that. ■

Escape Systems Evolution

ROBERT L. CAMPBELL
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The decision to eject could be either the most difficult or one of the easiest decisions a crewmember is forced to make. The reason for this paradox lies in the conditions surrounding the crewmember at that critical moment. Should catastrophic failure of the aircraft occur, the ejection decision is relatively simple — ejection without delay.

On the other hand, should a problem occur that the crewmember feels could or should be overcome, then the decision may be delayed, resulting in a last-second ejection, which increases the probability of an unsuccessful ejection. Fortunately, escape systems have continued to evolve, thereby enabling the crew to have the best possible chance for a successful ejection.

Military aviation began around the turn of the century, and by 1917, there were a large number of aircraft in the inventory. During World War I, the use of the airplane as a weapon system was established. However, during the early stages of this war, pilots were not equipped with any device which would allow them to abandon a damaged aircraft.

But as fatalities occurred, the need for a parachute was recognized, and soon pilots were equipped with a parachute similar to what balloonists had been previously using. The conventional over-the-side bailout remained basically the same until the end of World War II. However, as aircraft became much faster and more sophisticated, it became apparent that over-the-side bailout was not a reliable means of escape from a damaged aircraft.

During the latter stages of World War II, the Germans developed the first ejection seat. The first recorded use of an ejection seat occurred on 13 January 1943, and by the end of the war, the Germans had over 60 ejections. The first ejection seats were powered by various sources, including compressed air, a large spring, and explosive charges.

The U.S. military began equipping aircraft with ejection seats after World War II, using a ballistic catapult for power. The function of these early seats was strictly to propel the crewmember away from the aircraft. It was then up to the pilot to open the lap belt, kick away from the seat, and then deploy the parachute.

The early model ejection seats were an improvement over the previous method of escape, but there was still a need for more changes. During the Korean War, the need for an automatic system intensified. Even though the nonautomatic systems had a high overall success rate (85 percent success for overall ejections), the low-altitude success rate (ejections at less than 1,000 feet above ground) was very poor. Prior to 1958, only 1 out of 35 low-altitude ejections was successful. The need for a fast and fully automatic system resulted in a technological breakthrough for the Martin-Baker company of Denham, England.

One of the first fully automatic escape systems was the MK-3 which was designed by Martin-Baker and became operational in 1956. This system featured an automatic lap belt release, automatic parachute deployment, plus an aneroid-controlled timing mechanism which permitted operation at low altitudes. These features lowered the altitude minimum to 500 feet which broke the 1,000-foot barrier and greatly enhanced crewmember survivability. In 1959, the success rate for below 1,000 feet had increased to around 65 percent, but this was just the beginning of escape system evolution.

The first automatic system broke the 1,000-foot barrier, but greater improvements were needed. Areas prime for improvement included seat stability, quicker operating times, improved reliability, and reduced maintenance downtime. With improved stability and reduced operating times in the early 1960s, the focus now turned on improving reliability and creating equipment that could determine airspeed and altitude, then automatically select the proper mode based on the ejection conditions.

The Vietnam war also brought to light the need for some sort of flail protection for legs and arms. The jet aircraft of this era, plus the higher ejection airspeeds of wartime conditions, resulted in numerous flail injuries which prevented crewmembers from escaping after an otherwise successful ejection. Escape systems designers were tasked to create a system that would not only get the crewmember out of a crippled aircraft at increasingly lower altitudes and higher airspeeds, but ensure this could be accomplished with minimal or no injuries.

The first step for the next generation escape system was development of a ground-level zero-airspeed system. This would enable a pilot to eject on the runway (or carrier deck) with no forward movement of the aircraft. This was accomplished with the addition of a sustainer rocket to the already existing rocket catapult. This combination of rocket and catapult resulted in seat trajectories high enough to permit full inflation of the parachute prior to the crewmember descending below 50 feet.

USAF Photos

The ACES II is a lightweight advanced-performance escape system which incorporates rugged, lightweight aluminum structure, high technology subsystems, and electronically controlled sequencing.

The development of this zero airspeed-zero altitude system ("zero-zero" system, as it's commonly referred to) greatly expanded the escape envelope. The new training environment (low level), higher performance aircraft, and the aforementioned areas prime for improvements resulted in the development of the High Technology Ejection Seat.

The High Technology Ejection Seat selected by the United States Air Force is the Advanced Concept Ejection, more commonly referred to as the "ACES II." This escape system was designed by the Douglas Aircraft Company under contract with the Air Force. It incorporates design improvements from over 30 years of escape system experience, plus knowledge derived from research with the ACES I research and development program.

The ACES II is a lightweight advanced-

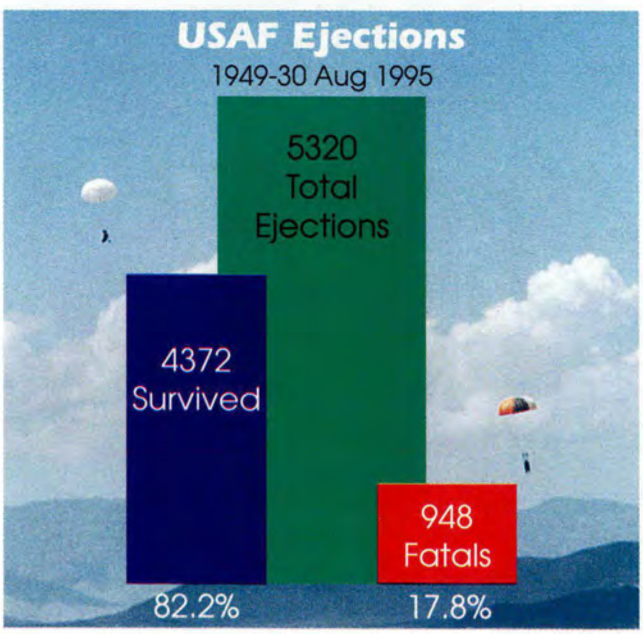
continued next page

USAF Photo

ACES II Ejection Rates
8 Aug 1978 - 30 Aug 1995

	Survived		Fatal	
Acft	**#**	**Rate**	**#**	**Rate**
A-10	32	82%	7	18%
F-15	43	89%	5	11%
F-16	166	93%	13	7%
B-1B	11	92%	1	8%
F-117	1	100%	0	0%
	253	91%	26	9%

Total Ejections 279



USAF Photo

performance escape system which incorporates rugged, lightweight aluminum structure, high technology subsystems, and electronically controlled sequencing. These subsystems, plus the electrical sequencing, are the foundation for the optimized recovery performance that has resulted in ACES II having the best overall success rate for ejections initiated within the design limits of the seat. The ACES II system is the standard seat for all current and future Air Force requirements. The ACES II seat is currently installed in F-16, F-15, A-10A, F-117, B-1B, and B-2 aircraft. The ACES II pioneered the use of electronic sequencing and airspeed sensing pitot tubes on ejection seats.

The ACES II ejection seat went into service in 1977 and quickly proved to be a significant improvement in the state of the art. The first USAF ACES II ejection was in August 1978. Since 1978, there have been 279 ejections with an overall success rate of 91 percent (see chart). This includes out of the envelope (14) as well as those ejections where the aircrew had a successful ejection only to be fatally injured by some means other than seat-related. The ACES II success rate of 91 percent is a great improvement over the ejection history survival rate (see chart) for the USAF.

Whenever aircraft performance improved or tactics changed and aircrew members were exposed to potentially greater risk in an ejection, the Air Force has always worked to improve their chances of survival. The success we are experiencing with today's ejection seats is the culmination of teamwork. This "team" consists of escape systems designers, maintainers in egress, life support and survival shops, as well as the crewmembers. However, the final link for a successful ejection rests with the crewmember. Crewmembers must make timely decisions in an environment where a fraction of a second could be the difference between life and death.

Safe flying! ■

UNSAFE TOWING

■ Over the years we've printed stories about towing mishaps involving untrained mechanics and/or inadequate task supervision. In addition, we've had some aircraft taxiing and landing mishap articles about mechanics, task inspectors, and pilots *all failing* to ensure an aircraft's nose landing gear scissors (torque arms) were **reconnected** after towing operations. What we have here is yet another age-old towing/nose gear scissors mishap tale, but with a different twist.

This particular ground mishap happened because some untrained (except for one individual) maintenance folks *didn't* disconnect the nose gear torque arms *before* a tow job began! When the aircraft was under tow and in a sharp turn, the nose gear suffered over $30,000 in damage due to neglect of this critical, checklisted item. To make things worse, the tow crew heard the loud noise coming from the nose gear well and did, in fact, find the "still connected" torque arms, but **they didn't discover the damage to the gear!** The damage wasn't actually discovered until the next week when other maintainers prepared for a tow job back to the flightline.


USAF Photo

On the day of the mishap, a three-person crew showed up at the aircraft with a tow tug and tow bar. Only one of the three was actually trained, qualified, and experienced as a tow team member and served as the mishap tow tug operator. The aircraft tow brake operator had some past experience in towing operations but had *never* been properly trained or qualified! **However, as incredible as it may seem, the mishap tow supervisor had *never* been trained *nor* did he have any prior towing experience at all! And none of them — not even the tow supervisor — was using a checklist or tech data!**

No further questions necessary. We shouldn't have a problem determining the mishap's development on this one. It was a done deal from the very start — just a few untrained, unsupervised maintainers out there having a mishap field day! Sure wasn't anyone responsible in charge on the mishap tow job, was there?

Of course, we could always ask the standard "Why?" question, but this towing operation was so blatantly unsafe and lacking in <u>any</u> resemblance to quality maintenance practices that asking "why" would be totally embarrassing to all of us, especially if the mishap managers tried to answer it. Obviously, the answers would spawn some more safety-related questions about personnel qualifications, training programs, supervisor selection processes, etc.

Regardless of the above mishap scenarios, there are several causal factors that seemed to surface in all of them — individual complacency, institutionalized maintenance malpractices, and lack of proper training and supervision. The last factors are a particularly hard pill to swallow since proper training and supervision are the two most critical elements in *any* task or maintenance activity. And the mishap personnel in this "towing/nose gear scissors" incident — well — **apparently they weren't even close to being responsible in proper training and supervision of towing operations.** ■

Maintenance Matters

Critical Incident Re

LT COL (DR.) JOYCE TETERS
HQ Air Force Safety Agency

■ An aircraft is lost while the squadron is TDY. Several crewmembers are killed, but some survive. The survivors, while shaken, are physically okay. But they and other members of the squadron have suddenly come up hard against their own mortality. *How do you, as a squadron commander or supervisor, help your squadron cope with the loss of their friends and crewmembers? What do you do immediately following the mishap so the squadron can get on with the business of flying airplanes and crews can refocus their attention on the mission?*

As you might expect, there are no magic answers to these questions. But there are things you commanders and supervisors can do to minimize the impact of a mishap on your squadron. *It's important to talk about these issues with your people prior to such a mishap rather than learning how to cope with them through a "baptism of fire" at the time of tragedy.* You need to prepare your aviators and maintainers to deal with an aircraft mishap because the reality is the Air Force loses approximately 30 aircraft and crewmembers a year.

Why take time to prepare? Commanders must take care of their own during a critical incident impacting the squadron. We don't have "go teams" in the Air Force which can suddenly materialize at your base to take care of the emotional aftermath related to a loss. We simply do not have enough money or people for this type of task. Also, a closely knit unit is not likely to talk with outsiders who come into their world in a crisis situation. They may react to such help with an attitude such as "We don't need you interfering in our world — we can take care of our own."

Your people are perfectly capable of managing the aftermath of an aircraft loss, but they may need help to be successful. So it makes sense to give commanders and supervisors the basics for handling critical situations which could impact their people anywhere in the world.

Keep crewmembers together at the squadron or TDY site. This allows them to begin talking about what happened. After all, they are the ones who went through the experience, and they need to support each other through the first hours and days following the mishap. Remember, they have shared an experience that will stay with them for a lifetime, and they're not sure others will understand what they have been through.

Most crewmembers who survive an aircraft loss where there are deaths of other aircrew feel guilty because they are alive and their friends are not. This may not seem rational, but it's true.

Separating survivors from the squadron isolates them and implies they are unacceptable to the others. They may very likely feel they are no longer an accepted part of the squadron, which is not true. Separation stops the recovery process because individuals can't talk about what has happened. There are many mixed emotions inside, and if survivors don't start the process of recognizing their feelings and dealing with them early, then these crewmembers become confused and unsure of themselves and their abilities. You simply do not want this to happen.

Sometimes it isn't possible to keep your people together as some survivors may be injured and need hospitalization. If this happens, and one or more crewmembers are separated from the rest of the group, make sure they receive support at the hospital where they'll be. Don't settle for one visit by a psychologist or psychiatrist as sufficient to allay the feelings of guilt which are usually present following a mishap.

Most crewmembers who survive an aircraft loss where there are deaths of other aircrew feel guilty because they are alive and their friends are not. This may not seem rational, but it's true. Crewmembers will constantly ask themselves what they could have done differently to save the lives of those lost. They will honestly believe they didn't do enough. Therefore, it's important for daily support and reassurance from both squadron and hospital personnel.

Make contact with family. Do whatever is necessary to allow surviving crewmembers to talk to their families — whether it be a spouse, parents, fiancee, or significant other. This is immensely helpful for the crewmember as well as the family member. This contact seems to anchor crewmembers and emotionally settle them down. It's as if their reason for being alive is on the other side of the phone. This offers tre-

sponse For Aviators

mendous reassurance and reminds them they are going to be all right. Often this contact quiets aviators and allows them to begin to think about what happened. It is also important for crewmembers to hear the voice of someone who loves and cares about them unconditionally. This will be the first time aviators may cry, so do your best to make this contact as private as possible.

If the squadron is TDY, encourage other members in the squadron to call their families and let them know they are okay. This is especially important for families with young children. If it is not possible for individual members to make calls, then send a message to a commander's official representative back at the home drome so timely information can be disseminated to the families and loved ones.

Newscasters can be very callous when it comes to reporting mishaps. Early release of information can cause a great deal of distress on families as they wait for word about what happened and who may have been injured or killed.

I recall, while stationed in Europe, a major news organization reported a mishap and fatality in my squadron before we were ever notified. We found out about the tragedy when one of the pilot's parents called from the States to ask if their son had been killed in the accident.

Get your senior leadership to talk with your squadron. Make sure they make a special effort to talk with your people. Senior leaders, or experienced aviators who have been in the flying world for a few years, have usually experienced the loss of friends or squadron members at some point in their careers. It's very important they make contact with survivors and other squadron members. The crew chief who last launched a pilot or crew may be experiencing as much guilt as anyone. Those who have never experienced a death may not know how to handle it, and they look to those who have been through it before for help.

If you're at home station, commanders, ops officers, and flight commanders need to make visible visits to the squadron and the flightline to spend time talking about how they successfully met and dealt with death in this business. Immediately following the aircraft loss, they need to be with the squadron for a while to talk to aviators and answer questions. Then they need to send people home, if possible, to spend time with their families. If there are single crewmembers, perhaps pair them up with people who care for them so they won't have to be alone. If you don't, they may likely add a few beers to the scenario and end up getting themselves into serious trouble.

The senior leadership role becomes even more vital to the survivors of a mishap when the squadron is TDY. As a commander, you need to have the survivors get together and talk about what happened.

The senior leadership role becomes even more vital to the survivors of a mishap when the squadron is TDY. As a commander, you need to have the survivors get together and talk about what happened. It is very important they talk as a group because during a mishap or combat loss, individuals do not always remember what they did, what they said, or how they acted.

The point was made clearly by Al Haynes, captain of United 232 that crashed in Sioux City, Iowa. He mentioned that a year after their fatal crash, the survivors met to talk about what had happened that day. He related how one of the flight attendants stood in front of the group and apologized for something she had forgotten to do during the evacuation following the crash. She stated she was sorry, because perhaps if she had given better information to the passengers, maybe more lives would have been saved. One of the group members stood up after her and said, "But you did do that. Don't you remember?" Only then did it become apparent that for a year this flight attendant had lived with tremendous guilt that was totally unnecessary. *A group meeting shortly following the accident could have prevented such unnecessary suffering.*

It is also important for commanders and senior leaders to spend one-on-one time with the survivors so they can talk very personally about what happened during the mishap. This contact should be immediate and casual, not formal; for example, a walk on the beach or a conversation over coffee in the squadron. It also allows senior commanders to talk about their own personal feelings when they first encountered similar circumstances and to provide these indi-

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viduals coping skills for handling the situation. This contact is essential for the surviving crewmembers to bring about the next step to recovery.

Treat the survivors with compassion and not as criminals. Surviving crewmembers will be exposed to some difficult times ahead with the convening of a mishap investigation board. Some tough questions will be asked and some difficult answers given as the safety board investigates what happened and why. They need the support of their fellow aviators at this time. It is a time which will require honesty and soul searching on their part, and they need to feel they have the support of their commanders and peers to do this with integrity and without the fear of being ostracized for what happened.

Summary

When an aircraft goes down and crewmembers are lost, it is a difficult time for squadrons and commanders. Add to this scenario a remote TDY location with minimal support for the troops, and commanders and supervisors can easily find themselves feeling helpless and unprepared for handling the aftermath of such an event. Such circumstances can quickly lead to another mishap or serious degradation of the mission.

The emotional aftermath of a mishap can be just as debilitating, just as much a limiting factor, as a lack of physical support or a shortage of resources. Since mission effectiveness may suffer, it's important we have the capability of dealing with just such a situation. Hopefully, the above suggestions will get you started on the road to helping your squadron deal with the loss and begin to refocus on the mission and flying safely. ■

About the Author

In September, the Air Force Safety Agency said goodbye to one of its most respected staff members, Lt Col (Dr.) Joyce E. Teters. Lt Col Teters served as Chief Aviation Psychologist, Headquarters Air Force Safety Agency, Norton AFB, California, and Kirtland AFB, New Mexico, for the last 8 years. In the last 2 years, Lt Col Teters maintained an exhaustive mishap prevention training schedule, visiting 68 Air Force bases worldwide. She provided briefings and training seminars to over 5,000 aircrew members, 1,650 spouses of aircrew, and 4,700 maintenance personnel and supervisors. Recognizing the extraordinary stress experienced by Air Force Special Operations Command personnel and their families, Lt Col Teters provided direct consultation to line commanders, aircrews and their families, enabling them to deal effectively with the problems of lengthy and hazardous operations and family disruptions.

Lt Col Teters also served as the Aviation Psychologist Consultant to the tragic Iraq "friendly fire" Blackhawk accident investigation and was cited for her invaluable contribution to the analysis of that mishap.

Dr. Teters has left the Air Force to become the Director of Human Factors at Alaskan Airlines. So long, Doc! We'll miss you!

NVGs

Don't Leave Home Without Them, Once You Understand Their Limitations

MAJOR DOUG TRACY
HQ AFSA/SEFB*

■ An optically guided weapon system is significantly degraded at night. A military that can "see" at night will enjoy a distinct advantage over an opponent that can't. Low- and slow-flying aircraft, such as helicopters, discovered they were less vulnerable to optical threats during hours of darkness.

In 1969, the U.S. Army first demonstrated night vision goggle (NVG) use in helicopter operations. USAF helicopter forces began using the devices in the latter stages of the Vietnam War. C-130 units have used NVGs since the late '70s and C-141s since the mid '80s, both in support of special operations forces (SOF). Also in the mid '80s, B-52s/B-1s and KC-135s started flying with NVGs as an aid for terrain avoidance and receiver acquisition, respectively. NVGs are now undergoing assessment in fighter operational test and evaluation (OT&E) for nearly all platforms, both in the active duty and reserve components. Some units are approaching operational status.

Since the Vietnam War, NVG use among USAF organizations has slowly proliferated, with the devices mainly concentrated in special operations units, units supporting SOF operations, combat rescue units, and the bomber world. These organizations have matured in night operations as night vision technology has progressed. For example, the first set of NVGs used by some of these aircrew members was AN/PVS-5s (AN/PVS-5s were Generation II NVGs). With these devices, the crews "chased the moon" because they were required to have a minimum of 20 percent moon disc illumination to fly using NVGs.

When Generation III NVGs (AN/AVS-6) were delivered to flying units, crews at first stayed with the 20 percent illumination criteria, but since these devices were more efficient at intensifying the available energy, the requirement was soon reduced to 5 percent effective illumination, which is defined as starlight with no cloud cover and no moon. Units flying with both FLIR and NVGs have further reduced the illumination requirement to zero percent. The point is, these organizations slowly developed their capabilities over many years. There are now crewmembers in the USAF with more than 1,000 hours of NVG time.

Nearly every weapon system in the Air Force will soon be equipped with NVGs. As these units begin to stand up their night vision capability, crews must learn to **"CRAWL BEFORE THEY WALK."** The tendency may be for these newcomers to jump in with both feet. However, night vision is thwarted with pitfalls that can lead to disaster. One method to overcome these pitfalls and avoid repeating history is crosstell. Talk to people from other weapon systems and other services, and learn from their experiences.

In addition to a relatively low NVG experience base among aircrew members, chances are high that squadron, operations group, and wing leadership (excluding AFSOC) in these new units also lack experience with the devices, and as such, they are not aware of the limitations of NVG operations. This is quite natural since the people in these positions did not have the opportunity to fly with these devices as line aircrew. However, it is essential they increase their knowledge of aided operations to ensure effective oversight.

NVG-aided night operations can dramatically increase your overall

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If your goggles are not properly adjusted on an approved focusing lane prior to flight, you will not even achieve 20/40 or 20/30 acuity.

situational awareness on nearly every mission. However, they will not provide all the visual cues you are accustomed to during the day.

In last month's (October 1995) issue of Flying Safety, Capt Bruce Fields introduced you to NVGs. In this article, I plan to address some of the limitations and cautions of NVG use, and I will then make a proposal to assist you in overcoming these limitations.

It is important to emphasize that the best way to ensure NVGs are an asset and not a liability is through knowledge, experience, and a wide exposure to the NVG environment under varied illumination conditions.

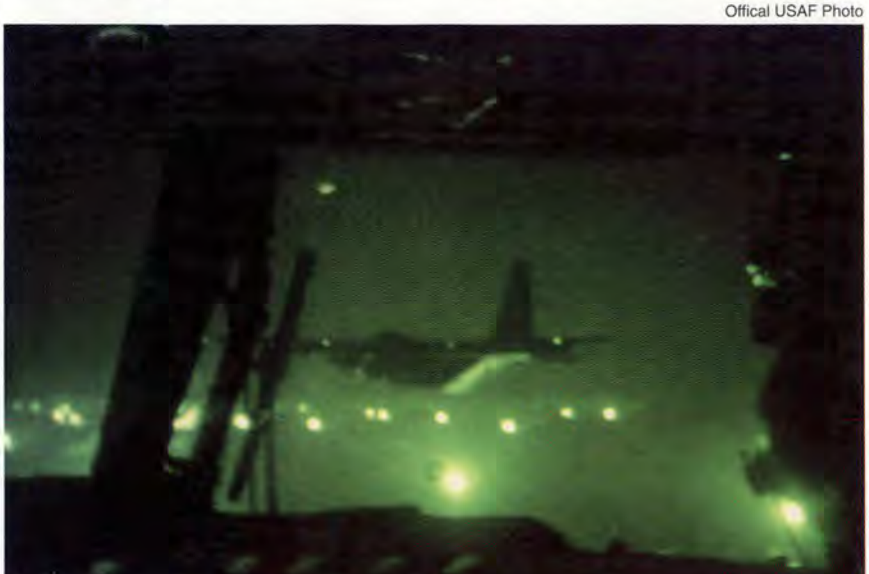
NVG Limitations and Cautions

The first time you slap on a pair of goggles, you will notice it is very similar to holding a pair of toilet paper tubes up to your eyes. With AN/VIS-6s and F4949s, your field of view (FOV) is limited to 40 degrees. This **reduction in FOV** has a dramatic effect on your situational awareness — your **peripheral vision** is degraded. Unlike flying during the day, your peripheral vision only comes into play when you fly past something bright enough to stimulate your unaided vision. To counter this limitation, it is imperative you employ effective scanning techniques — keep your head on a swivel. If you stop scanning, you're dead! In multi-place aircraft, the limitation can be further mitigated through assigning crewmembers overlapping scanning patterns. Pilots of single-seat aircraft will have to be even more vigilant because they will be unable to achieve the synergism of crewed aircraft.

NVGs also adversely affect your **depth perception**. Weather may appear much further away than it actually is. Closure on another aircraft or terrain may not be immediately detectable — until it's too late to recover. The only effective method to overcome this limitation is through experience with NVGs.

Visual acuity (VA) is significantly reduced while wearing goggles, both through limitations in the system and the cockpit lighting/windscreen combination. This will inhibit your ability to perceive objects and terrain features as rapidly as you might during the day; e.g., you will not visually acquire unlit towers or ridgelines as quickly as you might during the day (if at all). And even if you have 20/15 day vision, the best acuity you can anticipate during NVG-aided flight will be around 20/35-40 with AN/AVS-6s or around 20/30-35 with the newer F4949s. Remember, this assumes perfect cockpit lighting with goggles that have been properly focused in an Air Force-approved focusing lane using properly established procedures. Any incompatible cockpit lighting or adverse weather will degrade this VA even further.

Offical USAF Photo



Visual acuity is also affected during changing **illumination**. For example, flying through a valley on two different nights, or even the same night, at the same altitude, with different levels of illumination, the valley will appear different. During good illumination or moon angles, you will visually acquire most of the terrain features and obstacles along the flightpath. However, during low illumination, you will not see all the features, and may not recognize the valley. Currently, there is no device to warn aviators of low illumination. The only indicators you might have of lowering illumination levels will be scintillation (or sparkles in the tubes), increasing opacity in the halos around incompatible lights, or a general degradation in the outside scene. Remember decreasing illumination can be very insidious, and you have to be constantly alert for changes in your NVG environment.

NVGs operate off luminance — light reflected from a surface. The amount of light reflected off different surfaces is not equal. For example, take two different environments, one low contrast (desert) and the other being high contrast (farmland), both on clear nights, no moon, and only starlight to illumi-

Over extended periods, you may experience extreme fatigue when wearing NVGs. Eye fatigue can be lessened by periodically removing the NVGs to rest your eyes when the mission allows.

nate the landscape. The scene detail in the higher contrast environment will be better than the detail in the low contrast area. In the low contrast scene, more of the available light will be reflected back to the goggles, but the lack of different reflectivities will provide a poorer quality image. In other words, the more objects in the scene with different reflective properties (albedos), the better your image. ***NVG experience is the only method to compensate for low illumination.***

Depending on the elevation of the moon, terrain casts **shadows**. For example, when the moon is low on the horizon, mountains will cast shadows. When entering these shadows, you must exercise extreme vigilance because other obstacles or terrain features may be masked in the shadows.

Also, because the phosphor in the intensifier tubes only reacts in shades of green, individual colors in the outside scene cannot be distinguished unless you look under or around the NVGs. Since you see only shades of green, lights from other aircraft will give you fewer cues. Because of this, you won't be able to tell whether the other aircraft is flying toward or away from you based on the color of its navigational lights.

Incompatible lights, whether internal or external, seriously degrade your vision when using goggles. It is important to avoid all non-NVG-compatible lighting in the cockpit. If someone were to turn on an incompatible light in the cockpit, or even in the cabin, it could seriously impair your ability to see hazards. The automatic brightness control in the goggles reacts to the lights and will adjust brightness, creating a "washout" or halo effect.

Cultural lighting (lighting outside the cockpit) can either improve or degrade your ability to view the outside scene. Situations can vary between nights and even during a single sortie. Cultural lighting can assist you by improving the outside scene. During an evening with a thick cloud layer, cultural lighting can still reflect off clouds back to the earth, resulting in improved illumination conditions — more luminance for the goggles.

However, cultural illumination can also degrade the scene. In some cases, the incompatible lighting sources can create blooming, or halos. When a large number of these halos are in the same vicinity (as in an urban area), they can merge and create a blanket of lighting that you won't be able to see through with the goggles. This would be one case where it would be better to look under the goggles at the ground. Blooming and halos will be more noticeable in darker nights.

Over extended periods, you may experience extreme **fatigue** when wearing NVGs. Eye fatigue can be lessened by periodically removing the NVGs to rest your eyes when the mission allows. Also, the weight of the goggles may create neck strain.

With adequate illumination, NVG **vision enhancement is inversely proportional to altitude and airspeed** — the lower and slower you fly, the better visual acquisition you gain. In marginal illumination conditions, you will have to fly extremely low to maintain good visual acuity with terrain features, decreasing your reaction time to avoid obstacles. The paradox is that if you climb to a higher, safer altitude, you will lose acuity. As a general rule, you start losing acuity at 300 feet AGL and above.

The last limitation I will address concerns flying towards **moonrise/moonset or sunrise/sunset**. These conditions should be understood and avoided because the extreme intensity of the moon or sun will cause the goggles to wash out, which may prohibit you from visually acquiring an obstacle along your flightpath. Viewing the moon through a set of NVGs is comparable to looking directly at midday sun with naked eyes.

I hope this quick look at a few of the limitations and cautions associated with NVGs gives you an appreciation for the hazards you will

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The best way to overcome NVG limitations and cautions is through familiarity with the devices and your operating area. NVG proficiency is gained through repeated, frequent use.

encounter during aided night operations. The limitations just discussed can be found in MCR 55-41, Helicopter Operations, and U.S. Army publication TC1-204, Night Flight: Techniques and Procedures. Now, let's take a look at how we can overcome these challenges.

Working With These Limitations and Cautions

The best way to overcome NVG limitations and cautions is through familiarity with the devices and your operating area. NVG proficiency is gained through repeated, frequent use.

Recently, ACC and PACAF increased NVG experience requirements for HH-60 combat rescue pilots to upgrade to aircraft commander (AC) and instructor pilot (IP). Previously, a copilot could upgrade to NVG AC with 50 hours of NVG time and upgrade to IP with no additional goggle time. Now copilots have to acquire 100 hours of NVG time prior to becoming an AC and a total of 150 hours to become an IP. This policy change will require a significantly longer time for pilots, without previous NVG experience, to upgrade to higher qualifications.

I have heard comments from pilots of weapons systems that were just beginning to fly with NVGs: "Well, Capt Smith is experienced — he has 10 hours of NVG time." The person making this comment is missing the point. While Capt Smith may have the most NVG time in his unit, he can hardly be labeled an experienced NVG pilot. It's difficult to quantify experience and inexperience based upon NVG hours. However, it is a logical assumption that the more goggle hours a pilot has accumulated, the more varied the exposure to different NVG environments and illuminations.

If I had a choice of two pilots of equal talents, the first having a high number of hours in the aircraft and low NVG time, and the second, new to the aircraft, but with high NVG hours from a previous aircraft, and given a difficult NVG mission, I would select the second pilot over the first. The importance of NVG experience cannot be overstated. ■

Official USAF Photo

Operational Risk Management and the NVG Environment

How can commanders, operations officers, and individual aircrew members mitigate the risk associated with their NVG operations? One of the tools is Operational Risk Management (ORM). It is a process that identifies and prioritizes risk in the Air Force workplace which allows decision makers to possess all the facts that will assist them in placing the right balance between risk and mission objectives. The Air Force Safety Agency (AFSA) has adopted a six-step process to ORM: (1) identify the hazard, (2) assess the risk, (3) analyze control measures, (4) make control decisions, (5) implement control measures, and (6) supervise the process.

First, **identify the hazard.** Conduct a comprehensive analysis of the potential hazards associated with your NVG operations. Sources for information concerning hazards would include mishap reports, IG reports, AFSA's mishap databases, exercise after-action reports, other military organizations familiar with your operating location, and surveys of members of your unit. A few of the hazards you might identify relating to NVG operations are aggregate low NVG experience level among your aircrew members or individuals, low illumination, cultural illumination, the terrain and its effect on illumination, an unfamiliar operations location, incompatibility of cockpit lighting with NVGs, and obstacles in the operating area, e.g., wires.

Once the hazards are identified, you must conduct a **risk assessment** of these hazards to determine their impact on operations. A starting point would be to rank order the hazards identified in step 1 of this process. You may have identified wires as hazards, but wires are less of a hazard during daylight operations as opposed to higher

While aided night operations will dramatically increase your overall situational awareness, they will not provide you all the visual cues you are accustomed to during daylight operations.

night illumination. Mishap potential is vastly elevated during periods of low illumination, due to the difficulty in visually acquiring wires, and if you are fortunate enough to acquire them, chances are you will have insufficient time to evade them.

Altitudes at which operations take place also affect the risk assessment. During periods of low illumination, contour flight is more dangerous than low-level flight. Do not forget to factor the goggle experience level of your aircrews. The scenario with the greatest mishap potential would be a low-time NVG crew flying low level with low illumination. A key point of understanding is that with NVG operations, there are a myriad of combinations of environmental factors and operational considerations that affect safe operations and increase and decrease risk and mishap potential.

The third step in AFSA's risk management process is **analyze control measures**. Operational requirements will often dictate which hazards will be encountered and their associated risk, but there are almost always options — each with different levels of risk. We can weigh the risk of a particular operation against its potential benefits when selecting a course of action. Risk which cannot be eliminated must be controlled.

As commanders, operations officers, and aircrew members, you must analyze the control measures at your disposal. In the case of our wire hazard in a low-illumination environment, leadership could elect to fly the mission as is, cancel the mission, substitute more experienced crewmembers for those less accomplished, increase the minimum altitude for the sortie, delay the sortie until there is more illumination, or select a new route of flight with fewer wires. These are only a few of the possibilities.

Next, **make control decisions**. The decisionmaker must decide on a course of action. This is done by weighing the benefits of the intended action against the hazards and finding a balance of acceptable risk.

The next step involves **implementing controls**. Control measures must be part of your everyday operations — they should be part of your scheduling process. Unit leadership should clearly define the controls so that when unit schedulers build the monthly, weekly, and daily schedules, they apply the controls. If the unit is preparing to participate in an exercise or deployment, controls should be implemented **in the planning process**. For example, if the unit is deploying to an unfamiliar environment, unit leadership may clearly establish in the predeployment planning process that they will not fly NVG training missions during periods of low illumination.

The last step in AFSA's ORM is to **supervise the process**. Unit leadership must continually review the ORM process in their organizations, controlling or eliminating all hazards — which, of course, does not happen until the mission ceases. During this ongoing review process, leadership must ensure controls they have established are effective, and if not, identify new controls. They must also constantly be on the lookout for new hazards and for hazards that might have gone unidentified. This is especially true in the case of organizations that frequently fly in changing environments, e.g., deployments.

ORM will never guarantee a 100 percent safe operation. However, serious risks can be controlled. The risk management process can heighten hazard awareness of both leadership and aircrews, resulting in implementation of controls to lessen hazard exposure.

While NVGs can dramatically increase your overall situational awareness during night operations, they will not provide you all the visual cues you are accustomed to during daylight operations. Both unit leadership and aircrews need to be constantly aware of these limitations and institute methods to mitigate the hazard exposure. ORM is a tool which can aid in reducing exposure to these hazards. I am confident once you gain experience in the night vision goggle environment, you will also question how you ever survived without them.

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*Maj (Lt Col Sel) Tracy is the Helicopter Safety and NVG action officer, HQ AFSA, and is attached to the 512th Special Operations Squadron (SOS) (AETC) as an HH-60G night tactical instructor pilot, Kirtland AFB, New Mexico.

Official USAF Photo

New Weather Observation and Forecast Formats Ahead

CAPT JAMES KRATZER
AFFSA/XOFW

■ Just when you thought you could decipher the weather strip, the United States and Canada will implement the "International Terminal Aerodrome Forecast (TAF) and Meteorological Aviation Routine (METAR)" weather codes by early summer 1996. After the implementation date, there will no longer be the familiar "airways" weather code used in observations. This sweeping change will affect all users of weather information — pilots, controllers, and weather folks. So, you ask, "What is a METAR and a SPECI, and why should I learn this stuff?"

A METAR is a weather report which will replace the familiar "hourly" airways report. The METAR observation format will present more information than the current hourly report, but in a different entry order. A SPECI is an unscheduled weather report which replaces the current "special obs." Since the METAR and SPECI are new observation codes for CONUS fliers, there will be a learning curve associated with the changes.

The conversion from the airways system to METARs and TAFs has been brewing for a long time (the rest of the world uses METAR and TAF codes). To standardize the codes across the aviation world, the United States and Canada agreed to use the METAR codes beginning in 1996. The weather code conversion is a monumental task affecting 17 different National Weather Service, FAA, and military communications systems and the Automated Surface Observing Stations (ASOS). It's not just pilots who will have to learn new codes. Air traffic controllers, meteorologists, flight service specialists, and many other users will have to learn the new system, as well.

Civilian aviation forecasts will also use the TAF code. Since Air Force weather has been using the TAF code for several years, this shouldn't be a big deal for Air Force fliers.

The hourly METAR report contains information on winds, visibility, runway visual range (RVR), present weather, sky condition, temperature and dewpoint in Celsius, altimeter setting, and REMARKS. A SPECI (special weather report) is an unscheduled weather report taken for basically the same reasons as current airways special reports. One difference in the report is that SPECIs will contain all data elements found in a METAR plus additional plain language information in the REMARKS section.

Notice the format changes in Figure 1. It depicts both the current airways type surface aviation observations (SAOs) and the new U.S. METAR code. Visually, the biggest change is the larger volume of information contained in a METAR observation. Figure 1 shows a Dulles IAP, Andrews AFB, and Scott AFB observation in both the SAO and METAR formats.

Notice that the METAR code starts with the four-letter international identifier and date/time group followed by:

a. wind information,

b. prevailing visibility in statute miles,

c. longline RVR information,

d. the cloud layer(s) with the layer descriptor (FEW, SCT, BKN, OVC) followed by layer heights in three digits,

e. temperature and dewpoint reported in degrees Celsius,

f. four-digit altimeter readings prefaced with the letter "A," i.e., A3005, and

g. remarks section prefaced with the acronym "RMK" and followed by additional and amplifying data. Tower visibility, lightning data, and sea level pressure are just a few examples of "RMK" data.

A complete breakdown is shown in Figure 2, the "Draft" Key to 1996 International Aerodrome Forecast (TAF) and 1996 Aviation Routine Weather Report (METAR). This NOAA "draft" template, courtesy of the NWS Aviation Services Branch, should soon be finalized and available for distribution. **REMEMBER: This is only a draft!**

Publications, manuals, directives, procedures, tests, and training materials are being changed to reflect the new code. The new code information will be included in the next version of AFH 11-203, *Weather for Aircrews*, Vol II. Air Force weather stations can also help aircrews understand the new code and ease the transition.

This article is only a primer to give you a heads-up on the fundamentals of the METAR code. Just like all changes, METARs and TAFs will take time to master. Don't be caught with your fist full of weather strips on 1 Jun 96, asking your fellow flier, "What is this?" ■

FIGURE 1. Sample SAO and Future METAR Observation Formats

CURRENT US SAO CODE:

1. IAD SA 1055 11 SCT E15 OVC 1/2S-F 045/33/29/2119G27/945/R04VR30

2. ADW SA 1055 5 SCT M2OV OVC 2RW-F 045/58/53/3412G20/945/CIG 15V25

3. BLV SA 1055-X3 SCT M8 OVC 3/4ZR-F O45/30/28/0414G22/945/F2 TWR VSBY 2 IR08

US METAR CODE - 1996

1. METAR KIAD 081055A 21019G27KT 1/2SM R04/3000FT-SN BR SCT011 OVC015 01/M02 A2945 RMK SLP045

2. METAR KADW 081055Z 3401220KT 2SM-SHRA BR SCT005 OVC020 14/12 A2945 RMK SLP045 CIG 015V025

3. METAR KBLV 081055Z 04014G22KT 3/4SM R32/P5000FT-FZRA BR FEW000 SCT005 OVC008 M01/M02 A2945 RMK TWR VIS 2 SLP045 FG FEW000 IR08

"DRAFT" KEY TO 1996 INTERNATIONAL TERMINAL AERODROME FORECAST (TAF) AND 1996 AVIATION ROUTINE WEATHER REPORT (METAR)

TAF
KPIT 091720Z 091818 22020G25KT 5HZ FEW020 SCT040
FM1930 30015G25KT 3SM SHRA OVC015 PRO840 2022 1/2SM TSRA OVCOO8CB
FM2300 27008KT 5SM -SHRA BKN020 OVC040 TEMPO 0407 00000KT 1SM-RAFG
FM1000 22010KT 5SM -SHRA OVC020 BECMG 1315 20010KT P6SM NSW SKC

METAR
KPIT 091955Z AUTO22015G25 3/4SM R28L/2600FT TSRA OVC010CB 18/16 A2992

FORECAST	EXPLANATION	REPORT
TAF	Message Type: TAF-routine and TAF AMD-amended forecast, METAR-hourly and SPECI-special report	METAR
KPIT	ICAO location indicator	KPIT
091720Z	Issuance time: ALL times in UTC "Z", 2-digit date, 4-digit time	091955Z
091818	Valid period: 2-digit date, 2-digit beginning, 2-digit ending times	
	AUTOmated observation: AUTO indicated fully automated report; no human intervention; omitted when observer signs on	AUTO
22020KT	Wind: 3-digit true-north direction, nearest 10 degrees, (or VaRiaBle) next 2 digits for speed and unit, KT (KMH or MPS); as needed, Gust and maximum speed; 00000KT for calm; for reports only, if direction varies 60 degrees or more. Variability appended, e.g., 180V260	22015G25KT
5SM	Prevailing Visibility: in U.S., Statute Miles & fractions; above 6 miles in TAF Plus6SM. (Or, 4-digit minimum visibility in meters and as required, lowest value with direction)	3/4SM
	Runway Visual Range:R: 2-digit runway designator Left, Center, or Right as needed; "/", Minus or Plus in U.U., 4-digit value, FeeT in U.S., (usually meters elsewhere); 4-digit value Variability 4-digit value (and tendency Down, Up, or No change)	R22L/2600FT
HZ	Significant present, forecast and recent weather: see table	TSRA
FEW020 SCT040	Cloud amount, height and type: SKy Clear 0/8, FEW-1/8-2/8, SCaTtered 3/8-4/8, BroKeN 5/8-7/8, OVerCast 8/8; 3-digit height in hundreds of feet; and only Towering CUmulus or CumulonimBus. Or Vertical Visibility for obscured sky and height "VV004", or unknown height "///". More than one layer may be forecast or reported. CLeaR for "clear below 12,000 feet; for automated observations.	OVC010CB
	Temperature: degrees Celsius; first 2 digits, temperature "/" last 2 digits, dewpoint temperature, Minus for below zero, e.g., M06	18/16
	Altimeter setting, indicator and 4 digits; in U.S., A-inches and hundredths; (Q-hectoPascals, e.g., Q1013)	A2992

continued on next page

"DRAFT" KEY TO 1996 INTERNATIONAL TERMINAL AERODROME FORECAST (TAF) AND 1996 AVIATION ROUTINE WEATHER REPORT (METAR)

	Supplementary information for report; (Wind Shear in lower layers (METAR), and 2-digit RunWaY designator or ALL runways; REcent weather of operational significance.) ReMarK indicator and domestic remarks stripped before international dissemination.
FM1930	FroM and 2-digit hour and 2-digit minute: indicates significant change. Each FM group starts on a separate line, indented 5 spaces.
PROB40 2022	PROBability and 2-digit percent: probable condition during 2-digit beginning and 2-digit ending time period.
TEMPO 0407	TEMPOrary: changes expected for less than 1 hour and in total, less than half of 2-digit beginning and 2-digit ending time period.
BECMG 1315	BECoMinG: change expected during 2-digit beginning and 2-digit ending time period.

Table of Significant Present, Forecast, and Recent Weather — Grouped in categories and used in the order listed below, or as needed in TAF, No Significant Weather.

QUALIFIER

Intensity or Proximity
- Light "No Sign" Moderate + Heavy
VC Vicinity: but not at aerodrome; in U.S., 5-10SM from center of runway complex (elsewhere within 8000m)

Descriptor

MI Shallow	BC Patches	PR Partial	TS Thunderstorm
BL Blowing	SH Showers	DR Drifiting	FZ Freezing

WEATHER PHENOMENA

Percipitation

DZ Drizzle	RA Rain	SN Snow	SG Snow grains
IC Ice crystals	PE Ice pellets	GR Hail	GS Small hail/snow pellets
UP Unknown precipitation in automated observations			

Obscuration

BR Mist	FG Fog	FU Smoke	VA Volcanic ash
SA Sand	HZ Haze	PY Spray	DU widespread dust

Other

SQ Squal	SS Sandstorm	DS Duststorm	PO Well-developed dust/sand whirls
FC Funnel cloud/tornado/waterspout			

- Minor changes possible before implementation of METAR/TAF code changes before January 1, 1996.
- Explanation in parenthesis "()" indicate different worldwide practices.
- Ceiling is not designated; defined as the lowest broken or overcast layer, or the vertical visibility.
- TAFs exclude temperature, turbulence and icing forecasts and METARs exclude trend forecasts.
- Although not used in U.S., Ceiling And Visibility OK replaces visibility, weather, and clouds if: visibility is 10 kilometers or more; no cloud below 1500 meters (5000 feet) or below the highest minimum sector altitude, whichever is greater and no cumulonimbus; and no precipitation, thunderstorm, duststorm, sandstorm, shallow fog, or low drifting dust, sand, or snow.

DRAFT — UNITED STATES DEPARTMENT OF COMMERCE
August 1995 — National Oceanic and Atmospheric Administration - National Weather Service

AFFSA ON TRACK—

The **Instrument Quiz** Survey

■ It's been about a year now, and we've given you several chances to answer different questions related to instruments and flying. Now we need your help to see how we're doing. By replying, we can get you a better product — one that you would be proud to take to your stan/eval and say, "Look! I actually got all of these right!"

The easiest way to get your response to us is to make a copy of this page, answer the questions, and FAX us at AFFSA/XOFD, DSN 858-3196. We will gladly take mail-in, e-mail, or phone responses at the addresses below. Thanks for your help, and keep the calls coming in.

1. Does the *Instrument Quiz* help increase your knowledge of instrument flying and procedures?
   a. Yes
   b. No
2. Are the questions realistic and useful?
   a. Yes
   b. No
3. Should we continue to include TERPs and FLIP subjects?
   a. Yes
   b. No
4. Are the answers and references good enough, or do you like the explanation as well?
   a. Answer and reference
   b. Answer, reference, and explanation
5. Now for the essay portion of this exam. Please give us some (hopefully constructive) suggestions and perhaps some subject you would like us to cover in the future, either in the ON TRACK article or the *Instrument Quiz*. Be as general or as specific as you would like, but the better you suggest, the better we can respond.

____

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____

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FAX — AFFSA/XOFD DSN 858-3196,
Commercial (301) 981-3196
Phone — AFFSA/XOFD DSN 858-5416,
Commercial (301) 981-5416
E-mail — FowlerB@EMH.aon.af.mil
Address — AFFSA/XOFD, 1535 Command Dr. Ste D-305, Andrews AFB MD 20762-7002 ■

Pinned

LT STEVEN HALSTED*
Courtesy *Mech*, Jul-Aug 94

How sure would you have to be that an aircraft would have a major failure before you'd cancel a flight?

In one squadron, at least nine people saw indications of an impending engine failure. None took the steps necessary to prevent the mishap.

After a successful air combat maneuver (ACM) hop, Sport 212 bounced slightly as the pilot applied brakes. Plane captains tossed chocks under the wheels and pinned the gear. Just before shutting down, the port engine began emitting gray smoke with the exhaust. A plane captain asked power plants and QA to check out the problem.

After nearly 15 minutes, the troubleshooters gave up. They could find no cause for the smoke. The pilot shut down the engines, and the plane captains began their turnaround. Upon checking the port engine, an airman found no oil on the dipstick. He notified his supervisor, who told him to fill it up. The engine was 15 quarts low. No one wrote a maintenance action form (MAF).

More people became involved. Several airman apprentices (enlisted nonrated, E-2), an aviation electrician, third class petty officer (E-4), an aviation machinist mate, first class petty officer (E-6), an aviation electronics technician, chief (petty officer) (E-7), and an aviation structural mechanic senior chief (E-8) all discussed the situation. For some unknown reason, none of them checked the F-14A Power Plant Testing and Troubleshooting manual. If they had, they would have found that, based on the previous flight, the aircraft had consumed 10 times the acceptable amount of oil and was, therefore, a candidate for an engine change.

After a 20-minute low-power turn and a diagnosis of a stuck oil breather (based on the experience of several persons), maintenance control marked the aircraft safe for flight.

The next day, the radar intercept officer (RIO) for Sport 212 walked into maintenance control to read the aircraft discrepancy book. The chief told him about the possible oil-breather malfunction and engine-oil loss. He didn't mention the quantity.

After the second 2v2 engagement, Sport 212 was in a slight climb, wings level, 320 knots, when the crew felt and heard a thump from the rear of the aircraft.

RIO, intercommunication system (ICS): "Wooo, what was that?"

Pilot, ICS: "I don't know."

RIO, UHF: "We're having some compressor stalls. Weeble, can you come look at us?"

Pilot, ICS: "Left engine stall. Okay, it looks like it's clear...nope."

RIO, ICS; "Let's start heading back towards the field if it's the left one."

RIO, UHF: "Left engine has stalled a couple of times now. It is not clearing. We're heading back to the field."

Wingman, UHF: "Do you want me to go with you?"

RIO, UHF: "Yeah, why don't you give us a quick visual. We're on the 300 for 53 miles in a right turn."

Pilot, ICS: "I'm shutting down the left."

RIO, UHF: "Shutting down the left engine right now."

Pilot, ICS: "I don't know if I should start it or not. It was not pilot induced."

RIO, ICS: "Continue your right turn to about 130 degrees. If you get a chance and feel comfortable . . ."

Pilot, ICS: "I'll go ahead and start it. We've got good airspeed now. Air-start switch is on...coming around the horn. Let's see what happens."

Although compressor stalls are considered an emergency, they are so common in the TF-30 engine that crews have come to treat them casually. That would explain the crew's calm, almost matter-of-fact ICS and UHF communications.

Sport 212's wingman called fleet air control and survey facility, declared an emergency, and asked control to coordinate with home plate. Control instructed Sport to squawk emergency, head inbound, and stand by.

The second attempt for a relight was unsuccessful. Sport told his wingman the engine wouldn't relight and they were switching to Approach. Seconds later, things got worse.

Pilot, ICS: "Combined pressure zero."

RIO, ICS: "Okay...combined pressure, what?"

Pilot, ICS: "Zero."

RIO, ICS: "Okay, BIDI (bidirectional hydraulic systems — either of two pumps will drive both systems) secured?"

Pilot, ICS: "Yes."

For the next 30 seconds, there were no comms inside or outside the aircraft. Unknown to the aircrew, the engine was coming apart because of FOD that had been left inside after a depot-level overhaul. The resulting fire melted the flight control rods. (Why the fire warning system malfunctioned is unknown.) The aircraft was unrecoverable almost immediately. The next communication was from the wingman.

Wingman, UHF: "You guys okay?"

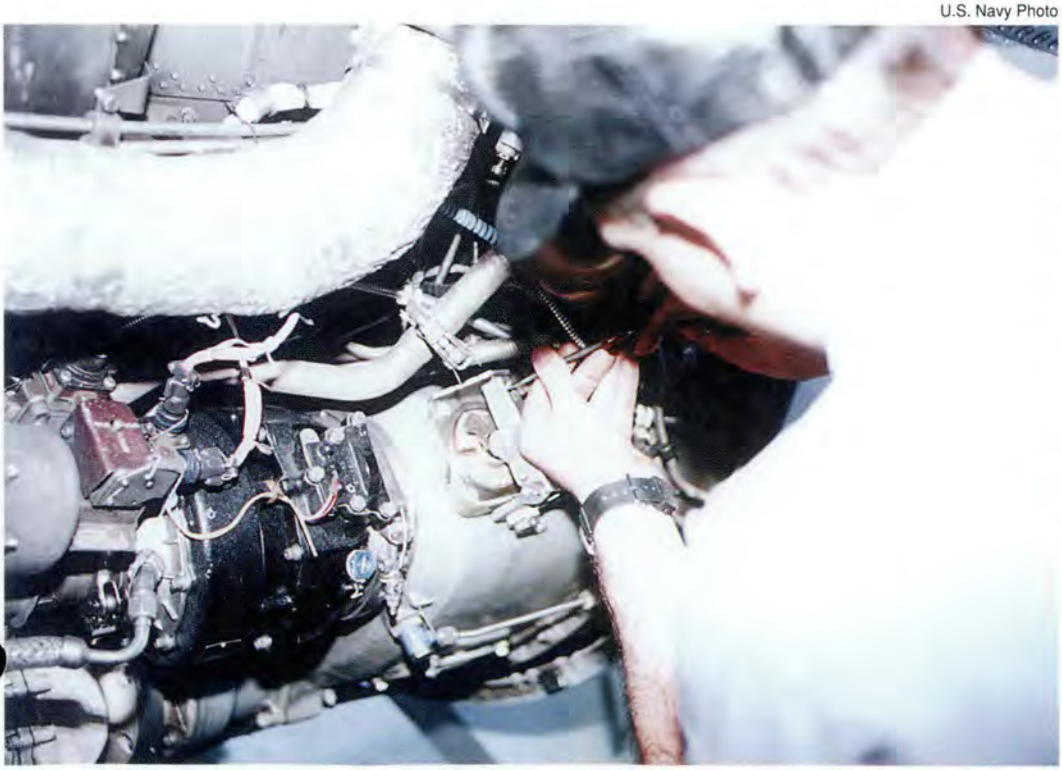
Pilot, ICS: "Let's get out, Milo. Get out!"

The aircraft departed violently. Both the pilot and the RIO were immediately pinned to the canopy by the negative G. During ACM, crews fly with harnesses unlocked to allow adequate movement and lookout. Since the F-14 seat does not have a power wheel or other device to pull the crew back into their seat, many controls, including the ejection handles, are unreachable during negative G.

The pilot called for ejection and got no response from his RIO. (The RIO was unable to communicate because his feet could not reach the ICS and UHF floor switches, and his mask was sliding off his face.) Still pinned against the upper left side of the

continued on next page

U.S. Navy Photo



Unknown to the aircrew, the engine was coming apart because of FOD that had been left inside after a depot-level overhaul. The resulting fire melted the flight control rods.

canopy, the pilot reached for the lower handle. Using all his strength, he pushed and stretched to get a grip on the handle. His fingertips felt the top of it. With one final push, he got ahold of the handle and pulled.

The RIO heard the call to get out and was also reaching for a handle. He couldn't reach the lower handle, and he couldn't get to the face curtain because he was so high in the seat. He felt the radar controls with his right hand when the canopy went. Then he was going up the rails.

Although they were in horrible ejection position, neither crewman was injured. Less than 50 minutes after ejection, both were aboard the helo and headed for the beach. Both were back on flight status within days.

This mishap raised many questions in the F-14 community. But the most important lesson applies to all who fly or maintain aircraft. It is never acceptable to circumvent procedures, and when someone does, it must be reported.

Of all the people who knew of this aircraft's discrepancies, only a plane-captain trainee made the proper deduction. When he informed his supervisor that the engine should be changed, he was ignored. Several very experienced mechs relied on "unofficial" procedures and well-known "F-14 lore" to troubleshoot a problem that was indicating imminent engine failure.

When the troubleshooters couldn't find a leak to explain the oil loss, the mechs made the error that sealed this aircraft's fate. They did not write a visual information display system MAF. Although it can't be proved, had the aircrew been aware of the volume of oil loss (10 times the allowable oil consumption according to NATOPS), they may have downed the aircraft.

Once again, we are presented with a mishap that was completely preventable. A conspiracy of experience, lack of communication, and improper (although community accepted) procedures led to a loss of an airplane. ■

*Lt Halsted was the editor of *Approach* magazine before he left the Navy.

Don't assume anything! If you have a doubt about an aircraft being safe to fly, make your concern known.

U.S. Navy Photo

ANALYSTS' COMMENTS

The TF-30 oil system holds approximately 16 quarts. NA 01-F14AAA-2-4-6 WP 007 states that oil consumption in excess of 0.3 gallons per operating hour or the presence of breather pressure above 3-inches HG requires an engine change.

If you have a doubt about an aircraft being safe to fly, make your concern known. I'll bet the crew wish they'd been given all the information before they accepted the aircraft. *--Aviation Machinist Mate Senior Chief (ADCS) (E-8 Mech) Tony Harris.*

Why didn't the aircrew from the first flight write a MAF for the gray smoke coming out of the exhaust? Why did power plants and QA work on the aircraft with no MAF issued and without referring to the maintenance instruction manuals? Why did the maintenance chief tell the RIO about the oil problem instead of the pilot?

A plane-captain trainee doesn't have the experience or horsepower to call for an engine change, but he does have the authority to write up a MAF. If a MAF had been written by either the first aircrew or the plane-captain trainee, the maintenance chief petty officer could not have released the aircraft "safe for flight" unless the CO changed the "down" gripe to an "up" gripe. *–ADCS Wayne Hayes*

Senior Chiefs Harris and Hayes are power plants maintenance analysts at the Naval Safety Center.

Flying Safety READER POLL

Flying Safety is published for aircrews, maintainers, their commanders and supervisors, and support people in such fields as operations, air traffic control, and life support.

If you are assigned in one of these career fields, *Flying Safety* is for you. We would like you to tell us how we are doing so we can publish a magazine that best meets your needs. Please take a few minutes to complete the attached survey, then fax (DSN 246-0931/commercial 505-846-0931) or mail us your response. We also welcome letters and articles for publication. Please write to:

Editor, *Flying Safety* Magazine
HQ AFSA/SESP
9700 Avenue "G," S.E.
Kirtland AFB NM 87117-5670

The following information about this poll is provided in accordance with paragraph 10, AFR 12-35, Air Force Privacy Act Program: **Authority:** 10 USC 8012, Secretary of the Air Force; Powers and duties; delegation by; **Principal Use:** To collect a sampling of opinions on *Flying Safety* magazine. **Routine Use:** To present resulting grouped data for decision makers to evaluate the effectiveness of the magazine. Your participation is voluntary, but we need and will appreciate your honest responses.

Thank you for participating in this poll.

QUESTIONS

1. How often do you see the monthly *Flying Safety* magazine?
   A. Every issue
   B. Most issues
   C. Some issues

2. When you see *Flying Safety* magazine, approximately how much of it do you read?
   A. 100%
   B. 75%
   C. 50%
   D. 25% or less

3. Do the articles help you with your job?
   A. Always
   B. Often
   C. Sometimes
   D. Seldom
   E. Never

4. Are the articles of value to you?
   A. Always
   B. Often
   C. Sometimes
   D. Seldom
   E. Never

5. Do you see our centerfold safety messages posted in your work areas? Yes No

6. What is your favorite regular feature?
   ___ There I Was
   ___ Maintenance Matters
   ___ Ops Topics
   ___ FSO's Corner
   ___ Instrument Quizzes
   ___ Well Done Awards

7. What type of articles would help you do your job better?

8. Are you currently an aircrew member? Yes No
   If yes, what position?____________________
   If no, what is your job?____________________

9. What is your rank?______

10. What is your AFSC?______

11. What is your MAJCOM?______

12. Please tell us how you would improve *Flying Safety*.

USAF SCN 95-102

Editor, Flying Safety Magazine
HQ AFSA/SESP
9700 Avenue "G," S.E.
Kirtland AFB NM 87117-5670

Another F-16 Canopy Update

"THE FLIP-TOP VIPER CONVERTIBLE"

USAF Photo by SrA Steve Thurow, 2d CTCS

CMSGT DON A. BENNETT
Technical Editor

■ **On the negative side, a calculated, responsible risk was taken, but it backfired into a ground mishap. On the positive side, however, the mishap itself surfaced an insidious, slowly deteriorating condition that if left undiscovered, could have led our *Viper* pilots and maintainers down a more disastrous mishap road.**

While sitting on the flightline, an F-16C (Block 40) *Viper's* opened canopy was ripped back to a near-vertical position by a wind of almost 40 knots. Only minutes before, an aircraft maintenance technician had exited the cockpit. She had been performing cockpit maintenance requiring a waiver by the production supervisor to open the canopy during the high winds.

The canopy's hinge arms were separated from their airframe-mounted hinge brackets, leaving only an actuator linkage arm and two *detonation* transfer assembly lines (explosion potential?) connecting the canopy to the airframe. The technician working the jet immediately tried to climb back up the cockpit ladder to get the canopy down. But lucky for her, a nearby alert crew chief directed her to get away from the now off-centered, precariously hanging canopy to prevent her from being injured.

Soon the wind died down and, sure enough, down slammed the canopy! Over 10 grand in damages was done to the surrounding airframe and associated canopy components. Thank goodness no one was injured or killed!!

But wait a cotton-picking minute!

This canopy was designed, tested, and proven to withstand up to 70-knot winds, so what gives? And, from the **outside** appearance of this "accepted risk" judgment call by the prod super, everything seemed to be all right — opening a 70-knot wind-proven canopy to perform required maintenance during 40-knot winds. No big hill for a climber! Probably any prod super would've made that call. Unfortunately, in this case, the mishap prod super didn't know what was lurking **inside** the canopy's locking mechanism!

First of all, the canopy itself didn't actually fail — at least, not material-wise. The bottom-line culprit was determined to be one of our aircraft maintainers' oldest enemies — corrosion — hidden, unsuspected, and pretty much undetectable.

Dating back as far as 1983, the mishap unit's research indicated there had been five similar Air Force ground mishaps of F-16 canopies flipping back. All happened during winds of 50 knots or less, still well under the 70-knot criteria. Of these five instances, four turned up nothing in particular. However, one was found to have an improperly installed canopy locking pawl. Maybe the corrosion factor in this sixth incident will shed some light on the mystery of the four "unexplainable" cases.

In this particular mishap, some F-16 canopy experts from the Lockheed-Martin Corporation were sent to investigate the problem. They analyzed the canopy linkage system and found corrosion in the canopy locking pawl mount bolt

continued on next page

USAF Photo

The canopies are supposed to be rigged on an as-needed basis, such as after actuator changes, but the mishap unit doesn't know when the last rig was performed. They do know, however, during the 200-hour phase inspections, TO 1F-16C-6-2-11 calls for a freedom-of-movement check of the pawl, but doesn't explain how to perform the check.

assembly. This assembly unit consists of a locking pawl, spring, sleeve, and the mount bolt. The corrosion on the mount bolt itself couldn't be seen during any "normal, scheduled, visible" inspections because it was hidden by the sleeve.

It seems the corrosion wouldn't let the tension spring return the locking pawl to its correct position when the canopy was first raised. And when the locking pawl is **not** in position to lock the hook linkage open, the condition will cause the canopy to overstroke through the canopy mechanism. This, in turn, allows the canopy to fall off its hinge track. Of course, when the canopy is subsequently opened again, a wind a lot less than 70 knots would be able to blow the canopy back — **well beyond its intended track limits!**

The canopies are supposed to be rigged on an as-needed basis, such as after actuator changes, but the mishap unit doesn't know when the last rig was performed. They do know, however, during the 200-hour phase inspections, TO 1F-16C-6-2-11 calls for a freedom-of-movement check of the pawl, but doesn't explain how to perform the check. A Lockheed-Martin engineer reported to the mishap unit that a retraction of the pawl, followed by a sudden release, will return the pawl to its proper position. Unfortunately, this "quick-release" method doesn't properly mirror the actual way the pawl is normally operated when the canopy is opened. Instead, if the pawl is "cocked" and then slowly released (like uncocking a pistol's hammer), the actual operation of the pawl will be simulated.

In this mishap, it was determined the pawl would get stuck on the corrosion, which left a .040-inch gap between the canopy frame and the pawl. Consequently, the pawl wouldn't engage the hook linkage cam which, in turn, let the canopy overstroke by 10 degrees.

Since there had been no known corrosion history in the affected area, it's hard to draw concise conclusions on the corrosion's origin. It's assumed that high humidity and possibly fine sand particles were introduced to this area during a deployment to the southwest Asia region.

In the meantime, the mishap unit has initiated a one-time inspection of all unit aircraft. No other aircraft were found affected (how about yours?). They also submitted an AFTO Form 22 on TO 1F-16C-6WC to improve the inspection of the locking pawl during the 200-hour inspections.

In closing, our "hats off" salute, from all of us here at the Safety Agency, to the nearby, quick-thinking crew chief who kept the mishap technician from being exposed to greater danger, and especially to all the safety and maintenance folks involved in getting to the bottom of this seemingly insignificant Class C mishap and exposing the truly greater potential for future death and destruction mishaps.

"Way to go, ya'll!" ■

Another Short Canopy Update

A transient maintenance technician was injured when an F-16's canopy unexpectedly fell on him. He had just moved the canopy actuator switch to verify it was in the neutral position when **the canopy suddenly fell.** Local maintenance suspected the problem was the canopy actuator. They believed the actuator's planetary gears lost several teeth which allowed the canopy to freely fall. They sent it off to the manufacturers as a product quality deficiency report (PQDR) exhibit.

Congratulations!! Keep those PQDRs coming! That's how the Air Force prevents mishaps — look for materiel failures, poor manufacturing processes, poor workmanship, human errors, etc.

*U.S. GOVERNMENT PRINTING OFFICE 1995-679-016/03020

The Colonel Joseph B. Duckworth AWARD

■ I'm sure you remember those trying hours in the simulator attempting to master the intricacies of instrument flight — particularly the dreaded "Vertical S" which combined carefully controlled climbs and descents. You probably don't know that the Vertical S technique, as well as many other techniques which the USAF uses today to train pilots to successfully fly through weather, was developed by Colonel Joseph B. Duckworth.

Prior to the introduction of Col Duckworth's instructional techniques, Air Corps instrument flight instruction was virtually nonexistent. In the early years of World War II, the US Army Air Corps taught its pilots to use "needle, ball, and airspeed." Though the directional gyro and artificial horizon were installed in aircraft, the use of these critical instruments was not taught to the fledgling military pilot. As a result, in the early years of World War II, instrument flight was often more deadly than combat. Col Duckworth's efforts to develop, formalize, and teach modern effective instrument techniques undoubtedly saved thousands of lives during World War II and an untold number since.

In recognition of Col Duckworth's pioneering work, the Air Force awards the "Colonel Joseph B. Duckworth Annual USAF Instrument Award" to the individual or unit making the most outstanding contribution to the art and science of instrument flight.

The Duckworth Award winner for 1994 was the Spatial Disorientation Countermeasures (SDCM) Task Group, Armstrong Lab, Brooks AFB, Texas. The SDCM task group members are Lt Col David W. Yauch, Chief; Dr. Fred H. Previc; Dr. Carita A. DeVilbiss; Mr. William R. Ercoline; and Dr. Walter E. Sipes. This task group has worked to determine the underlying causes behind spatial disorientation and to apply their knowledge toward improving the quality of spatial orientation information and training presented to aircrews.

In the past, individuals, as well as teams, and aviators, as well as research people, have been recognized. Recent winners include Capt Lloyd F. Hubbard, for his improvements and innovations in rewriting his unit instrument refresher course, and Maj Donald W. Thompson, for his development of a portable night vision lighting system for the B-52.

Col Duckworth worked to make instrument flight safe and its techniques state of the art. The award which bears his name recognizes the efforts of others who follow this same path. Let's recognize those people — nominate them! AFI 36-2807 tells how to do it. If you have any questions regarding making nominations for the Duckworth Award, contact Maj Mike Wilson, DSN 858-2118, or e-mail Wilson M@emh.aon.af.mil. If you have any questions about the spatial disorientation countermeasures effort, contact Lt Col Yauch, DSN 240-3521, e-mail Yauch%Kirk.decnet@hqhsd.brooks.af.mil. ■

Maximize
Your
Holiday Survival Potential

The very best to you and yours this holiday season from the staff of Flying Safety Magazine.