
flying
SAFETY
SEPTEMBER 1996
HUMAN FACTORS ISSUE

AIR COMBAT COMMAND

GENERAL RICHARD E. HAWLEY
Commander, ACC

■ The impressive capabilities of our Combat Air Forces are due in part to the technological advantages that we enjoy as a nation. But perhaps more importantly, we would have little more than "iron on the ramp" if not for the sacrifice and dedication of the many men and women who make up our airpower team. From the sands of the Middle East to the hills of Bosnia, our airpower team consistently demonstrates that land-based air power can reach anywhere on the planet with a degree of immediacy and precision that is unequaled in the history of warfare. Our success as an air force rests squarely on the talents and abilities of every member of the airpower team. When we lose people or equipment to mishaps, it affects our ability to perform even routine day-to-day missions and eventually our combat capability suffers. Our mishap losses are felt deeply and are very difficult to replace. Operations DELIBERATE FORCE and JOINT ENDEAVOR, and now the Air Expeditionary Force, are our most recent examples of what the right people, in the right places, and operating the right equipment can do.

Our continued ability to rapidly deploy decisive combat airpower relies heavily on the strong foundation of safety awareness that we've instilled into each member of the Air Force Team. We've clearly demonstrated that this "Safety Foundation" has firmly taken root by our third mishap-free deployment of the Air Expeditionary Force (AEF). Though flying very difficult operational missions from austere bases, the AEF safety record has been superb! So far, our AEF teams have deployed to Bahrain, Jordan, and Qatar — and have flown thousands of operational combat missions at each of these remote operating locations. The AEF, along with thousands of other airmen who are "routinely" deployed to Southwest Asia, help provide the combat strength necessary to preserve continued peace in the Middle East.

Short-notice deployments to support contingencies are but one way we fulfill our mission of providing the world's best combat air forces. Doing that safely, and preserving our resources is critical — and just as important as putting bombs on target. During AEF deployments, our commanders and supervisors have repeatedly demonstrated effective leadership — leadership which places the proper emphasis on mission accomplishment — while also ensuring that unnecessary risk is eliminated from our daily operations. Those operating the equipment and performing the mission have, in turn, responded to this outstanding leadership by elevating their own levels of risk awareness while safely carrying out their daily tasks. During each of my visits to ACC bases, I have been impressed by the strong sense of safety awareness that I see on the part of each one of our people — be it on the flightline, in the back shops, the dining hall, or the gym.

We are highly respected by our friends and potential adversaries alike. Maintaining this enviable position requires continuous effort and a lot of work — especially in our safety programs. From wing commanders to crew chiefs to airmen — every action, every philosophy, every attitude, every hallway conversation is an opportunity to communicate safety's importance. For safety is one subject that deserves much more than passing attention. Safety must be a theme that resonates as a natural rhythm of day-to-day business, a theme continually repeated and reinforced by every member of the unit. Actions do speak louder than words. That is why I see safety as a "Soapbox" issue, and I talk about it wherever I go. Talking about safety keeps it in the limelight and ingrains safety awareness into the culture of our Air Force. This, in turn, reinforces the idea of stewardship and accountability: Each one of us is responsible for ensuring that we drive risk out of each operation we perform — both on duty and off. Whether you are injured (or killed) in a boating accident, a sporting event, or while performing your mission — your loss is felt deeply…by your family, by your unit (your *other* family), and by the Air Force as a whole.

A strong safety record does more for us than "look good on paper…" It allows us to stand up to our stockholders — the U.S. taxpayers — and say that we have been good stewards of the resources with which we have been entrusted. Further, the people and equipment we preserve today (through continued safety vigilance and effective risk management), will be there for us as we meet the political and economic uncertainties of the Twenty-First Century.

Ours is a dangerous business. We have been entrusted with some of our nation's most valuable resources to conduct this most serious of all missions: providing for America's defense. We have a special obligation to take care of *all* of our resources. Of course, this includes our most valuable resource — our people.

We will undoubtedly face many challenges in the years ahead; but with our collective talents and commitment to our nation, we will turn each one of these challenges into golden opportunities and continued success for our airpower team. ✈

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SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS

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There I Was

Official USAF Photo

■ There I was, preparing for my first overseas deployment as an aircraft commander. We were scheduled to be TDY for 45 days as a minimum. I was saddened knowing I would be leaving behind my family, but I was anxious to show my commander I could perform the responsibilities of my new position. I had flown with my crew for a few months prior to this, and I had great confidence in their abilities. I enjoyed the rapport we had with each other. "This should be a successful trip," I mused to myself. We had spent many hours talking to crews that had recently completed a similar deployment and more hours pouring over the FLIP. We wanted everything to go well.

As part of our "leaning forward in the shoulder straps" attitude, we coordinated with maintenance to load some of our gear on our aircraft the day prior to our departure. We heaved the numerous bags from the tarmac into the open cargo door. We arranged them inside the aircraft and tied them down with a cargo strap. Finally, we closed the cargo door and prepared to leave. As we did, we caught a glimpse of a strange light source that seemed to shine inside the now darkened cargo compartment. It immediately struck us as being out of the ordinary, and we began a search to see if we could determine its source. It seemed to be coming from the cargo door, but we couldn't be certain if we weren't all just experiencing a temporary blind spot on the retina from staring up at the bright sun while tossing our bags up. We seemed satisfied that everything was well, and we headed back to the squadron building.

We arrived the next day for a morning departure. We were scheduled to stop in at an east coast base for the first night in order to participate in a possible coronet or cell flight to Europe. We completed all of the necessaries and arrived at the aircraft with the last of our bags.

At the aircraft, we decided to have one more look in the cargo compartment to see if we could find our mysterious light. This time we had the advantage of having a crew chief and his assistant there to hear our strange tale. It wasn't long before the chief discovered the light was coming from a small hole in the skin of the cargo door. The hole had apparently been made by a slip of a tool when someone was working on the latching mechanism of the door. It was behind part of the latch handles, and that was why we had been unable to find it.

It wasn't long before a whole gaggle of maintainers was gathered around our jet trying to assess the impact the hole had on the airworthiness of the aircraft and what needed to be done. It was determined the bird was unflyable until the hole was repaired, and so back we went to the squadron to find out what our next step would be. We hadn't even gotten off the ground, and already we were trying to work a contingency plan to accomplish the mission.

Back at the squadron, we waited for the repair forecast and looked for alternatives. Soon the DO came with the news. The hole would need to be patched in an operation that could take an entire day to allow the adhesive on the new patch to cure. It was obvious we wouldn't be leaving on time. The possibility of cannibalizing a cargo door from another aircraft was looked at as well as the gains and losses of switching aircraft entirely. The DO was noticeably annoyed by the unexpected turn of events. Through no fault of ours, we had started his day off with a load of extra work.

Some phone calls and discussion later, it was determined that if we arrived early the next morning at our first stop, we could still meet crew rest and fly the planned deployment. The aircraft could be patched and cured in 12 hours, so we were sent back into crew rest

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NEGATIVE TO POSITIVE G — The Push-Pull Effect

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■ Centrifuge training, Combat Edge, ATAGS, HUD tape reviews — seems like we have just about beat the G monster for all time. Or have we? Just when we think we finally have a 9G body in a 9G jet, those researchers discover something else to complicate the problem. Consider this recent mishap scenario:

A head-on setup for a 1V1. The guy in the high block gets a lock, eases forward a bit to keep the bad guy in sight, and as the two pass beak to beak at the merge, rolls over and pulls. About 5 seconds later, his jet unloads from 6.4G, accelerates downhill, and (you've already guessed) impacts the ground. The SIB has an easy task. It's just the latest case of GLOC.

But — in analyzing the mishap pilot's usual G tolerance, a previous ACMI tape is found with precisely the same setup and positive G levels. Our hapless aviator was well prepared for both missions and tolerated the same G just fine during the first mission and on the centrifuge. What was the difference? A small thing: In the previous engagement, he had not eased over to almost zero G before rolling over and pulling. Pulled with no previous push, you might say. A small thing, yes, but with a large physiologic effect and almost unknown until the early '90s.

WARNING

The ensuing paragraphs contain hard science and even (ugh) a graph. Avert your eyes in chaste dismay, if you must. A plain language explanation, suitable for polite company, follows.

Aerobatics pilots have known for some time that pulling G after being inverted is much tougher than starting from upright flight. "Puts your lights out, right in the middle of the show," they'd say. There even was a short account of this phenomenon in *TAC Attack* a few years back. But until recently, it was not possible to verify it on the centrifuge. You will, no doubt, remember our centrifuges go 'round nicely, but only at positive G. Yes, there was that dreamy-eyed scientist who wanted to turn the whole machine upside down. Anyway, the former East German centrifuge has yaw, pitch, and some roll capability. Sure enough, when a small group of centrifuge subjects were shuffled from +1.4 to -1.8, their relaxed, no g-suit tolerance to positive G fell markedly, from +4.11 to as little as +2.47G. The amount of minus G and time of exposure both were factors.

But, most centrifuges can't do more minus than -1.8 and find zero G positively daunting. So, we took to the air to look at zero and minus g down to -3.0. See the aforementioned obscene graph on page 6. Stand by to blush.

Starting from an established, post-g warm-up, relaxed tolerance with no previous negative G was 4.85G in the air. Tolerance declined to the figures on the graph after brief, or 10-second exposures to 0.0, -1, and -3G as plotted along the x axis. Note also the standard deviation bars: Some of these "subjects" were close to GLOC at as little as +2.8G after 10 seconds of -3G.

Suppose you went from -3 to +9G. Just how much would you have to strain to stay awake? Could you strain enough? In this worst case, probably not, especially if any other factors known to reduce G tolerance, for instance, body heat or fatigue, were present.

Aviation aside: Would you go to war in a '57 Chevy? I did this experiment in just that — a delightful '57 model Hawker Hunter T7, the side-

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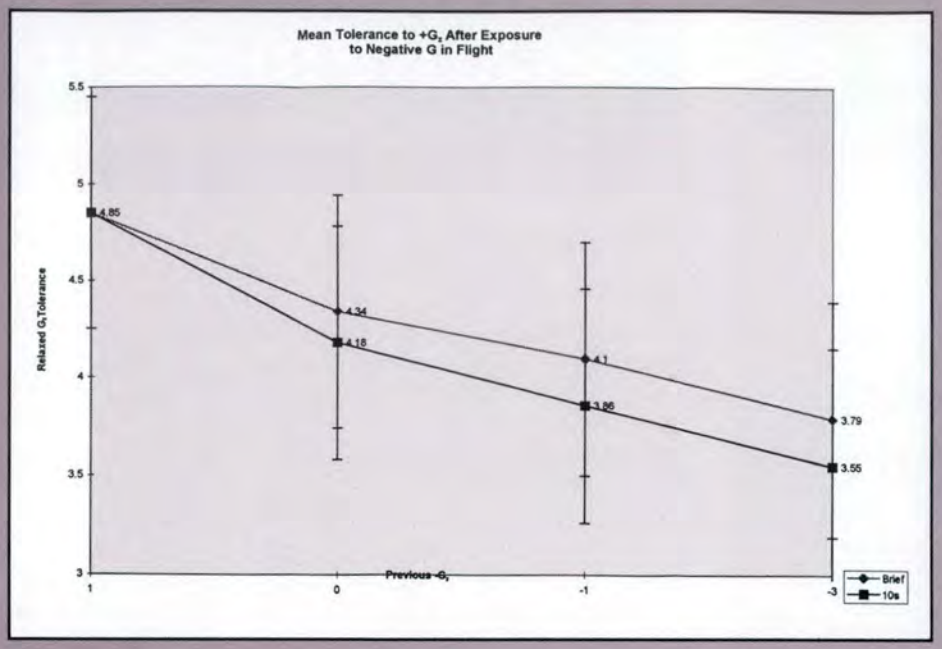


by-side trainer version of Sidney Camm's elegant '50s fighter. So, just how do you sustain -3G for 10 seconds and then achieve +6G at 1G/sec in that old jet? Answer: below 5,000 feet and above 500 KIAS for neg. G corner; 135° bank; both hands forward on stick with vigor; fervid prayer to avoid: (a) Pleasant Green Land of Hampshire; or worse, (b) an accelerated, inverted, negative G stall with ensuing loss of data point and ever-so-wiggly lines on G recorder. Seriously, many of these willing "subjects" were not centrifuge riders, but RAF fast-jet test pilots. And here's an unexpected qualitative finding: These 45-minute trips (elegant she was, long-legged she was not) were the most tiring thing I have ever done in over 30 years of flying fighters. Seems that the multiple shifts of blood north and south provoke an extreme form of fatigue.

How should you apply this new G knowledge? Does Combat Edge prevent it? Will ATAGS cure it? Apply it intelligently. No, no, CE/ATAGS will not be a cure. Yes, you will have a relaxed g tolerance of over 8G with CE+ATAGS. But if you have gone to less than 1.0G for even a few seconds, a *near-maximal strain will still be necessary at as little as 4-5G*, and remember, you can't wait for vision loss to use as a cue. For more practical implications, do chat us up at a future article on G tolerance and attentional resources. Cheers! ✈

There I Was

continued

with a report 12 hours later. The DO gave us this final update on the situation, and then, before he left, he paused and turned towards me.

"Don't ever do that again!" were his parting words to me as we prepared to reenter crew rest.

The comment seemed innocent enough. Reworking the deployment had cost him some valuable time and effort. I could see he wasn't anxious to endure that again, but since I had never intended to burden him with unnecessary work, I had to ask myself, "Don't ever do *what* again?" What was it that I did that he didn't want me to do? The next time I found a maintenance problem with an aircraft, did he want me to keep my mouth shut?

The comment fermented in my brain over several days, but not because I didn't know its correct interpretation. I knew our unit was not a "mission first, safety last" operation. The local commanders lived a consistent creed of safety and risk reduction. This was just an ill-aimed comment uttered in a moment of frustration, but it had the potential of undermining the local safety culture. The frustration seemed pointed at me personally, and yet I felt that I was part of the solution.

I was fortunate to have had many opportunities to work with the DO and knew his words were not intended to be aimed at me, but merely a chance for him to vent after facing the day's problems. However, the unexpected situation was as frustrating to me as it was to everyone else concerned. It was apparent his words left an impression on me or I wouldn't be writing this story.

To me, it is a warning that a single comment uttered in frustration has the potential to undermine a safety mindset that has taken years to create. In more personal terms, don't shoot the messenger — just help him fix his aircraft. If I wasn't a safe pilot, I wouldn't have asked someone to plug up the hole. ✈

There are no New accidents

COL RICHARD A. LEVY
Chief, Life Sciences Branch

■ During the last 9 years (368 Class A aircraft mishaps and 410 fatalities), I have heard myself say "... Oh no, not again!" Safety investigation boards (SIB) keep turning up the same problems year after year — fatigue, poor discipline, failure to follow appropriate procedures, lack of proficiency, poor systems knowledge, inadequate crew coordination, complacency, disorientation. These are some of the human factors responsible for 55 to 65 percent of our aircraft mishaps.

Safety investigation boards spend a minimum of 30 days meticulously analyzing each accident. Their findings and recommendations for the prevention of future mishaps are provided to commanders and crews. The lessons learned are painful and not easily forgotten, but the mishaps continue. It is remarkable that we can predict with unfortunate accuracy the number of future mishaps.

Can we do anything about this problem? You bet! We select our aircrews for their self-confidence and aggressive nature. They are expected to "hack the mission." Commanders, once "bulletproof" fliers, are similarly confident in their ability. It's not unusual to hear a flier say after hearing of a mishap, "... That was a dumb mistake. I'd never do that..."

On any day, two identically appearing aircrews can launch on a similar mission. One has a mishap, but there is no apparent difference in training or experience. The plain truth is that anyone on any day is a candidate for a mishap — no one is truly "bulletproof."

The first thing we can do is accept the fact that we are vulnerable, and the next step is to defend against that potential by careful preparation for every mission and application of lessons learned. For example, before launching on a night mission with NVGs, be sure everybody has adjusted and focused their goggles with the appropriate grid. Does everyone know where the wires are or might be? Remember, you can't see wires at night with goggles (all factors in a recent mishap, but old lessons not remembered). Do you have your systems down cold? Do you know precisely how your fuel system operates, which tank feeds which engine, and the effect of fuel imbalance on asymmetric loading? All basic stuff, but contributors to a recent tragic mishap.

Commanders, are you aware of the impact of fatigue on crew function? Judgment is impaired, crew coordination is compromised, information processing slows, and memory suffers. "Ops Tempo" is a problem often discussed today and is associated with significant fatigue. Most fliers forget they graduated from the Academy or college in sleep debt, enter UPT chronically fatigued, and then continue to get 5 or 6 hours sleep and never really catch up to a fully rested state. How many of you are carrying masters degree programs on top of regular and additional duties? Most important, what impact does this have on performance?

The next thing we can do is recognize the risk associated with all these factors and the missions we fly. For example, when a crew walks out to their helo on a dark night to fly an NVG mission, an accurate estimate of available light (moon disc or luminance) must be made and the risk quantified. The mission commander must then "manage" that risk based on criteria previously established by the organizational leadership. Is this an operational search and rescue or a training exercise? Is risk more acceptable with one or the other? Is the crew familiar with the route? Is the equipment satisfactory or marginal? Risk is part of our business. Hard lessons learned have taught us that a casual or simple "can do" attitude can lead to a tragic outcome.

We can also do something about an age-old problem — discipline. I'm not talking about punishment, but about an approach to flying. I have seen too many mishaps where the crew did not properly prepare and brief, where the crew did not coordinate their actions, where a crewmember made a dangerous decision leading to an unrecoverable action, where the unit culture or "way of doing business" resulted in a thoughtless or sloppy way of doing business (e.g., dropping flares down an AC-130H 105mm gun barrel), where a copilot stepped on the rudder when told not to by the AC, where a pilot continued an ACM engagement although "blind" (and killed the other guy in the resultant midair), where an out-of-control "hot dog" pilot killed himself and his crew in a flagrant violation of basic air discipline and established ROE. Do you personally pride yourself on your disciplined approach to flying? What do you do about fellow fliers who are casual or erratic? What is the unit culture, and how do you impact it? What is the quality of your leadership?

It's not the eye-watering or exotic human factor that kills people and destroys aircraft. Do not accept a "cost of doing business." These "same old" mishaps can and should be prevented. ✈

WHEN IT'S TIME TO GO...

COL LUCKY ANDEREGG*
Professor of Aerospace Studies
University of Pittsburgh

I snatched the ejection handle. Less than a second earlier, I had been pretty sure we would miss the ground, but as the canopy separated over my head, I realized we weren't going to make it. Temporal distortion slowed everything in my mind to slo-mo. I closed my eyes and clenched my teeth for the fatal impact.

It was 1 December, nearly 20 years ago. The day started uneventfully enough. As I walked into my squadron — the F-4 Fighter Weapons School (FWS) — the Duty Pig called my name and told me I was replacing an instructor pilot (IP) who was ill. The ride was a defensive Basic Fighter Maneuvers (BFM) hop for a pilot who was getting recurrent in the F-4. We usually didn't do transition training in the FWS, but the pilot (a major with over 2,000 F-4 hours and more than 200 combat missions) was a local, so we were checking him out right there at Nellis. I knew the major very well — a good stick and deeply experienced, plus he had been out of flying only 18 months. No sweat.

When our two-ship arrived in the assigned working area, the weather was not good. We flew to the bordering area. No dice. Back to a third area, and there we found a relatively large area clear enough to work, but just barely. The cloud bases (yes, Nevada does have clouds at times) were about 10,000 feet AGL, and our maneuvering floor was 5,000 feet AGL. The clouds meant we would have to work considerably lower than usual.

The flight leader called, "Noway 21, we'll work here. Mil power. One is 9.1."

The major in my front seat acknowledged, "Roger, mil power only, two's 9.0."

Two brief radio calls confirmed both jets had about 9,000 pounds of fuel, enough for three engagements, and that both pilots would not use the afterburner. Restricting our power to non-afterburner would mean the fights would not go up. They could only go down, thus keeping us out of the clouds above. A common practice — nothing unusual.

After a brief bit of maneuvering to warm up, check our systems, and get the jets in the proper positions, the flight leader called, "Noway 21, rig stab aug check complete, roll aug off, one's ready." My major parroted the radio call confirming his readiness to start the first engagement.

I reached down and started the small tape recorder I kept strapped to my right thigh. A thin wire ran from the recorder, under my parachute harness, up to the edge of my helmet, and into my earphone. A small microphone on the wire recorded all radio calls as well as the intercom talk between the major and me.

The fight commenced with the flight lead attacking us from the prearranged position, about a mile and a half at our 7 o'clock. His radio call to us simulated a combat situation.

"Noway 21, BREAK LEFT, bandit, left seven o'clock, mile 'n' a half, level!"

My major started out doing things right, a condition which would last only a few seconds. He rolled the big fighter hard left, put the attacking aircraft right on the top of the canopy, advanced his throttles to military power, and pulled hard on the stick. Our "G" increased to about 6, and I commented, "That's good, six right there."

Almost immediately the aural angle-of-attack tone started a slow "boop-boop-boop" tone in our headsets as the airspeed started to bleed off under the G load. I looked inside at the airspeed indicator and said, "Three hundred." We had started at 400 knots.

Straining against the G forces, I again looked back over my left shoulder at the attacker who had closed to about 4,000 feet. Our hard defensive turn was working well. The attacker was well out on our wingline and was definitely going to overshoot our flightpath. However, his nose was still pointed in front of us — a sure sign he would attempt a raking gun pass as he rapidly flushed to the outside of our turn radius.

I made my first mistake. With no small amount of urgency in my voice, I said, "Don't let him gun you!" My student elected to do an immediate and violent maneuver called a "rolling guns break underneath." The idea is to rapidly roll the jet inverted, in this case a steeper left roll, then pull the nose hard down, thus jinking out of the path of the oncoming bullets. I was caught off guard. I had expected him to roll the other way.

I made my second mistake. I ignored the small voice in the back of my head which said, "Something bad just happened" and watched the attacker overshoot our flightpath. My thought was to continue to evaluate the attacker's potential to still attack us. I was now looking extremely high over my right shoulder, but I lost sight of the attacker. As I swung my head back to the cockpit, I was startled to see a lot of desert. I said, "Watch the..." but the major interrupted my intended warning about our proximity to the ground by saying, "It's coming up. It's coming up," in a very calm voice.

At this point, the airplane was in about a 60-degree inverted dive and was going through about 4,500 feet. The aural tone was going "boop-boop" in a frantic trill signaling the aircraft was fully stalled. We were below our minimum fighting altitude.

Mistake number three. I didn't take control of the airplane from my student. I wanted him to break the stall by relaxing his back stick pressure, roll the wings level to the hori-

continued on next page

At this point, the airplane was in about a 60-degree inverted dive and was going through about 4,500 feet. The aural tone was going "boop-boop" in a frantic trill signaling the aircraft was fully stalled. We were below our minimum fighting altitude.

zon, and start a pull to recover from the dive — just like pilot training. As I started my instruction to him to do so, "C'mon, let's..." he pulled the stick full aft into his lap and held it there. My mind was racing to catch up with the situation. Was he trying to pull the aircraft all the way through? The long way????

He repeated, "It's coming up." *It wasn't.* In fact, the jet was in very heavy wing rock from an even more deeply stalled condition. I was totally surprised by the major sucking the stick full aft. Surely, with all his Phantom time he knew the airplane would never recover unless he broke the stall by moving the stick forward. I said, "C'mon, you've got to put this (expletive deleted) on-speed!" He responded, "It's comin' up."

"Wrong-o, moosebreath," I thought. I hit the transmit switch and called "Knock it off!" over the radio because it suddenly occurred to me the attacker may have lost his senses, too, and was trying to follow us through this gawdawful maneuver.

I brought my right hand down from the upper hand hold towards the stick. I intended to say, "I've got it" and take control of the airplane. But as my hand neared the stick grip and my mind's eye projected what was needed to miss the ground, the crystal-clear realization hit me. "I've never made this corner before, and I'm not going to make it today."

Instead of taking the stick, I snatched the ejection handle between my thighs. I was finished making mistakes that day.

In the slo-mo of temporal distortion, my mind pictured the face of my son in his first grade school picture, and I waited to slam into the ground. My brain said the words so often seen in print, "The pilot initiated ejection outside the ejection envelope and too low for a successful recovery." I felt remarkably calm, and I could hear every clink, clank, and plink of the Martin-Baker ejection seat as all its automatic features functioned in their Rube Goldberg sequence.

Suddenly, "WOOFF!" The parachute snapped open. I opened my eyes. I was about 100 feet in the air. Training kicked in. I ran quickly through the actions required for a parachute-landing fall. About 500 yards in front of me, the dead Phantom's huge black and orange fireball boiled up from the desert floor. I saw no other parachute. I looked between my feet and saw panicked prairie dogs scurrying out of my way as I landed right in the middle of the soft earth of their village.

I was on the side of a fairly steep ridge with the burning wreckage at the bottom. I realized immediately that the "ground rush" I had gotten as the jet approached the ridgeline was what had triggered my decision to eject. Luckily, we missed the top of the ridge, and the steep downslope on the other side gave time for the parachutes to open. Yes, parachutes. About 5 minutes later, I spied the major making his way up the steep slope to my position.

The Phantom's ejection system has a mode which allows the backseater to eject both crewmembers. I had selected that mode before we took off — as always. My policy was simple: If I decided it was time to go — it was time to go. Period.

The major had come very close to not making it since the front seat fires after the rear seat. He got the proverbial "one swing," then hit the ground. The mishap investigation board said he wouldn't have made it if I had delayed another seven-tenths of a second. He went out of the jet with his right hand on the stick and his left on the throttles. I was very relieved to see him not only alive but uninjured as well.

I think I've already told the lessons I learned while I've told the story. However, there's a really stunning point you should know and consider. Time elapsed from the start of the fight until the ejection? Nineteen seconds. Yep, 19 seconds! Good golly, Miss Molly!

Actually, I've always thought the best part of this story happened the next morning which was Saturday. I was very stiff and sore from the parachute-opening shock, but I stretched out on the living room carpet on my back. My son, age 6, and my daughter, age 2, each snuggled up next to me. I had a small blonde head on each shoulder, and we watched cartoons together. Sure glad I didn't hesitate when it was time to pull the handle. Sure hope you don't. ✈

*Col Anderegg flew fighters for another 17 years following the above mishap. He flew his last fighter mission as an IP in the F-15 chasing a second lieutenant on his first solo. He finished with over 4,000 hours in the F-4C/D/E/G and the F-15A/C/E.

FATIGUE can be as dangerous as drugs or alcohol

LT CDR J. J. ROMANO, USN
Insomniac Flying With VP-64
Courtesy *SAFEJOURNAL*, January 1996

■ It was zero-dark-thirty somewhere over the Indian Ocean, a thousand miles from nowhere. There was no moon, but there were a billion stars. We were 7 hours into a 12-hour mission, conducting surface surveillance ops. We had been flying around the clock for the last few days with minimum crew rest. The entire crew was dragging, and performance was less than 100 percent.

We were steadied out at 180 knots, 2,500 feet, with one engine shut down for maximum endurance. My copilot was monitoring the autopilot, and the flight engineer was doing his fuel log. We were so tired that we hadn't said anything for the last 15 minutes.

I sat there with my bloodshot eyes half open, fighting the overwhelming urge to nod out. I glanced down at my airspeed indicator, which was now reading about 5 knots fast. I mumbled to my copilot, "Watch your airspeed." We still had a couple of hours left on station, and I was trying to squeeze as much time as possible out of a drop of gas. My eyelids were heavy, and my vision was periodically blurred. It was going to be another long night.

I returned to stargazing for a few moments and then looked back inside, only to see my airspeed still increasing through 187 knots. In a more demanding voice, I told my copilot, "Pull the power back and watch your airspeed!" I was growing annoyed with him at this point since he didn't appear to have the same concern about our fuel as I did.

As my annoyance grew, so did my impatience. I finally grabbed the power levers and squeaked off some power. We were approaching 190 knots. But something was odd. I had just reduced power and airspeed was still increasing! I finally broke my fixation with the airspeed indicator and realized we were in a 500-foot-per-minute rate of descent and passing through 1,700 feet! Somehow we had just lost 800 feet, and I had no idea how to account for it.

Now, semiawake and very confused, I turned to my copilot to ask what was going on. Much to my amazement, he was sound asleep with his head buried in his chest. His right hand was still dutifully holding the yoke where he had inadvertently disengaged the autopilot and started our slow descent. In disbelief, I turned to the flight engineer, who sat there fully reclined, mouth wide open, also in a deep sleep, with his fuel log still on his lap. I took a few moments to fully absorb the impact of the situation and the impending disaster.

Here I was in a three-man cockpit with two guys sound asleep, another half awake, and an aircraft in a low, pilotless descent, just a few minutes away from going into the water. In a loud voice, I asked my copilot to "Get back on altitude!" He promptly awoke and, in shocked disbelief, pulled up the nose and cobbed on the power. The flight engineer also woke up and was equally stunned by our deteriorating situation. We raised the cockpit lighting, took turns getting out of our seats to stretch, went on 100 percent oxygen, and called back aft for some fresh coffee.

Fatigue can be as dangerous as drugs or alcohol. You think you can resist it, but sometimes it overwhelms you. It strikes slowly, and its effects can be devastating, impairing judgment and degrading performance.

There have been many a dawn patrol where we all have nodded out for what we thought were a few seconds, only to awaken and realize it had been a few minutes. Had I succumbed to nodding out for a few minutes in this situation, I would not be here today.

If you're tired, take a break. And if you're being pushed too hard, tell somebody! Your aircraft and crew depend on it. ✈

USAF Photo by SrA Jeff Allen

The COPILOT SYNDROME

Both the military and civilian flying worlds are subject to the negative effects of having human beings at the controls of airplanes.

CAPT MIKE MARGOLIS
USAFR

Copilot syndrome is a nasty ailment. It's difficult to detect and quite a challenge to overcome. It has been found causal in both military and civilian aircraft mishaps and incidents.

The following scenario can be adjusted to any flying situation which requires two or more humans to communicate. This could be a formation of single-seat fighters, a crew airplane, a training flight, or just about any other sortie involving people.

As you read the following segment, simply exchange a duty title that may be more appropriate to your particular flying environment. Replace aircraft commander with titles such as *flight lead, mission commander, instructor pilot (IP), and so on.* Replace copilot with *wingman, student pilot, subordinate, and so on.*

The narrative: The copilot was contemplating how to approach the aircraft commander. There was a step-down fix they were approaching that was not mentioned when the aircraft commander briefed the instrument approach.

The copilot thought, "Gee I wonder if he knows about that altitude restriction? Shucks, I'm just a new copilot. The aircraft commander has been at this business since I was in grade school. I'm sure he knows about the level-off."

A little later: "I thought he knew about the restriction, but he doesn't seem to be leveling off. I'm sure he'll notice it soon and climb back up. We've still got plenty of altitude just in case."

The situation now unknowingly critical: "It sure doesn't look like he's fixing the altitude. If I point it out now, he'll yell at me for not mentioning it earlier. It's too late to fix it now anyway. We're almost there."

The aircraft shook and yawed wildly. "We've lost the number one engine!" exclaimed the copilot.

They nursed the aircraft to the runway and performed an emergency landing. Upon egressing from the injured bird, the crew found the No. 1 engine missing, and in its place large sections of pine tree was deeply embedded in the wing.

In the hypothetical situation above, the copilot failed to perform his duties. He failed to mention the altitude restriction which was inadvertently omitted from the approach briefing. He failed to call the altitude restriction before the aircraft commander flew through it. And he failed to correct the situation when they leveled off too low.

Could this happen in "real life"? You bet it could! Similar situations have caused the loss of airplanes and the needless loss of life.

Both the military and civilian flying worlds are subject to the negative effects of having human beings at the controls of airplanes. Now, before you start defending manned flight and the problems with autonomous airplanes, I agree with

you. We need to have humans in the cockpit (at least for now). Humans can adapt better and faster than any computer yet made. We also have a thing called judgment which helps out from time to time.

However, as bipedal earth beings, we do have some limitations when thrown into a dynamic, high-speed, aerial environment.

As crewmembers, we must understand and recognize our own limitations and those of our crew. Our physiological limitations have been thoroughly investigated and are well taught in our required training courses. Yet our sociological limitations (the basis for crew resource management (CRM)) have only recently been considered critical for a safe and efficient flying environment.

The self-omission and situational resignation associated with copilot syndrome is difficult to overcome. All of us, at one time or another, have felt "out of the loop" or hesitant to correct a deviation by a senior crewmember. As a student, it's a feeling you might experience often. As a qualified aviator, it might happen on a check ride or maybe when flying with the senior ranking pilot in your wing.

Can we put all the blame on the copilot? No. The aircraft commander sets the pace long before turning a wheel. If he's overbearing and lives by the old adage, "Sit down, shut up, keep your feet off the seats, and if I want your advice, I'll ask for it," the odds are pretty good the individuals involved will remain just that — individuals — and not members of a synergistic flightcrew.

On the other hand, the aircraft commander may welcome and encourage input from any level of his crew. This in no way suggests relinquishing his command authority. He's simply using all the resources available to him.

For example, a couple of years ago, a transport aircraft was shooting an approach into a field surrounded by thunderstorms. The aircraft commander had the field in sight 10 miles out. There were heavy rain showers easily discernible on both sides of the active runway.

The aircraft commander was concerned with the "on-time" delivery of his passengers and the completion of this 5-day mission. He stated: "Looks good enough. Heck, I can see the runway from here. What do the rest of you think?"

The copilot responded, "Yes, sir, I can see the runway as well, but the radar shows a 'box-canyon' wrapping around the field." The copilot paused for a moment while the aircraft commander scanned the radar image. Then the copilot continued, "What if we need to go around for wind shear or something?"

The aircraft commander answered, "Good point. Let's break off this approach and request a holding pattern to wait out the weather."

When encouraging input, the aircraft commander may put parameters on possible deviations. For example, he may ask that he be notified if he deviates more than 150 feet off his assigned altitude. Or he might ask for a heads-up call if his airspeed strays more than 10 knots off the mark.

In this case, a possible disaster was averted because the CRM concept worked. The copilot continued to do his job, and copilot syndrome was not a factor.

When encouraging input, the aircraft commander may put parameters on possible deviations. For example, he may ask that he be notified if he deviates more than 150 feet off his assigned altitude. Or he might ask for a heads-up call if his airspeed strays more than 10 knots off the mark.

In the student training environment, copilot syndrome is more common than it should be. There are several cases of a student pilot not only failing to speak up, but also planning his own escape with or without the IP.

One case in particular involved an IP who got himself in trouble in the final turn of an overly aggressive traffic pattern. The student pilot on board recognized the situation very early. Rather than challenge this particular IP's actions or authority, the student simply decided the situation was a threat to his continued existence. The student actually started to raise his handgrips to initiate the ejection sequence. Fortunately, the IP was able to recover the aircraft before the student ejected — most likely out of the ejection envelope.

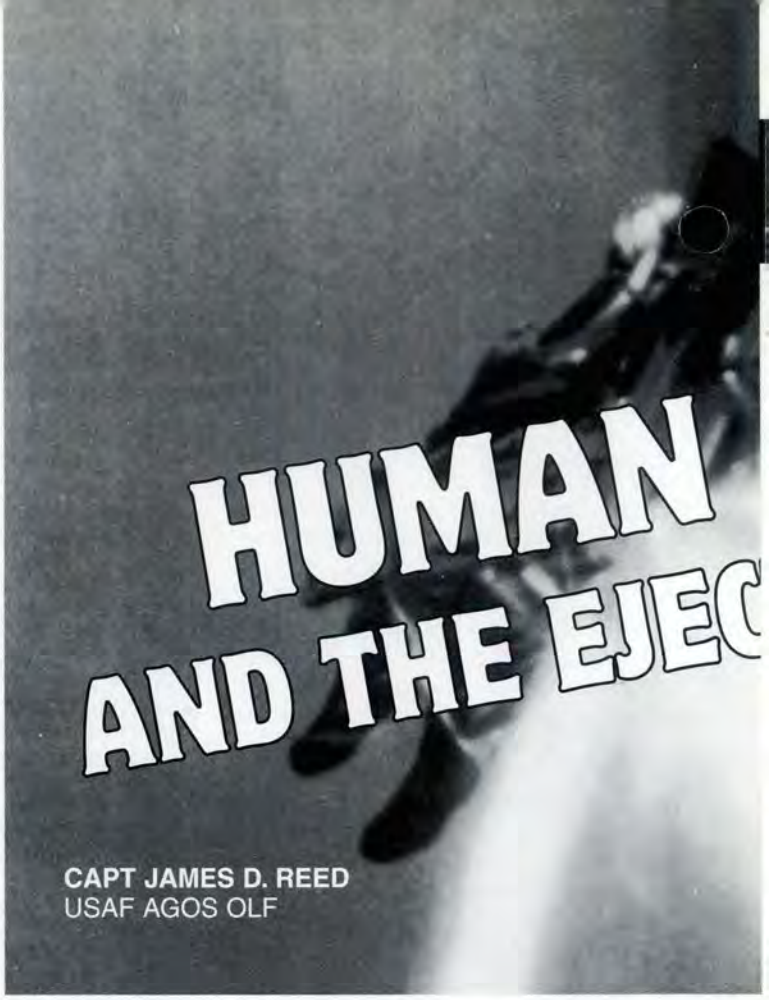
If you are the new guy, copilot, wingman, subordinate, and so on, please remain an active member of your crew and/or mission. There are well-defined lines between offering a suggestion and attempting to take over the aircraft. The problem then comes down to communication — how to tactfully and professionally intervene.

Specialized Undergraduate Pilot Training students in the tanker/transport track are taught the *Two Challenge Rule*. This rule is used by a crewmember not in command (the aircraft commander may, of course, intervene at any time). The rule suggests that two attempts be made to make the aircraft commander aware of an impending hazardous situation.

The goal is to make this communication tactful, assertive, and clear. If the aircraft commander does not correct the situation after two attempts, the subordinate must then decide to intervene or not. Here's that judgment thing again.

If you are the old guy, aircraft commander, flight lead, IP, and so on, please encourage your team to help you in the accomplishment of the mission. This in no way means give up command authority. Simply allow your crew to approach you with problems that may save your aircraft, life, or career.

Copilot syndrome can affect even you. Be prepared to recognize and overcome it. ✈



CAPT JAMES D. REED
USAF AGOS OLF

The wing safety meeting was a standard safety meeting. Mishap reports were read, briefings were given, and statistics were presented. According to the statistics, we were due for a Class A mishap (just what we all wanted to hear). The statistics told us the mishap would occur on a Monday, in the morning, as the result of a bird strike on a low-level route.

The briefer went on to explain the mishap pilot would be a low-flight-time instructor pilot (IP) and probably a first assignment instructor pilot (FAIP). "Yeah, right," I said. How could they come up with those stats? It must be one of those briefs the supervisors give to sober you up and to think safety.

Then I started to think (a possible mistake). I am a FAIP, and our class is in the two-ship low-level phase. "No way! Not me," I thought. What was to happen 2 weeks later was not due to my lack of experience. It was a clear case of being in the wrong place at the wrong time.

There I was.... It was Monday, and I was scheduled for a two-ship low-level sortie (sound familiar?). I was scheduled to fly with one of my best students. The IP in the other aircraft was a FAIP (one of my old students) on his first student sortie. The students had picked out good turn points, initial points, and targets. The weather was good, and the mission was thoroughly briefed according to our briefing guide. I was looking forward to this sortie. Let's Go Fly!

I was in the lead aircraft, and everything was going as planned. Commencing our target run-in from the initial point at 420 knots is when the prophecy struck. In less than a blink of an eye, things went *terribly* wrong. I heard a loud thump, and my world turned strangely red. My forward visibility (which is already poor from the backseat of a T-38) was cut to nearly zero. The whole situation caught me by surprise. What happened? My mind needed time to analyze the situation. I asked my student up front what had just happened, but there was no reply. Fortunately, my hands knew what to do — pull back on the stick!

It didn't take long to figure out what had happened. Bird strike! Two birds struck the front canopy. One bird obscured the right side of the windscreen, and another bird penetrated the forward canopy just aft of the canopy bow. That son-of-a-gun went through the forward canopy, and broken pieces of Plexiglas and bird remains struck my student in the face and chest. The windscreen separating the two cockpits was covered with blood and feathers. Whose blood?

As briefed for an emergency, we climbed to trade some of our airspeed for altitude and started a turn to our nearest divert base some 40 miles away. It was during the climb I noticed a problem with the engines. They sounded strange, and the engine gauges were fluctuating wildly. Both engines were compressor stalling!

While attempting to clear the compressor stalls, I radioed my No. 2 man, related what had just happened, and told him to come up and take a look at our aircraft. We were able to minimize the compressor stalls and hoped to prevent an engine flameout.

The engines were stabilized at 90 percent rpm, although the indications were still erratic and the thrust provided was much lower than expected for this setting. It became obvious that both our engines were damaged to the point that we were incapable of sustained level flight even though we had 90 percent rpm available. Our airspeed could be maintained only by establishing a 200-foot-per-minute descent. We were now passing 2,500 feet AGL.

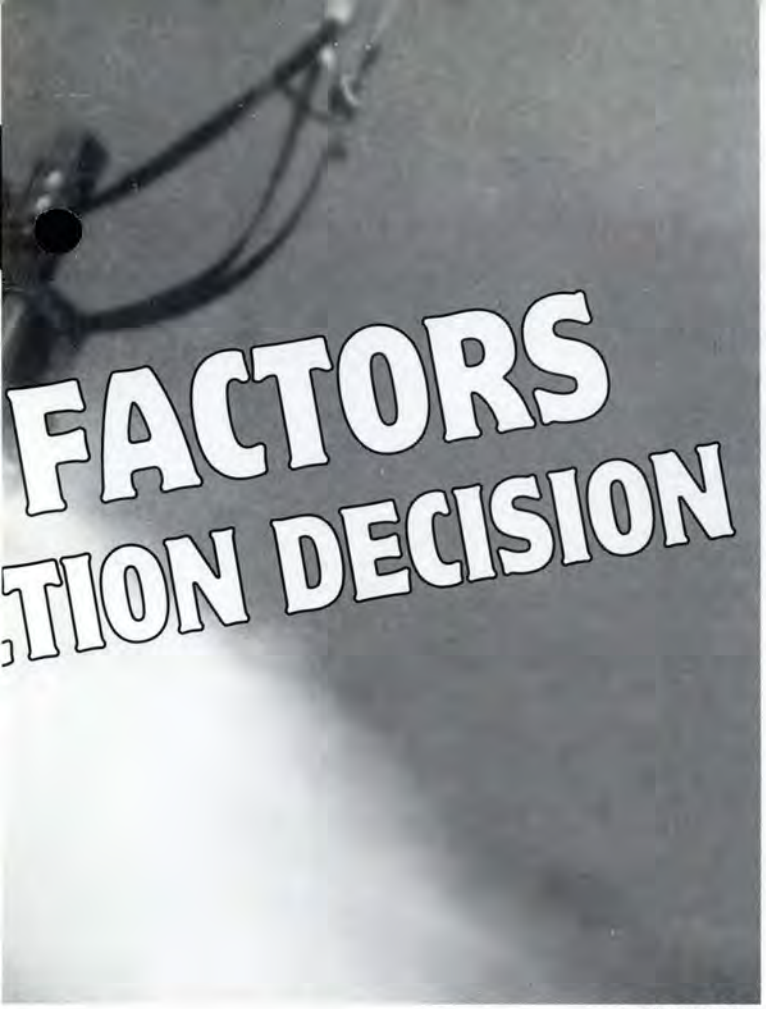
The divert base was still 30 miles away, and my aircraft was severely damaged. I was 2,500 feet AGL and losing altitude in order to maintain airspeed. That's all I had. It was time to eject.

But wait! My student is injured. My engines are damaged, yet still working. What would the safety board say? Things seemed bad, but were they that bad? My cockpit was a familiar environment. Did I really want to step over the side?

I think I've gotten the point I wanted into your cranium — *human factors* and the ejection decision. Some decisions are easy — some are more difficult. What would you have done? How would you have handled my situation?

The following information on human factors comes from an excellent article in *The Combat Edge,* March 1995, written by Maj Tom Breen. What human factors came into play?

Reaction time. Recognition — "What just happened?" Latent reaction — "Did this really happen?" And decision time — "What do I need to do?"



Official USAF Photo

Distraction. "My student is injured. How badly? Where is my No. 2? What will the investigation board think if I eject?"

Task management. "I need to climb and turn to my divert field. What is the TACAN channel? I need to clear the compressor stalls. Can I make the divert airfield?"

Temporal Distortion. During times of high stress, the human brain will slow down the perception of events so we can deal with the crisis. Temporal distortion is insidious — it is anxiety reducing and causes a loss of the sense of urgency. It is a principle cause of delayed ejections and ejection-associated fatalities.

Altitude Assessment. Altitude estimation above 1,000 feet is relatively inaccurate. A pilot will not sense "ground rush" until around 500 feet AGL. Misjudging altitude and poor altitude awareness are not uncommon in controlled ejection situations.

Behavior. Behavior can also be considered ego. A person may make a conscious decision to delay the ejection decision because "I am a good pilot. I can handle this." Or, "The seat will save me."

Combined Effects. It is not uncommon for several of these human factors to come into play at the same time when an aircrew is under stress. Prior to an ejection, aircrews often second guess themselves — worrying they may have done something wrong. Often, the aircrew will overcome preliminary human factors, make the cognizant decision that it is time to eject, then "give it one more try" since they are controlled and feel relatively safe at the moment. The trap is they can again be overcome by subsequent human factors (especially temporal distortion) and press to a dangerously low altitude. They fail to account for the post-ejection factors which will affect them once they pull the handles and submit themselves to conditions beyond their control.

The ejection decision is easier to make in a combat situation versus the training environment. The pilot is more mentally prepared and has a sharper instinct for survival in combat. In many cases, the combat ejection decision occurs shortly after battle damage is sustained. In a training environment, the pilot is not as mentally prepared for the possibility of ejection. The "sure-it-can-happen-but-not-to-me" or "it's-just-another-training-sortie" attitude is ever present. Don't become complacent. It *can* happen to you.

Now for the rest of the story...

My student was injured. My final decision was — "We can make it to the divert base." But if we lost an engine...if altitude loss becomes critical...if the gear does not come down...if we "pooched" the landing — **bailout, bailout, bailout!**

Traffic at the divert base was landing to the south. En route to the divert field, we determined we did not have enough altitude to maneuver to the active runway. We coordinated for an opposite-direction landing and requested the emergency vehicles and flight surgeon meet us at the jet.

Our chase ship aligned us up on extended centerline for the runway. Once aligned on final, I could not see the runway due to obstructions of my windscreen. My student, although injured, reported he could see the runway and felt well enough to make the landing. I transferred aircraft control to my student in the front cockpit.

We approached the field and set up on a steep glidepath to minimize the thrust required for final approach. Upon lowering the gear, the student did not get a green light in the right main gear. However, I confirmed a safe indication from the back cockpit. My student made an excellent landing and safely stopped the aircraft.

The maximum altitude during the emergency was less than 3,000 feet, and the time from the bird strikes to touchdown was about 9 minutes. The flight surgeon removed several pieces of Plexiglas from my student's left eye. He had multiple bruises from the bird and Plexiglas striking him on the chest.

Further investigation of the jet revealed relatively minor skin damage existed on both sides of the fuselage from other strikes. About 3 feet inside both intakes, the sheet metal of the intake was buckled and bent into the windstream. On the left side, the metal was torn loose from the rivets. Both engines sustained bent and cracked inlet guide vanes as well as damage to the first through seventh stage compressor blades and stators (there are eight total). It was determined the engines were producing less than indicated power — we were lucky the engines kept running. Evidence indicated the aircraft struck a flock of six or more small birds.

That night, while relaxing in the hotel lounge, my student pointed out the name of the establishment — "Feathers"! ✈

COCKPIT RESOUR...Training

These large vehicles, which have been variously referred to as "urban assault vehicles," "land boats," or just "buses," roam the countryside providing roll in/roll out training right to your front door. These 34-foot monsters contain a suite of high-speed computers, cameras, VCRs, a large-screen TV, and a cluster of sticks, throttles, and yokes.

USAF Photos by MSgt Perry J. Heimer

MAJ ERIC OFFIL
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Many of you reading this article will already have experienced ACC's new Cockpit Resource Management (CRM) training package and will be interested to know a little of the background of this program and where we are planning to go with it. If you have not yet been through the initial program, you will see it soon, and hopefully, this brief article will whet your appetite and explain the ACC philosophy behind the program.

In 1993, the ACC commander, Gen Loh, directed that a single contractor be appointed to manage a focused and standardized CRM training package for every cockpit within ACC. The general's aim was to achieve safer aircraft operations while achieving greater mission efficiency and effectiveness. This motive was in response to the significant number of mishap reports which identified human factors issues in the findings. MEI Technology was identified as the company which would be the most likely to fulfill the aims of the relevant AFI (AFI 36-2243 for those needing a reference).

Those who have not yet undergone CRM training may be surprised at both the hardware and software MEI Technology will bring to your base when your turn for training comes around. The most visible evidence of the company's presence will be one of the five mobile training units (MTU). These large vehicles, which have been variously referred to as "urban assault vehicles," "land boats," or just "buses," roam the countryside providing roll in/roll out training right to your front door. These 34-foot monsters contain a suite of high-speed computers, cameras, VCRs, a large-screen TV, and a cluster of sticks, throttles, and yokes.

Under the direction of the two most important assets provided by MEI — the instructors — all this equipment is tied together to provide a unique means of delivering the CRM message to the aircrew member. The two instructors on each team are highly experienced, recent ex-members of the military flying community. Reports so far have rated the contribution of these individuals as being the most important single asset within the program.

The training itself takes about 4 hours and provides a baseline of knowledge to get everyone on the "same sheet of music" and upon which subsequent training can build. Each student participates from a computer work station, and after a brief initial orientation, an attitude survey, and a demographics questionnaire, they jump straight into the main program which is split into three primary methods of delivery as follows:

• A training module that is similar to an interactive CD involving each of the students and taking their inputs into a database which throws them anonymously on the big screen TV in the form of a "histogram." This has

CE MANAGEMENT

on the Move

A computer interactive "case study" is discussed which takes the students back through an actual mishap so they can identify and discuss CRM factors that could have been involved.

The students have an opportunity to test, try, and prove (or disprove) the skills and philosophies the instructors offer during the training session by using his/her PC/work station as a type of simulator.

proven to be an exceptional tool for generating discussion and proving the point that we don't all think and react to a given set of circumstances in the same manner (even though many of us believe we do).

- A computer interactive "case study" is discussed which takes the students back through an actual mishap so they can identify and discuss CRM factors that could have been involved.
- The students have an opportunity to test, try, and prove (or disprove) the skills and philosophies the instructors offer during the training session by using his/her PC/work station as a type of simulator.

The company calls the work station a situational trainer (ST). Make no mistake, though, this is not a typical simulator. Its primary purpose is not to teach or practice flying, emergencies, or procedures. The ST is set up so aviators can work on managing their resources and learn how to contend with task loading, prioritization, and timely, efficient, and effective communication. Videotape playback of the ST provides the instructors a means to help students hone these skills. At the conclusion of the training, another attitude survey is completed along with an end-of-course critique.

So what is the overall reaction to this innovative training? Both the bomber and fighter communities have made favorable comments about the training package. The fighter folks are saying things like "...this was the best ground training I have ever had," or "...these are exactly the types of problems we face in the squadron...inexperienced through experienced," or "...will be most helpful if my mates put the CRM ideas to work," and "What I feel is most valuable is not that I have had CRM training, but that my whole squadron has had the training and (will) start from common ground."

The bomber community has had a type of CRM training for some years. However, comments indicate the new training is an improvement and is right on target. Comments such as "This CRM training is vastly superior to the previous package..." and "Best CRM class that I have been taught," "Good instruction...," and "Outstanding for young guys, but valuable even for old heads."

Reactions from the ACC airlift communities which are undergoing CRM training with MEI Technology are positive. AWACS mission crews, as well as front-end crews, will soon receive CRM training, and based on experience to date, ACC is expecting to see an equally favorable reaction to the CRM experience.

While feedback from the field is very good overall, the true value of the training will be realized with lower flight mishap rates. While this is happening, it is important that the course continue to grow to meet the changing needs of the command. To remain effective, the training must be fresh, new, and relevant each year.

Next year, the content of the CRM package will become progressively more mission and aircraft specific in a continuing effort to support our mission. ✈

USAF photos by Carlos Baker

USAF Photo by SSgt Andrew N. Dunaway, II

UNHEALT

It is incumbent on leaders to be completely aware of the interpersonal dynamics which come together to form an organiza-

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HQ AFSC/SEFL

As I travel throughout the Air Force, working with mishap investigation boards and lecturing to unit level personnel, one fact is continuously reinforced — unit culture is the most important factor in an organization's performance. This subject area is difficult to define and even harder to assess within a unit. More important are the effects of unit culture on unit performance. A unit displaying a healthy organizational work ethic with the support of unit leaders will be most effective in accomplishing the mission. They will work with their allocated resources to accomplish the mission, safely and efficiently.

It is incumbent on leaders to be completely aware of the interpersonal dynamics which come together to form an organizational culture. Some of the most seemingly minor events can have major effects on the organization's performance.

A very good case in point occurred to an individual very close to me. In the interest of flight safety, he has allowed me to recount it as a case study.

I will recount the situational dynamics which illustrate how the actions created an unhealthy situation in the unit. I am hoping that by illustrating this example we can improve our own effectiveness.

First, it's clear to me heavy tasking is causing some of our dedicated young people to lean too far forward. In this case, the maintenance organization was down-sized to support several fewer aircraft than the unit actually possessed. The unit had not changed its alert commitment or its off-station support of national defense requirements.

In most situations, if the aircraft are on the ramp, you fly and fix them as required without regard to manning. This case demonstrates that you can only do more with less if you cut out something. And the young people are making the choice of what to cut! This example will show how, if we do not act decisively, we can be putting into motion situations that could create a mishap.

It is important that the circumstances of this situation be explained so we can see just how an unhealthy environment can occur. We will see how this unit's most senior leadership took strong management responsibility and corrected the situation.

HY UNIT CULTURES

tional culture. Some of the most seemingly minor events can have major effects on the organization's performance.

The events started when a pilot wrote up a perceived problem requiring an engine shop troubleshooter to respond. The fully certified engine shop representative, after looking at the problem, returned to his section to gather data to substantiate his belief there was *not* a problem. Only after review of the technical data, and after discussion with supervisors and the engine manufacturing technical representative, did he ascertain the writeup was, as he suspected, not a problem and reflected a normal operation. The situation recounted by the pilot was normal.

The engine technician returned to the crew chief room to make a notation in the Form 781 of his findings. In the presence of the engine mechanic, one of the crew chiefs suggested that since the writeup was not appropriate and, further, it would take a great amount of time to enter the data from the writeup into the computer database "CAMS," his time could be better used performing other maintenance activities.

USAF Photo by MSgt Perry J. Heimer

The engine mechanic reluctantly agreed to the suggestion the page containing only this one writeup be removed from the Form 781. The engine technician clearly should have stopped right there, said "No!" and then called in senior leadership, insisting strong corrective action be taken for the inappropriate suggestion.

Unfortunately, as a team player, we sometimes don't take appropriate actions, and we become a part of the problem. He had seen this same thing happen in the past at his unit, and it seemed harmless in the case at hand. The engine mechanic, armed with all of the technical data, found the pilot in operations, and explained what actions had been taken in response to his writeup. Unforgivably, he did not explain the Form 781 page had been removed. He returned to his shop thinking that was the end of the subject.

Six hours later, the pilot went to the aircraft. While reviewing the Forms 781, he noted the entry he had made earlier was not present. As you might guess, the bad stuff hit the fan, as it should have. Several days later, all of the unit's supervisory elements and the engine technician were in a not-so-friendly group discussing the malfeasance and inappropriate actions of this supposedly outstanding worker. The engine technician, trying to be a stand-up team player, took full responsibility and did not explain the crew chief's involvement at this meeting. He was aware the lead crew chief had been in some trouble earlier and wanted to protect this family man from further reprisals.

The engine technician was given a formal letter of reprimand. To his credit, the engine technician insisted that he be decertified from red X authority and all other certifications until the entire issue could be reviewed. After review, and if appropriate, he would receive training and recertification.

It is still unknown what actions were taken on his co-conspirator — the crew chief. Those actions are, perhaps, unimportant. The engine technician wanted me to tell his story in the hope no one else in a similar situation would make these same mistakes.

By taking some extraordinary actions, management has hopefully corrected the situation at their unit. I am extremely proud of the engine technician for having the moral character to admit his mistake and thanked him for his personal integrity in letting everyone learn from his error. It takes a strong man to admit doing something wrong and a stronger man to allow his example to be used so it doesn't happen to someone else.

This is the right stuff! I pray this experience will influence positive change in unit culture at this and other units and perhaps prevent a mishap which would cost someone their life. We are in a deadly serious business. We must possess the moral strength to do the job correctly and honestly, and this includes the paperwork.

This case also clearly shows how intertwined the human performance issues can become. It shows how strong, even-handed leadership is required in this era of reduced resources and continued high tasking. ✈

It Ain't a Question of Training

CMSGT DON A. BENNETT
Technical Editor

What our enemy fighter pilots might find extremely difficult to do, some of our own aircraft mechanics accomplished quite easily. That feat was to ***knock an airborne F-15 Eagle out of action.***

It just ain't too cool for an F-15E crew to be screaming along at 480 knots only 500 feet off the deck on a night surface attack mission, then suddenly have both scopes go momentarily blank, followed by a multitude of caution and warning lights. And, if that ain't enough headaches for the two crewmen, while initiating a climb to gain altitude, they promptly got an engine fire light to deal with too! (Where's the crew chief or specialists when ya need them, eh?)

After running a few critical action checklists, shutting down the engine, firing off an engine fire bottle, and getting some outside confirmations from the wingman, this particular mishap crew was able to declare an emergency and safely return to base on one engine.

(Maintainers, beware! In the past, other pilots and crewmen weren't as fortunate under similar circumstances. For instance, how many engines does an F-16 or QF-106 have to lose anyway? So please pay close attention here.)

The mechanical discrepancy that contributed to the engine's failure was that there were three little washers discovered missing on the engine's power takeoff (PTO) shaft mount flange, which led to an imbalanced condition and the eventual failures of the PTO and engine. But most disturbing, the reason for the omission of these little, simple, but critical pieces of hardware was that some highly trained, educated, and skilled Air Force mechanics didn't diligently follow tech data and ensure those washers were ***re-installed*** during the last engine change. And what's worse yet is the tech data even had a caution highlighting the critical need for installing these washers to *prevent* exactly what happened in the mishap!

Okay, so the installation mechanics missed a step during the critical tech data-driven installation procedures — mechanics are human and mistakes do happen. But the Air Force realizes humans make mistakes, so it has painstakingly instituted safeguards to catch those mistakes.

So with this in mind, what's incredibly inexplicable in this incident are the following: Where did the installation mechanics think those three extra washers came from when the job was finally completed? Why didn't the red X inspector catch the omission or even question the leftover hardware? The inspector was part of the installation team! And, aren't responsible job site housekeeping and hardware (and tool) controls still unquestionably an absolute must for safe, successful task completions? After all, aren't unnecessary leftover installation parts illuminating signals there just might be something wrong with the finished task? Makes sense to all of us, doesn't it? If not, it should!

There's an additional point of interest that was clearly brought out of this mishap and the reason for the title of this article. The unit also reported the mechanics involved in the last engine change were retrained to prevent recurrences. Well, this corrective action might or might not work for them. Why? Because I believe there's one thing that loudly rings true in most missing hardware-type mishaps — "it ain't a question of training." There may be a lack of maintenance, aircraft forms, or tech data disciplines as well as other maintenance malpractices on the part of the mishap participants, but not training — certainly not in this mishap.

Our field-level mechanics already know about the need for general aircraft hardware when associated with critical aircraft systems or subsystems. And they had better already know how to properly install those nuts, bolts, cotter pins, and washers. Plus, it goes without saying, they must know how to read and interpret tech data. Likewise, these simple maintenance procedures should be easy to retain in knowledge and skills and not require retraining. So, why would anybody suggest a corrective action that had nothing to do with the real reason the mishap occurred in the first place? The missing washers were only symptoms of a much bigger problem — a lack of job site integrity.

Remember: It's advantageous and forever more productive in our mishap prevention efforts to address and fix the true causes of past mishaps, not their symptoms. You can chase those symptoms all you want, but don't stop until you find the root cause. ✈

A PLEA FROM THE TECHNICAL EDITOR

By the way, we at the Safety Center need a gigantic favor from all of you managers and leaders out there. Please make sure the working force levels get the opportunity to read copies of this magazine (including the Air Force's *Road & Rec* magazine) so they might also gain some valuable mishap prevention information, too. Many worker-bee-level maintainers, as well as some operations support folks, have voiced a concern about not getting these magazines in the trenches, where the other half of *your* flight safety team works.

So make sure *everybody* in your flight safety business gets *all* the tools of their trade to gain valuable insight and be continually successful, and that includes *Flying Safety!* You have everything to gain and nothing to lose when you do.

WE'D LIKE TO PUBLISH YOUR STORY!!

We know there are some great experiences out there just waiting to be told, so how about jotting them down.We'd like to hear from you — how you are accomplishing your mission **safely**, or some first-person lessons learned, or some new technological advances, or anything you think will interest the **Flying Safety** magazine audience. Your articles can help us "get the word out" about what's happening in the Air Force.

We accept any length. Double-spaced draft hard copy is fine. Any supporting color slides, color prints or graphics you can contribute are preferred and much appreciated.

You can reach us by mail at HQ AFSC/PA, 9700 "G" Avenue S.E., Kirtland AFB, New Mexico 87117-5670, or call commercial (505) 846-0950 or DSN 246-0950. You can also fax to DSN 246-0931 or E-Mail to hodgep@smtps.saia.af.mil.

We look forward to hearing from you and reading your story!!!

IT'S A PRIVILEGE

COL KEVIN L. DAUGHERTY
AFSC/JA

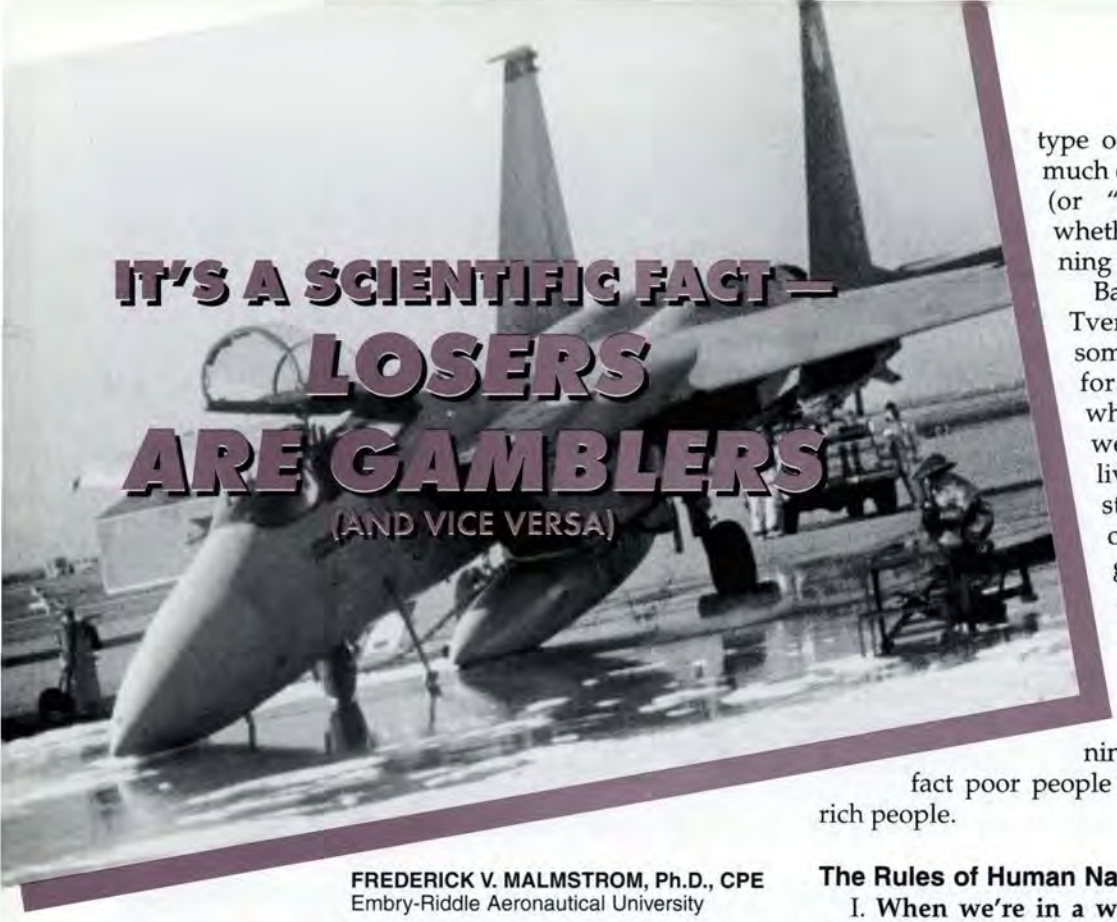
■ Is there a doctor/patient privilege in the life science portion of a safety investigation? When a mishap occurs, the safety investigation process under AFI 91-204 begins, and an investigation into the cause of the mishap is conducted to determine how future mishaps may be prevented. The need to prevent mishaps has been determined to be critical to the national defense; therefore, certain aspects of the process are privileged — that is, they are protected from disclosure or use for anything but mishap prevention. This safety privilege assures the investigation uncovers and considers all available factors involved. The privilege increases the availability of evidence by protecting witnesses' confidentiality, privacy concerns, and the internal deliberative process of the board.

In the life sciences arena, much data is collected from witnesses which frequently is very personal in nature. This is most often done by the medical representative to the board. To overcome the natural reluctance to discuss the private aspects of the mishap individual, these witnesses (frequently the mishap personnel themselves) are given a promise of confidentiality which is, in fact, a grant of testimonial immunity. Their testimony may not be used for any adverse or administrative action or in litigation. These statements may not be handed over to the legal investigation conducted under AFI 51-503, to the press, or other individuals or agencies not involved in the safety process. The witness statement form included within AFI 91-204 informs the witness of these limitations when the interview starts.

Included within the safety privilege is information protected by the Privacy Act. This includes the social security number of an individual, his or her home phone number and address, photographs of a sensitive nature (such as autopsy or other photographs of the deceased), or personal information gained from family members. However, nonprivileged medical information is releasable. Examples include toxicology reports, autopsy protocols, x-rays, lab reports, and death certificates.

Finally, the deliberative process of the board is protected. Those portions of the life science report which go to the board's analysis, findings, conclusions, or recommendations may not be made public. This protection is crucial to fully discuss and resolve issues based on the facts gathered by the board.

The safety privilege is one created by Air Force regulation and recognized by law. This differs from any doctor/patient relationship. No doctor/patient privilege exists under military law. But the medical interviews conducted as a portion of the life science report are privileged by reason of the medical officer's participation in the investigation as a member of the safety board. ✈



IT'S A SCIENTIFIC FACT — LOSERS ARE GAMBLERS (AND VICE VERSA)

FREDERICK V. MALMSTROM, Ph.D., CPE
Embry-Riddle Aeronautical University

The world's oldest sport must surely be gambling. I'd even bet that the first two cavemen watching saber-toothed tigers chasing antelope made bets on the outcome. People even bet money on seemingly odd events like horses running around in circles or what the price of corn will be in 6 months. Sometimes these bets pay off handsomely — other times we end up wearing a barrel.

We humans are naturally prewired to anticipate the future and take risks on the outcome. Risk taking is as natural as our ability to speak. After all, we watch the weather forecast and then take the risk of whether or not to do things like pack an umbrella or even launch a mission. Oddly enough, in the entire animal kingdom, humans are the only animals who consciously anticipate more than 24 hours ahead. This is why we take long-term gambles when we set up savings accounts or invest in college educations.

Who Are These Risk Takers?

We all are. However, some people are born to gamble more than others. For example, research shows that successful entrepreneurs and businessmen are actually quite moderate risk takers. Personality tests historically indicate military pilots are moderate risk takers, too. As you might expect, the laws of natural selection demand that "creative" pilots don't have nearly the life expectancies as "creative" artists.

But being born with the itch doesn't explain everything. Other situational factors can enter into the equation and bring out our natural gambling instincts. The type of risk you take depends very much on (1) how the risk is presented (or "framed") to you, and (2) whether you're in a losing or a winning position.

Back in 1984, professors Amos Tversky and Daniel Kahneman did some clever and useful research for the U.S. Navy — research which helps us understand why we sometimes foolishly place our lives in danger for quite small stakes. Point No. 1 above is sort of like the half-empty/half-full glass point of view — a 50 percent chance of winning can also be viewed as a 50 percent chance of losing. Point No. 2 above means simply whether you are actually in that winning or losing position — it's a fact poor people buy more lottery tickets than rich people.

The Rules of Human Nature and Gambling

I. **When we're in a winning position, we prefer to stand pat.**

II. **When we're in a losing position, we seek out risks.**

Want some examples? Try the exercises in decision making shown in Table 1 (adapted from Tversky and Kahneman [1984]). People overwhelmingly make the choices of options A (84 percent) and D (87 percent), even though it can be shown mathematically that the choices with the highest payoff are actually B and C! (See table 1.)

In the words of the Kenny Rogers ballad "The Gambler": "You gotta know when to hold 'em and know when to fold 'em." Overcoming that basic human urge to pick the losing option must be *learned*. Pilot training is an excellent place to learn this lesson.

This isn't an empty classroom exercise, as people make the same types of seemingly irrational choices when faced with life-and-death decisions. For example, suppose you're faced with a cancer diagnosis and you must choose between:

(1) No operation — you have a 100 percent chance to live at least 6 more months, or

(2) Operation — you have a 20 percent chance to live at least 2 1/2 more years and an 80 percent chance to die within one month. Most of us would (irrationally) take the go-for-broke option No. 2. I bet *I* would.

Emotions Guide Your Bets, Too

Another complication is that people don't take winning nearly to the extremes they do losing. For example, winning $1,000 (although it's admittedly nice), doesn't give us nearly the same emotional high as losing $1,000 gives us an emotional low. We take our losses much

harder than we enjoy our winnings. Figure 1 (also adapted from Tversky and Kahneman) shows the relationship between ***value*** (or emotional investment) and ***gains.*** This is why losing gamblers are much more likely to take enormous risks than are winning gamblers. This is why pilots with sick aircraft are more likely to take risks when attempting to salvage a bad situation. With the benefit of hindsight, wouldn't it have been more logical either to RTB or else simply abort? (See the figure.)

How Should the Pilot Call It?

Let's take Problem 1 down to the pilot's viewpoint. I've rewritten Table 1 into a commercial pilot's dilemma when he or she is faced with a choice between a bonus or a penalty. (The penalty doesn't have to be monetary — a good tail-chewing from the boss will do just as well.) Most of us in this dilemma would be pretty tempted to choose Options A and D, the ones in which winners don't gamble, but losers do. It makes no difference whether we are putting our lives in danger for pretty small stakes. It's part of human nature. (See table 2.)

So, where does this leave us in regard to the risky decisions of whether we push the envelope, fly in bad weather, ignore instrument readings, etc.? The two rules to follow are really quite simple:

I. Know when to hold 'em. Don't even *think* of putting yourself in the position of a loser. Plan for everything you can before you take off. After all, no accidents are ever planned.

II. Know when to fold 'em. Winners have no need to gamble. If you find yourself in a losing position (like facing a late takeoff or a sick airplane), make a firm rule ahead of time that you won't continue on the loser's course and take that risk. This is the time to call off the game. Don't yield to the gambling instinct. Losers are gamblers, and vice versa. ✈

The Author: Fred Malmstrom is a Certified Professional Ergonomist and is retired from the Air Force Reserve.

Table 1

Problem 1. Suppose you are faced with the following pair of immediate decisions. Which of each do you prefer?

Decision 1: *The Sure Gain.* Choose between:

A. A sure gain of $240 (84 percent)

B. A 25 percent chance to gain $1,000 and a 75 percent chance to gain nothing (16 percent)

Decision 2: *The Sure Loss.* Choose between:

C. A sure loss of $75 (13 percent)

D. A 75 percent chance to lose $1,000 and a 25 percent chance to lose nothing (87 percent)

Table 2

Problem 2. Suppose you are faced with the following pair of immediate decisions. In each case, you have the choice of pushing the airplane to the limits of its maximum airspeed when faced with receiving either a bonus or a penalty. Which of each do you prefer?

Decision 1: ON-TIME TAKEOFF. *The Sure Gain.* Choose between:

A. A sure bonus of $240 (if you don't speed)

B. A 25 percent chance at a $1,000 bonus and a 75 percent chance for no bonus (if you speed)

Decision 2: LATE TAKEOFF. *The Sure Loss.* Choose between:

C. A sure penalty of $750 (if you don't speed)

D. A 75 percent chance for a $1,000 penalty and 25 percent chance for no penalty (if you speed)

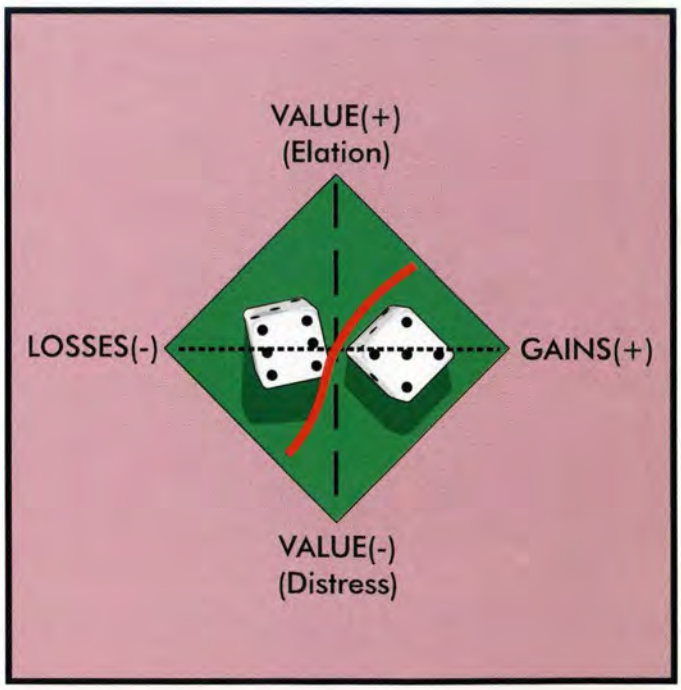


Figure 1.

A Typical Value Function. Note that the value and corresponding emotional investment people place on Losses is proportionately greater than the emotional investment in Gains. We take our losses harder.

OPERATIONAL RISK MANAGEMENT: ORM DECISION-MAKERS' TOOL

MR. JIM QUICK
HQ AFSC/SEPA

The Operational Risk Management (ORM) program has been in the news lately. It was briefed to General Fogleman in January and to all the four-stars at Corona Top in June. Support for continued development of the program and its earliest implementation was universally given. So, what is ORM? How does it apply to you in the cockpit? In the shops? In Civil Engineers? Quite simply, ORM is a decision-making process.

Day in and day out, decisions are made that affect the Air Force mission. These decisions come in all sizes, with all kinds of impact on our mission. They can be lofty and complicated Air Staff decisions to procure weapon systems in the year 2040, or simple, day-to-day decisions that keep airplanes flying, meals prepared, supplies issued, or that affect any of the thousands of situations we face daily while doing our jobs. ORM provides a process through which the system of decision-making can function much better.

Why Risk Management?

If there were no risks, then no decision would have to be made. If no decisions are made, then we do nothing. We'd call this "risk aversive." A typical scenario might be a bad weather situation where activities are knocked off owing to lightning, low visibility, winds, or some other type of environmental factor that poses risks that are greater than the benefits to be gained.

Change this scenario a little, and suppose that the base is under imminent attack. Could we then justify taking risks that might not otherwise be taken? Sure! Launch the fleet! This situation then becomes one in which opportunity is seized, i.e., risks taken, because the risks of operating in inclement weather certainly outweigh the costs, based on an accurate survival (or risk) assessment.

The two situations above require decisions based on an assessment of the risk. The hazard (bad weather) was assessed differently, with the variable being peacetime or wartime operations. The benefits remained the same: force survival. Therefore, we can say that risks have gradients or dimensions that are situationally derived. More on this later.

Operational Risk Management Process

The Safety Center has looked at a lot of risk management programs within the DoD and in industry. There seems to be a common process in successful programs, as depicted in the figure.

This process can be used in any Air Force mission, whether it's flying a mission to the range, putting up a fence, changing a nose-wheel tire, or making procurement decisions on the cockpit configuration of the F-22.

Day in and day out, decisions are made that affect the Air Force mission. These decisions come in all sizes, with all kinds of impact on our mission. They can be lofty and complicated Air Staff decisions to procure weapon systems in the year 2040, or simple, day-to-day decisions that keep airplanes flying, meals prepared, supplies issued, or that affect any of the thousands of situations we face daily while doing our jobs.

The good news: It ain't rocket science, but rather a phased process in which we can look at our mission, in its smallest parts, and make implementation decisions that spell success rather than mishap.

Decision makers are the folks that have the assets to control risk. They may be flight leads, commanders (aircraft, squadron, flight, wing, etc.), supervisors, foremen, work team leaders, etc. Risk control costs something. Frequently, in industry, the cost is money. In a military environment, the cost is often time (flying time or schedule time), procedural or policy change, added technology, facilities, equipment or materials, and sometimes money.

How Is Risk Controlled?

Folks in the workplace are ideally situated to identify hazards and determine their risk. They can also recommend to the decision maker what controls are appropriate. Safety folks figure prominently in the first three steps of the process and are in a key position to recommend to the accountable leader/manager the adequacy and applicability of control measures. The rest of this article will be devoted to a discussion of risk strategies and controls.

Risk strategies are (1) accept, (2) reduce, (3) avoid, (4) spread, and (5) transfer. They are applied when controls are selected. Typical controls are discussed below.

Engineer the Hazards Out of the System. Engineering is one of the best controls in the bag of ORM tricks. The best course is to design a human-operated machine that reduces, avoids, or spreads the risk so that it becomes acceptable.

A good example of an engineering fix is the ground collision avoidance system in the A-10 aircraft. If ground collision is imminent, a voice warning tells the pilot to "pull up." Had this system been engineered into the A-10 during procurement, then the Air Force would not have lost over 30 Warthogs and pilots to controlled flight into terrain.

Guard/Control. These controls affect the environment around the person(s) at risk. They limit exposure, which

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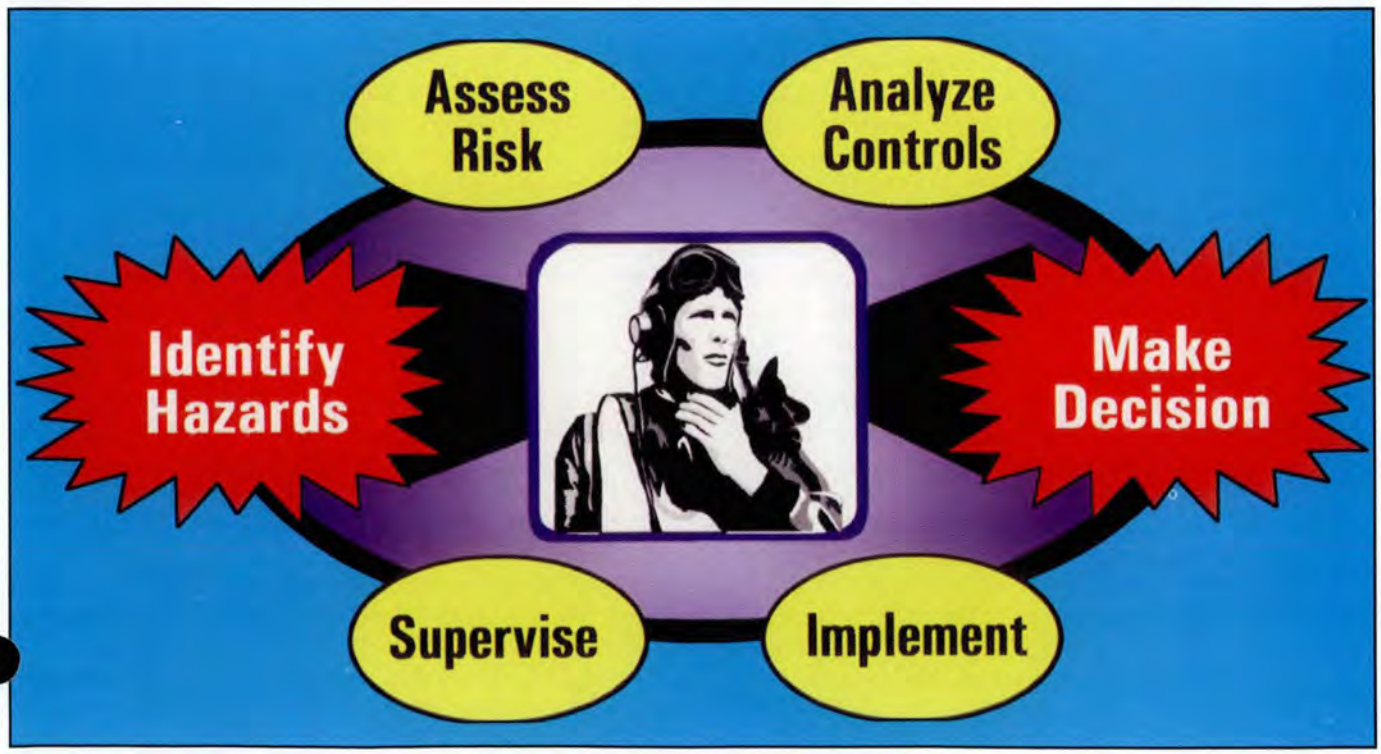

ORM Update

Air Force ORM was briefed to General Fogleman in January 1996 by the Safety Center. He enthusiastically supported the program and requested that AF/SE present the program to the Chiefs at Corona Top in June, where it was well received and supported.

The Air Force Safety Center has written AFI 91-213, Operational Risk Management, and coordinated it throughout the MAJCOM/FOA/ DRUs. It has recently been approved by General Fogleman.

The Center has developed a strategic plan to implement ORM at all levels within the Air Force, beginning with MAJCOM/FOA/DRU training which is slated to begin in August 1996 and continue through FY97. ORM will be included in PME and technical school venues, as well as Safety Education and Training at the Center.

The Army is in its seventh year of risk management. It is imbedded in all Army schools, doctrine, and policy. The results of their efforts are impressive. All safety mishap rates are down, and metrics developed to provide system feedback indicate that operational effectiveness has improved significantly. The Navy is deploying a program that parallels Air Force developments.

in effect spreads and reduces risk to an acceptable level. Examples are the yellow lines on the hangar floor that restrict exposure to those trained in the environment who are equipped with safety gear such as helmets and goggles. The same principle applies tactically when the F-15s provide escort for the strikers.

Distance. Distance can spread or reduce risk by inserting a linear or time dimension to the process. Safe separation parameters during aerial weapons delivery is one example. The antithesis is the Kamikaze technique. Another example of applying distance is the way munitions are stored. Don't put all your bombs in one igloo. Spread them out. Create linear distance between them so that if one blows up it doesn't clean out the entire supply. It's difficult to meet tomorrow's frag if you have to borrow bombs from somebody else.

Time. Time is a critical dimension in risk control and is an outgrowth of ops tempo. We have plenty of evidence that points to the effects of poor time management and mishaps. A direct relationship can be made between rushing and high risk, particularly in logistics-caused mishaps. Taking enough time to do the job right the first time is one of the most effective risk controls we have.

Restrictions and Limitations. These measures are often put in place as a reaction to a mishap. Therefore, they don't conform to process improvement goals, but rather as mishap prevention measures. For example, low-altitude flight operations expose aviators to risk due to ground proximity. If an aircraft hits the ground, a natural assumption is made it was operating too close to the ground. Seems pretty obvious. So, in order to control the risk of another aircraft hitting the ground, operations are restricted to an arbitrary ground clearance, or minimum altitude. Results: Aircraft still hit the ground, and training becomes unrealistic.

Training and Education. These risk controls will always have a viable application. Training and education allows us to accept risk with the understanding that learned folks in the Air Force workplace can manage risk.

Implement Controls. Once controls are selected, then they are put in place. To complete the cycle, review the process to determine if hazards were properly identified, risks assessed, and if, indeed, the controls worked. The ORM process must be continuous. It does not quit until the process stops or the mission is no longer being conducted.

A large number of flying organizations have developed a local risk management matrix that is filled out before a mission. Many of them address things like crew rest, crew compatibility, mission complexity, crew experience, and many other variables. The flight lead or aircraft commander completes the risk assessment which is then given to the next level of supervision for review of total mission risk. Variables are managed to reduce the risk to an acceptable level (as determined by leadership), then the mission is flown. Ideally, after the mission, debriefing will contain a review of the matrix to determine if all the hazards encountered on the mission were identified in the pre-mission assessment and if they were assessed correctly. Controls are also evaluated to determine if they worked or not. Based on this post-mission review of the process, the matrix can be updated to become a more accurate and realistic tool rather than an artificial impediment to the next flight.

To close, ORM need not be a ponderous, time-consuming exercise. Rather, it is an excellent management tool that facilitates sound mission accomplishment... SAFELY. ✈

OPs TOPICS

Bolt Out of the Blue

■ An F-16B pilot was cruising home when his jet was struck by a bolt of lightning which then traveled out his sidestick controller, through his body, and exited the back of his head! (And who said *Viper* pilots don't experience any exciting sorties!) Anyway, he lost 150 feet in altitude when he released the sidestick, but immediately regained it.

The pilot had just entered clouds at 7,000 feet MSL but didn't observe any thunderstorm activities before doing so. In fact, even the weather folks hadn't forecast any thunderstorm activities in the area. The clouds capped out at 12,000 MSL. The pilot stayed VMC the rest of the flight (don't blame him, probably was a little shell shocked). It appeared to be just that — a bolt out of the blue. With lightning, sometimes you just never know for sure when it will jump you.

The jet took the jolt on the right missile launcher rail and canopy, then it traveled into the cockpit to nab the pilot. The pilot will be fine, but the aircraft damage totaled almost $50,000.

Whoa mule!! Doesn't this mishap pilot's "shock treatment" sound a little familiar?

You might remember back in the June 1995 issue of this magazine an article titled "Don't Get 'Shocked Into Action.'" It recounted the story of another F-16 pilot receiving a similar shock aftermath. However, it wasn't lightning that generated the initial electric juice — his cockpit canopy did! His shock wave did, however, enter his body when he rested an arm on the cockpit "towel rack" and also exited out the back of his head. Hm-m-m-m. Interesting.

In that particular incident, the electric shock was generated by the steady deterioration of the canopy's gold solar coating causing the canopy, over time, to charge up like a capacitor. Of course, when the pilot's arm rested on the so-called "towel rack" inside the cockpit, the static charge offloaded on the poor, unsuspecting pilot.

So what's the common denominator between these two shocked pilot mishaps? Static charges, canopies, and arm-to-head discharge route. One would wonder if the lightning-struck jet's canopy might have also added to the lightning's route of travel. Maybe there's something to this familiar route of static discharges. And if there is, let's hope there's some way to prevent or divert the static charge from routinely using the pilot's body, i.e., his head, as its path of least resistance!

All right, all you fine depot engineers, MAJCOM weapon system managers, item managers, and creative crew chiefs should be able to solve this one in "short" order. Thanks!!

Pilot Credits Physiological Training

A single-pilot aircraft experienced a rapid depressurization at 24,000 feet because of a failed canopy seal. The pilot credited his refresher physiological training for the safe recovery of himself and the jet. You see, there were extenuating circumstances preventing the normal recovery reactions of this hypoxia situation. This pilot was definitely in a bind.

Immediately upon the onset of his hypoxia symptoms, he gang-loaded his oxygen regulator and started monitoring his rate and depth of breathing. But because he was on an NVG (night vision goggle) Operation Southern Watch mission, the theater's rules of engagement prevented him from descending below his assigned 24,000 feet altitude. Minutes later, he experienced a steady, low-profile headache, but he had no other symptoms. The "Loss of Cockpit Pressurization" checklist didn't provide any recovery of pressurization, so he was exposed to the decompression until he was eventually able to leave the area and descend.

The cool-headed pilot finally made it out of the restrictive area 10 minutes later, declared an emergency, and performed an uneventful straight-in landing to his deployed base. The flight surgeon met him on engine shutdown and soon began observations and treatment for possible decompression sickness and dehydration.

This air warrior can credit the life support folks and his single-seat physiological training all he wants to because they definitely deserve the high praise, but the fact still remains — all the quality training in the world is for naught if it's not responsibly received and professionally employed.

Credit *all* where credit's due. "Way to go, sir!" ✈

The AF Flight Standards Agency

Instrument Quiz

CAPT JEFF KING
HQ AFFSA/XOF

■ This month let's all take a nostalgic trip back to the "good old days" when you were flying Tweets. (For some of you, the "good old days" aren't that far away!) Somehow, you managed to convince your ops officer to let you fly to beautiful Newburgh/Stewart International Airport in New York. Since the mighty Tweet has no TACAN and only one VOR receiver, the only published approach available is the "VOR or TACAN RWY 27." During your amazingly thorough mission planning session, you check the NOTAMs and discover that the Kingston DME is out of service.

Now, armed with this information, the big question is "Can you fly this approach?" Before you answer this complex question, many sections of the approach need to be reviewed. For those of you who need guidance, the process is described in AFMAN 11-217's paragraph 8.6.2. When you are through reviewing the approach plate, test your instrument IQ by answering the following questions.

1. Can you "cross-tune" to identify the SCRUG intersection (FAF)?
A. Yes
B. No
C. It depends

2. What are the straight-in landing minimums for your category B aircraft?
A. 940 feet
B. 1,040 feet
C. 1,220 feet
D. 1,100 feet

3. How is the MAP point defined for this approach?
A. Timing
B. DME
C. Radar
D. Cross-tuning off CMK VORTAC

4. Can the T-37 comply with the published missed approach instructions?
A. Yes, but on a hot day it may not make it to 4,000 feet by IGN.
B. No, a TACAN is required for the missed approach.
C. Yes, but the holding requires DME.
D. No. T-37s never comply with published missed approach procedures.

5. Now, let's return to the original question. Can you fly this approach?
A. Yes
B. No

BONUS: What is the minimum weather required to file to Stewart International?
A. 800-1 1/4
B. Vis-Only: 1 1/4
C. VFR
D. 500-1

ANSWERS

1. **(B)** Yes. AFMAN 11-217, Volume 1, Instruction Flight Procedures, paragraph 14.1.1.1, second bullet states, "Once the aircraft is inside the Final Approach Fix, one navigation receiver must remain tuned to and display the facility which provides final approach guidance." For this approach, this means we can use the CMK R-321 to identify SCRUG, but cross-tuning cannot be used thereafter. (If your AFMAN 11-217 doesn't reflect this change, refer to AF/XOO message 142012Z JUN 96.)

2. **(C)** 1,220 feet. Because we can't identify the step-down fix at 13.3 DME, we cannot descend to the TACAN or DME minimums of 940 feet.

3. **(B)** DME is the only way to identify the MAP. Some of you may be saying, "Since I know the distance from the FAF to the MAP is 3.8 nm and I know my groundspeed, I can make up my own timing to identify the MAP." **NO, YOU CAN'T!** Check AFMAN 11-217 again. Read the note following paragraph 14.1.1.2.2, "If timing is not specifically depicted on the instrument procedure, timing is not authorized as a means of identifying the missed approach point (MAP)."

4. **(A)** Yes, this is the easy question. Reviewing the missed approach procedure is a traditional weak area during approach plate reviews.

5. **(B)** No. Paragraph 8.4.1 of AFI 11-206 states that "an operational facility, with a published instrument approach capable of being flown with the navigational equipment aboard the aircraft must serve the destination." Since you cannot identify the MAP (DME OTS), then you are not authorized to use the approach.

BONUS. **(C)** VFR. According to AFI 11-206 paragraph 8.4.2, if there is no published approach, then pilots "may file IFR to a point en route (where forecast weather is VFR at the time of arrival) or to a point served by a published approach procedure (where the pilot can make a descent to VFR conditions) and then continue under VFR to the destination." ✈

Somebody Failed an Integrity Check!

■ Well, here's another case of an unknown careless mechanic performing unsafe maintenance, this time on a C-130 *Hercules*. The flight crew was fortunate enough to be flying around the airfield instead of over a vast ocean, hours away from an emergency landing. Regardless of minor damage costs, this was a warning signal for the mishap unit — a signal that can't be ignored!

The crew was doing a touch-and-go when the No. 3 engine instruments started acting up, followed soon after with the right inner and outer wing overheat lights coming on. As they began the overheat checklist, the No. 3 engine "FIRE" light lit up even though there weren't any visual signs of a fire. Next, the crew unsuccessfully tried to get the engine bleed air valve closed. They finally had to perform an emergency engine shutdown.

Official USAF Photo

Despite the overheat lights going out, both engine fire extinguishing bottles being discharged, and no visual signs of a fire, the engine "FIRE" light stayed on. After the aircraft landed safely, the unsafe maintenance was discovered on the No. 3 engine bleed air shutoff valve.

An installation clamp for the shutoff valve was found at the bottom of the horse collar area. Apparently it had become disconnected. This let the extremely hot bleed air escaping from around the valve melt some engine instruments' wiring, and heat damaged the shutoff valve itself. Although there weren't any signs of an actual fire, the potential for one was very high. We all (especially the flight crew) were lucky — this time!

The clamp disconnected because a mechanic had severely stripped the clamp's retaining nut threads. There were other indications of overtorquing — the nut head had been rounded out, and the nut's bottom surface had been badly scarred. Of course, the locking integrity of the nut was lost and, consequently, the nut backed off and allowed the clamp to fall off. Just imagine — a simple little nut worth a couple of cents contributing to a $18,000+ mishap bill!

The last maintenance performed in the area was during an isochronical inspection several months before the mishap. The aircraft had flown only three other sorties since then, but that was probably enough flight time to vibrate the nut off the clamp stem. No documented work had been accomplished on the bleed air shutoff valve itself, but that doesn't necessarily mean it really wasn't done. (We've had many past ground and flight mishaps caused by faulty work that wasn't documented in the aircraft forms.) It is known, however, that general inspect and repair-type maintenance was indeed accomplished.

There's not a mechanic worth his or her salt who wouldn't have known the nut and/or bolt is probably stripped out when they're cranking down enough to cause this kind of extensive hardware damage. The fact the nut couldn't possibly be tightened or snugged down properly was probably enough of a hint to warrant a replacement of the hardware. And believe it or not, nuts or bolts with this significant thread damage *aren't* going to be tightened to specific or generalized tech data specs — except maybe in cases of cross-threading.

From the top of the C-130's wing to the iso dock's bench stock was only a "hop, skip, and a jump" away for a replacement nut. What was it that kept the mechanic from expending a little extra effort to fetch a replacement nut? Proficiency? Complacency? Rush-itis? Or

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maybe the worn out excuse of OPS TEMPO? Regardless of how rushed we think we are, the fact remains if we don't do it right the first time, *every time*, we can expect to suffer the consequences later. Unsafe maintenance can and will come back to haunt us! It's a fact we need to remember every time we turn a wrench!

The success of the USAF and the lives of our people depend upon your professional pride, integrity, and skill. We ask for a lot, but we can afford nothing less. Either you have these professional traits or you don't — how say ye? When was the last time you did a self-assessed integrity check?

Well, then, what are you waiting for? Do it now!

The Washerless Viper Caper

From time to time, mysterious circumstances have caused an in-flight or ground mishap that, despite our best investigative works, defies identification. This is one such case.

An alert and inquisitive F-16C *Viper* crew chief was performing a thru-flight when he discovered one of the horizontal stab's bearings had come loose and caused over $60,000 in damages to the surrounding airframe. Further inspections revealed the stab's support bearing had one of its retainer nuts laying inside the panel. The other two retainer nuts were completely missing. None of the three bearing bolts had the required washers installed. It's no wonder, with this much missing hardware, the bearing eventually came loose and wasn't supporting the stab to the bulkhead.


Official USAF Photo

The aircraft's historical maintenance records didn't surface any unit maintenance performed in the damaged area. In fact, there wasn't any documented maintenance, depot or otherwise, being done since the stab was originally installed by the manufacturer. However, the unit also checked with a depot modification center about any work they may have done in that particular area of the stab. But again, no documented work was found.

As a precaution, the unit inspected the rest of their jets and found one of two other jets returning from the same depot modification center also had deficiencies with horizontal stab bearing retainer nuts. A total of four retainer nuts was discovered loose. Again, neither the unit nor the depot had any documentation of repair work being performed in the affected areas. There weren't any more deficiencies with the rest of the unit jets.

Besides the obvious damage on one jet and the loose or missing stab bearing retainer nuts on two jets, the only common link between the two jets was the same depot modification. Another jet that also had the same mods completed didn't have any deficiencies at all in the mishap area. Of course, this working hypothesis was abandoned because of the lack of any known work in the area and supporting documentation.

Anyway, the unit felt the bottom-line reason for the bearing retainer nuts coming loose is unknown. This really smarts a little, considering preventing mishap recurrences is our goal when conducting mishap investigations. But, we can't learn a lesson if we don't know what the lesson was, right?

"Hats off" to the unit for thoroughly beating the bushes for an answer, despite the dead-end finish. Hopefully, their suggestion to the responsible agencies to keep an eye opened for the possibility of further deficiencies on jets leaving the depot mod center might reopen a closed avenue.

There was, however, an extremely valuable bit of information that was revisited and once again highlighted by this mishap unit's investigation. ***Even the smallest pieces of neglected hardware can cause dangerous, life-or-death situations for our pilots and aircrew members — the same kind of unnecessary, preventable situations the Air Force flying community totally entrusts our aircraft maintainers to prevent.*** ✈

"It is better to be careful
a hundred times
than to be killed once."

Mark Twain