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MX & Maintainers

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THE ISSUE:

Cover: USAF Photo by MSgt Perry J. Heimer

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PEDs: A Continuing Saga

Courtesy ASRS *Callback*, Mar 99

■ The new rules governing Passenger Electronic Devices (PED) seem to have lessened the frequency of PED-related reports to ASRS. But we still occasionally hear about PEDs, including this unusual incident experienced by an air carrier captain:

While at cruise, we experienced multiple spontaneous disconnects of the left, center, and right autopilots over several hours of flight. After due consideration of the sequence of disengagements, starting immediately after I had authorized the use of PEDs…I made an announcement asking that all PEDs be secured. All passengers complied.

The anomaly continued. I asked the lead flight attendant [FA] to make a more rigorous check of the cabin. She reported that there was a passenger who had a significant hearing impairment requiring that he use a hearing aid with headphones. The microprocessor was carried in his shirt pocket. Without it, he could not hear at all. Recalling…that PED interference is normally very site specific, I asked the FA to move the passenger forward…six rows. No further interference occurred for the balance of the trip.

The only reason I did not have the passenger turn off his device was my concern with his being able to hear and follow instructions from the FAs in the event of an emergency. Also, since we had no further instance of disengagement, and retained the option of securing the device since we knew what the culprit was, I was very comfortable with this course of action.

The captain adds that an extensive check of the autoflight system was performed later to confirm that there was no mechanical anomaly.

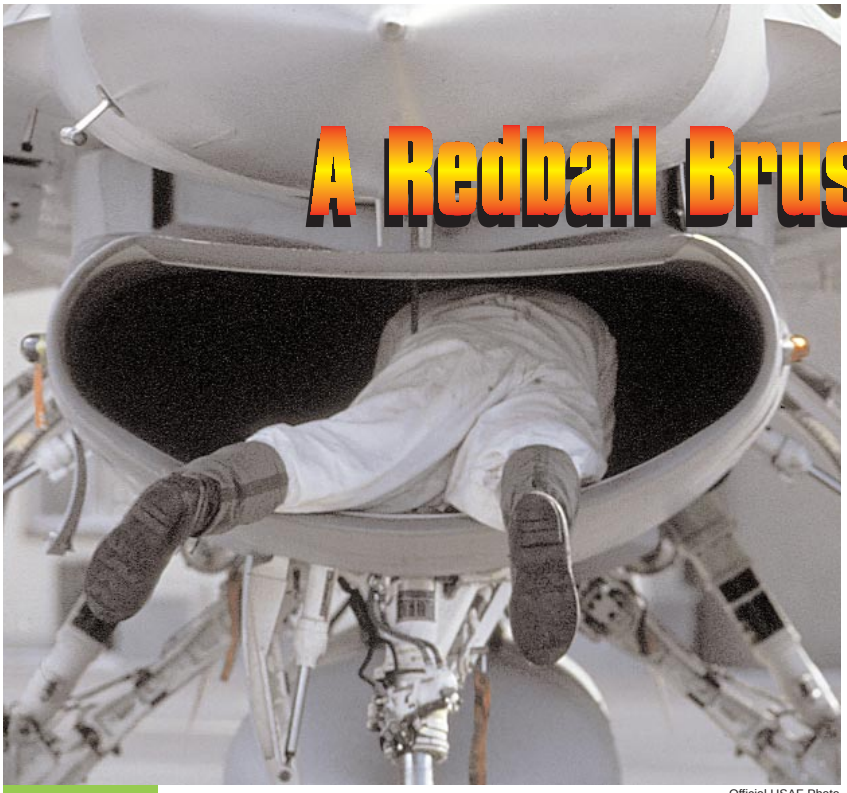
GPS-timate

In another incident, a first officer reports that the suspected source of interference with his jet's navigation system involved a passenger's "guessing game."

Aircraft equipped with IRS and FMC. Once airborne, I confirmed IRS/FMC nav functions were working normally by using the fix page and raw data. [During] the climb, both the captain and myself noted the FMC was not auto-updating itself. About this time, we received a "verify position" message from the FMC. The left and right IRS claimed the actual position was 3.8 and 3.4 miles, respectively, 90 degrees to our left.

We were going to complete a position shift exercise when we noted we had auto-updating functions back and the FMC was correcting itself. Later in the flight, a flight attendant called and asked our ground speed. I told her it was 389 knots. She stated she had lost a bet because a passenger had guessed 388 knots. I asked her to ask the passenger if he had a GPS. The passenger said yes. I asked her to tell the passenger to turn it off and keep it turned off.

The flight continued uneventfully. At deplaning, I found out that the passenger was employed by another airline. ■



Official USAF Photo

A Redball Brush With Death!

CMSGT(S) MICHAEL J. MLODZIK
372 TRS/Det 15/CCS
Kadena AB, Japan
Courtesy *The Combat Edge*, Feb 99

The sun was shining along with a refreshing breeze—it was beautiful outside. We were flying pit-n-goes. It was to be no different that day, except we had to divert an F-16 aircraft back to chocks when it squawked Code-3 after hot-pits.

Have you ever been rushed to get that sortie? Have you ever pushed the limits of time to meet that takeoff? Well, let me tell you about an event where both of the above-mentioned questions almost killed a friend of mine. It was a normal flying day; launch the jet, scramble the people to the hot-pits, manage the lunch schedule, and recover the aircraft.

The sun was shining along with a refreshing breeze—it was beautiful outside. We were flying pit-n-goes. It was to be no different that day, except we had to divert an F-16 aircraft back to chocks when it squawked Code-3 after hot-pits. With the Production Super's quick thinking, everyone's objective was to fix the aircraft while the other jets were refueling. If we could repair it in time, the jet would then be able to meet up with its four-ship at the end-of-runway. We envisioned success. We hoped we could fix the aircraft and avoid the stigma of a Ground Abort and the additional workload for swing shift. Clearly stated, "We wanted this jet to take off!" We had the knowledge, enthusiasm, and people to prove it!

The crew chief shut down the aircraft, and the specialists approached the aircraft with computers and technical data in hand. People galore were focused on getting the aircraft fixed and turned. We wanted to make sure we did all we could, so there were actually more people than required to turn the jet. It's one of those precautions maintainers take—the more resources, the better the chance we have of turning the jet in a shorter period of time. There were five or six people with speedhandles opening the panels, and at least seven other people performing odds and ends in an organized fashion. It was like a well-oiled machine; it was a routine redball. Everybody knew what their specific task was. We were professionals of the trade and kept the mission in mind—generate the aircraft!

As the specialists were reprogramming one of the aircraft's many computers, the crew chiefs were taking oil samples and roving over the aircraft accomplishing the thru-flight inspection. Then, one of my coworkers went down the engine intake to do an inspection. There was lots of noise from the -60 ground power unit, too many people to keep track of, and everyone was in a hurry. The situation was prime for a catastrophic event. You could almost feel it in the air.

The specialists were done reprogramming the aircraft, and (in order to save time) the plan was for the pilot to perform the operational check "after" engine start. By doing this, we were confident we would make the sortie without a deviation to the flying schedule. The aircraft panels were going back up, and the Production Super was waiting for the technicians to complete the forms. The crew chiefs were doing their last foreign object check and cleared the area for engine start. The pilot remained in the cockpit during the redball, and the technicians were scrambling everywhere doing their tool inventories—entering and clearing forms entries. Then the Production Super gave the "thumbs up" to the pilot indicating the forms were cleared, and the jet was good to go.

The pilot switched on the main power switch and established communication with the crew chief. The crew chief cleared the pilot forward and aft; the pilot commenced to start the aircraft. He switched the jet fuel starter (JFS) switch to Start 1, the doors opened, the JFS began to spin up, the specialists had their fingers crossed, and the

sound of a successful redball fix was in the air. The technicians were anxiously awaiting idle speed for the operational checks.

Then—all of a sudden—we saw legs dangling from the intake lip. Next, a whole body appeared! Scrambling for his tech data, mirror, and flashlight, my coworker finished his intake lip inspection and quickly cleared the area. The launching crew chief, standing at the left rear of the aircraft, never saw what was going on—neither did the pilot. However, everyone standing around and sitting in their trucks saw the unthinkable—somebody was in the intake safety zone! For those of you who don't know the F-16 aircraft, it's like a giant vacuum with more suction than you would believe. We almost had a mishap due to the enthusiasm and drive we had in proving we could generate that aircraft, not to mention overlooking certain critical supervisory responsibilities on the part of the person in charge of the aircraft.

Immediately a small convention formed at the right rear side of the aircraft, the engine was started, and nobody could hear a thing. Arms were in the air with lots of shouting going on. Everybody was kind of in a mode of shock, but we continued with the mission and got the jet rolling. Nobody really realized the impact of what had just transpired because there was still too much confusion. My friend jumped in the Production Super's truck, and you can imagine the verbal words that were flying around. Needless to say, articulate expressions were bounding off the windows and dashboard. They stared at each other in disbelief, shook their heads, reaccomplished the forms, inventoried the tools, and the jet rolled on time.

What is the lesson here? We are commonly faced with challenges, and as maintainers, we routinely perform redball maintenance. However, we don't normally push the envelope on killing our friends (i.e., those people who work for us, with us, as well as those we work for). In this case, the redball forced too many people into a chaotic situation. Even though everyone's heart was in the right place, the job was rushed, the paperwork wasn't completely finished, and the "thumbs up" was given too early. If you determine—at any point in time—that continuing an ongoing operation is unsafe, you need to speak up and say, "Stop! This is unsafe!" Each of us is empowered to help prevent a major catastrophe, especially when a person's life is at stake.

How many times have you heard or read the following quote: "Not a single sortie we fly is worth compromising the integrity of an aircraft or the life of an airman." Folks, no sortie is worth it! We pushed the envelope that day, and it almost cost us the life of a fellow airman. Just for your information, my friend came out of the intake and performed a surrounding area intake inspection before he ran to the back of the aircraft. From his actions, you may ask, "Why didn't he try to stop the operation?" Well, he had the same mentality everybody else did at the redball—"Let's get the sortie!"

Interestingly enough, one thing that remains a mystery to me is that the pilot (our squadron commander) never knew what was going on until he returned from the sortie. We thought it was best that way—you know, keep his mind on flying and stuff like that. Sure, he saw lots of people scrambling, but he got the "thumbs up" and pressed on as if it were business as usual. But when he returned from the mission, guess who was waiting to brief him on the almost fatal mishap? You guessed it—ME! However, before I got a word in, he mentioned how professional we were during the redball and that he was impressed with our hustle to fix his aircraft. At that time, I didn't have the heart to say anything, but I had to anyway. When I told him about what had transpired, I saw his eyes well up and a lump in his throat form that wouldn't go down easy.

Talk about embarrassing on my part—but that wasn't the half of it! The incident was a devastating blow to our commander's confidence in our safety practices. I often think back to the situation and wonder how we could have prevented it. Have you ever seen the professionalism, pride, and drive of maintainers? We want more than life itself to get a jet airborne.

We find ourselves "jumping through hoops of fire" to make things happen. But one thing I can't emphasize enough is the fact that with all our drive and experience, we need to remember that we can still control the situation by limiting the number of people in an area and—most of all—by understanding what is going on around us. Know who is where, what forms need to be completed, and ensure you are doing the job right, by the book, and as safely as possible. Sure we had to start back at ground zero to regain our commander's confidence level. But most of all, I'm glad my friend is still with us. So next time the fire gets hot in a redball, try mellowing it out with a cool head. Somebody's life depends

How many times have you heard or read the following quote: "Not a single sortie we fly is worth compromising the integrity of an aircraft or the life of an airman."

SPARE PARTS

About 1 minute into refueling, fuel began to gush out of the vertical stabilizer, onto the flight deck.

AD1(AW) K. D. JOHNSON
AD2 BRIAN HILDRETH
Courtesy *Mech*, Jan-Mar 99

Six weeks into a WestPac deployment, Talon 201 developed a fuel-vent gripe. Power-plants troubleshooters looked over the bird during a fast turnaround and determined that the external fuel tank on station 3 was not pre-checking properly. We removed and replaced the tank before the next event, but not in time to refuel and check it; the pilot was already doing his walk-around inspection. He manned up and started the Hornet's engines.

The fuel crew arrived and began hot pumping. In door No. 8, the red vent-tank-wet light illuminated. The ground crew assumed the light would go out as soon as the vent tank had been scavenged. About 1 minute into refueling, fuel began gushing out from the vertical stabilizer and onto the flight deck. The ground crew stopped refueling, and the pilot shut down the engines.

After shutdown, a power-plants supervisor requested a complete de-fuel and a re-spot into the hangar bay to do a pressure-refueling test with electrical power. During the test, we determined that fuel cell No. 1 was taking fuel aboard under pressure with the refuel valve in the closed position on the digital display indicator.

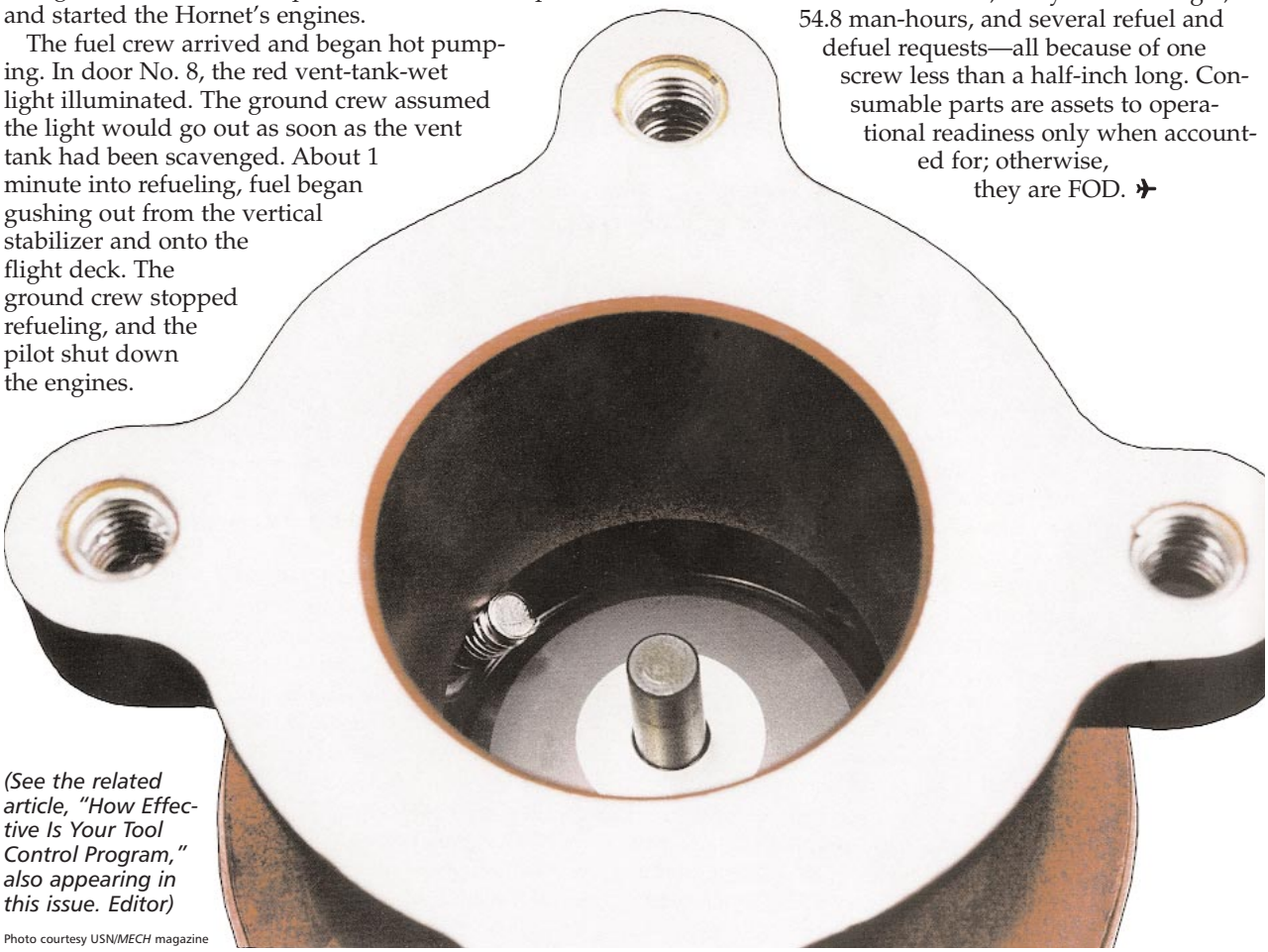
After defueling, we opened the No. 1 cell, purged it, and had the gas-free engineer check it for safe entry. We isolated the cause to No. 1 cell's fuel-level-control shutoff valve and high-level pilot valve. We removed and replaced the shutoff valve.

Inspecting the valve we'd removed, we saw a hex-tip cap-screw lodged in the inlet side of the fuel-level-control valve, jamming the valve open. The jammed valve caused cell No. 1 to overfill and vent overboard. We removed and replaced both valves and inspected cell No. 1 for a missing cap screw. All hardware and fasteners were accounted for and secure.

We couldn't determine whether the screw came from an outside source during refueling or from the aircraft's fuel system. We inspected cell No. 1 to be sure it was free of FOD and closed it. Our refueling pressure test checked good, and Talon 201 was ready to fly.

Results

One lost sortie, 5 days in the hangar, 54.8 man-hours, and several refuel and defuel requests—all because of one screw less than a half-inch long. Consumable parts are assets to operational readiness only when accounted for; otherwise, they are FOD. ✈



(See the related article, "How Effective Is Your Tool Control Program," also appearing in this issue. Editor)

Photo courtesy USN/*MECH* magazine

Maintenance Officer Perspective:

An Aircraft Mishap Safety Investigation Board

USAF Photo by MSgt Perry J. Heimer

CAPT ERIC TURNBULL
21 AF/LGMW

Completing the Aircraft Mishap Investigation Course (AMIC) at Kirtland AFB makes you vulnerable for a no-notice call to investigate an aircraft mishap. My call came 2 1/2 years after I attended the course when our safety officer walked in and said that there had been an aircraft mishap. He said they needed a maintenance officer for the Safety Investigation Board (SIB). I was the only one qualified, I was the only one available, etc., etc., etc. But I didn't need convincing—it sounded exciting! A damaged aircraft on a high-visibility mission in a remote location. Knowing it was a once-in-a-lifetime opportunity, I was raring to go.

Getting There

Unlike some of my fellow SIB members—who had only 3 hours before leaving—I had plenty of time to prepare. It would be 24 hours before I departed. During that time, I made travel arrangements, picked up some extra clothing (winter weather gear), gathered all the data I could on the mishap, made arrangements for the two evening classes I taught, and canceled an upcoming training course.

A lot went through my mind while traveling to the mishap location. I spent the time reviewing the materials given during AMIC and a sample mishap report I got from our safety office. This was very helpful. While every investigation is unique, there will always be similarities. Understanding how a SIB Report is put together, and how a final report should look, helped me frame my role and put that of the SIB in better perspective. After nearly 24 hours of traveling by train, plane, automobile, and boat, I arrived at the mishap location.

I was initially dismayed to discover that personnel had "contaminated" the investigation site and were trying to move the damaged aircraft off the runway. But considering that the aircraft was blocking the only available runway and had closed the airfield, this was understandable and unavoidable. As the senior maintenance person on the scene, it was my responsibility to take over and ensure the aircraft was removed from the runway safely. This took priority over the investigation, and for good reason: We didn't want to cause another mishap. It's more important to make sure that things are safe, even if it does mean contaminating some of the evidence.

What I Learned as a SIB Member

The mishap aircraft had sustained major landing gear damage, so a *lot* happened over the next few weeks as we conducted the investigation to zero in on factors that could have caused it. What follows, in no

continued on next page

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particular order, is a list of lessons I learned and some helpful hints that could help you when you get "the call." They're tailored toward SIB investigations, but would be beneficial in any mishap inquiry.

- Start with known facts and work backwards. Keep asking, "Why did this happen?" It'll help you get closer to the root cause and may help you rule out nonfactors.
- Keep an open mind. Anything is possible. Even after you start focusing on one cause, keep looking at other possibilities. Try to rule out what you can, but keep in mind that some things may come back to be a factor as more evidence surfaces.
- When looking for the root cause, one or more of the following factors are typically involved—crew error, maintenance practices, design flaw, manufacturing error, and acts of God.
- Brainstorm for factors that could play into the area you're concentrating on. For example, if you're investigating landing gear damage, you should look at all aspects of landing gear "care and feeding." Here would be a few things that one should consider: tire condition and pressure; strut pressure and X-dimension; how recently the landing gear was serviced and lubricated and if it was serviced properly; brake condition; hydraulic components for proper operation, proper servicing, leaks, and fluid contamination; and TCTO completion status.
- Remember: The SIB team will brief the final report to the MAJCOM commander. Even if the root cause appears obvious, ask yourself what possible questions that four-star may ask during your briefing. Try to answer them beforehand. Being asked if you looked into this or that possibility by a MAJCOM commander, and having to answer "No," could prove pretty embarrassing. Moreover, what got overlooked *may have been a factor in the mishap,* and you'll have missed your opportunity to look into it.
- The quality of your briefing and the final SIB report reflect the quality of your investigation, so spend sufficient time preparing them.
- Check aircraft forms for "who did what" in the area of your investigation, and photocopy the forms. You'll need the data for your report after the aircraft has been released back to the home unit.
- Check the aircraft's maintenance history using the automated CAMS/G081 system for significant actions or events related to the damaged area. List all TCTOs related to the damaged area.
- Interview people who worked in the area and check their training records. Give them privilege to speak freely and ensure they understand that your reason for questioning is strictly for fact-finding, not disciplinary, reasons.
- Take note of all improper maintenance practices and other discrepancies, even if they aren't a factor in the mishap. You may uncover things that the home maintenance unit doesn't know about—but should—to prevent a different type of mishap.
- Use all available resources—manufac-

Official USAF Photo

turer, SPO, the owning unit, headquarters, etc.—to gather data and get information. This enables you to get the info you need quickly and allows you to crosscheck it for accuracy. It also makes everyone a little smarter.

- Work quickly to gather data. Immediately after the mishap, finding and sending you the data you need is everyone's priority, so the longer you wait to ask for it, the longer it will take to get it.
- Don't rely on one person's word as the only possible answer. Check other sources and compare. The person could be mistaken or may feel compelled to take a "best guess," neither of which does you any good.
- And in line with the previous suggestion, don't be mistrustful in the extreme. In my experience, I found that everyone involved had a sincere desire to provide honest, factual information and data that would help determine why the mishap occurred. But do be mindful that it's not always easy for someone to admit he made a mistake. For instance, an assertion that a known problem was previously identified to higher headquarters for their decision should be verified.
- Keep other board members informed of what you learned during daily meetings. They'll help ensure you don't overlook anything.
- Decide what types of lab analyses need to be done. Contact the Air Force Safety Center to find out where to send parts and/or fluids. Contact the lab(s) so that they'll know what to expect when the parts and/or fluids arrive.
- You don't have time to do all the legwork yourself, so delegate. Use the host unit's resources whenever practical. Task *them* to ship parts or fluids to the lab (follow up to make sure shipping did take place). Task the host unit to submit deficiency reports and help collect historical data. *But don't be a thorn in the host unit's side.*
- Expect a lot of changes. Our transportation procedures for sending a part to the lab for analysis changed *five times.* Also, keep size and weight limits in mind when using commercial shipping companies.
- Expect a lull in the action. You'll be working at high speed and then come to a near standstill waiting for lab analyses or outside data to arrive.
- A laptop computer is almost a necessity, but if one will be available at your destination, make arrangements to use it. It'll be one less thing for you to worry about carrying with you to the mishap location.
- Dress for the environment.
- Plan on being gone for 30 days and working long hours.
- Finally, pick up birthday and anniversary gifts and cards in advance, and don't forget to call home!

Summarizing the Experience

It was great to finally put my AMIC training to use. Serving as a Safety Investigation Board member will no doubt be frustrating at times for you, as it was for me. You've gathered data and analyzed it to arrive at a reasonable conclusion, only to have something shatter that conclusion and require you to start over again at square one. I believe, though, that ultimately you'll come away from it feeling that it was a hugely rewarding endeavor, especially when everything "comes together" as you uncover the root cause of the mishap and make recommendations that will prevent future mishaps. It's a great experience and a rare opportunity. If your safety officer pays you a visit, *don't pass it up!* ✈

It was great to finally put my AMIC training to use. Serving as a Safety Investigation Board member will no doubt be frustrating at times for you, as it was for me.

Capt Turnbull is an aircraft maintenance officer with more than 14 years' aircraft maintenance experience. He wrote this article while assigned to the Logistics Division at Air Mobility Command's Twenty-First Air Force, McGuire AFB, New Jersey. Capt Turnbull has since PCS'd to Ramstein AB, Germany.

WHY BOTHER WITH ORM?

Although not a "new" concept, ORM merely offers a more formalized process that can be easily understood and used daily by anyone in their job.

MAJ PHILLIP P. TABER
8 AF/SEF
Barksdale AFB, Louisiana

During the past year, I have taught operational risk management (ORM) to more than 800 people as part of the 8th Air Force ORM Roadshow. While some embraced the ORM concepts enthusiastically, I encountered many skeptics who thought this was just a passing fad. Although I truly believe in the concepts and tools provided within ORM, my belief is irrelevant. You must decide for yourself.

Just Another Fad?

The idea of weighing risk and balancing it against a desired outcome or mission is not a new concept. Many personnel have used some form of risk management with great success throughout their careers. Although not a "new" concept, ORM merely offers a more formalized process that can be easily understood and used daily by anyone in their job.

Why go to the pain of formalizing this systematic process of risk management? Primarily, because not everyone understands or uses the concepts of risk management—not everyone possesses this "sixth" sense often referred to as common sense.

Common Sense

One of the most common reactions to ORM is, "It's just common sense." On the surface, this reaction seems rational and logical; however, military and civilian mishap statistics reveal that over **80 percent of ALL** mishaps are *a result of or can be attributed to* human factors/error.

A review of these mishaps normally reveals an *obvious* absence of common sense in combination with other human inconsistencies that caused the human error mishaps. A lack of *apparent* common sense can simply be described as not possessing a systematic or logical process to analyze and manage risk.

Just What Is *Common Sense*, Anyway?

Quite often the term "common sense" is overused, or used out of context. How do you define common sense?

Some would suggest common sense is simply possessing situational awareness, while others would define common sense as the ability to apply sound and consistent judgment regardless of formal education.

For the sake of this discussion, we will assume you are new to your unit and are attempting to learn a new task for which you have no previous exposure. Without some type of directions or formal guidance, you would likely develop your own technique or set of directions through trial and error. Even with technical directions or technical orders (T.O.), you would still lack the depth of knowledge required to complete this new task with the skill and efficiency of a craftsman.

A true craftsman represents the culmination of countless iterations of experimentation, searching for efficiency and mastery of a craft or process. Craftsmen know the

"tricks of the trade" which were handed down to them from their mentors or teachers—from craftsman to apprentice. What is *common sense* to a craftsman is not necessarily *common sense* to an apprentice. Only after you observe and work with the craftsman do you begin to fully understand and learn their *secrets* and, in a sense, graduate to their level of *common sense*.

Trial and Error

Currently, the US military is facing monumental challenges in trying to accomplish its mission in the face of shrinking budgets, extremely low retention rates, and high operations tempo. We can no longer afford the luxury of allowing our "apprentices"—the young and inexperienced personnel—to become "craftsmen" through trial and error.

Unlike the previous "days of Camelot," the abundant supply of parts, equipment, and experienced personnel no longer exists. The exodus of our experienced personnel (craftsmen) is dramatically lowering our corporate knowledge. Without the benefit of our craftsmen, we are forcing our apprentices to perform at levels previously reserved for our most experienced personnel.

To prevent or lessen the mistakes made during the inevitable trial-and-error process, we must capture and transfer our collective experience and craftsmanship to our apprentices, thus avoiding potential losses to our combat resources—our personnel and equipment.

The Perfect Tool

ORM uses numerous tools which are perfect for capturing and retaining valuable experience before it is forever lost. Many of the ORM hazard identification/analysis tools, such as the Operations Analysis, Preliminary Hazard Analysis, Change Analysis, or the "What If" Analysis, are ideal for capturing and incorporating the irreplaceable wealth of experience and knowledge still in the military. These types of structured tools are far more reliable in securing information than current processes, such as word of mouth or out-of-date continuity books.

Can Common Sense Be Taught?

It would be simply naïve to imply everyone who enters the military understands the concepts of risk assessment and possesses a systematic approach to risk management. Most basic/entry-level technical schools currently teach a compliance-oriented/"no brainer" concept of safety. While this isn't a completely bad mindset, it's sometimes too rigorous and doesn't allow any room for flexibility and adaptation in a rapidly changing environment, such as contingency operations.

Additionally, pure compliance-oriented safety can have a negative impact on mission outcome. This is one of the reasons personnel are willing to ignore or violate T.O.s or existing safety procedures during "real world" operations to ensure mission success.

In contrast, formal ORM emphasizes mission success through the identification and control of hazards/conditions that could lead to mission failure. Although not the focus of ORM, safety does indirectly benefit. How many times have you heard, "If you do the smart/tactical things, safety will take care of itself"? Lower mishap rates are a by-product of ORM—not its focus!

Bottom Line

ORM is not just another management initiative or safety program designed to be eyewash hanging on the wall for an inspector, or an annoying, time-consuming paperwork drill. Once fully implemented, ORM can provide the backdrop and tools to maximize combat capability and ensure mission success! ✈

FLY SMART—FLY TACTICAL—FLY SAFE!

About the Author: *Maj Phillip P. Taber is currently the Chief of Flight Safety for Eighth Air Force at Barksdale AFB, Louisiana.*

ORM uses numerous tools which are perfect for capturing and retaining valuable experience before it is forever lost.

USAF Photo by SMSgt Boyd Belcher

Error Management

Error management targets the gap between errors and their consequences.

USAF Photo by SrA Jeffrey Allen

J. T. RAGMAN

Error is universal. Error is inevitable. One cannot engage in human performance of *any* form without human error.

"Error Management." The phrase struck me as a bit odd. However, after 8 hours of the mandatory "Error Management" class, I emerged with but one question: "Why had I waited 19 years to hear this for the first time?"

"Error management" represents a fundamental shift in aviation philosophy. The first and most basic premise of error management is that human error is universal and inevitable. Error management views human performance as a two-sided coin—human performance and human error. The coin's two sides are inextricably linked. We cannot have one without the other.

Consider our history within the Air Force. Our flight safety reports offer ample evidence that the finest, most qualified aircrews, having received the finest training from the finest instructors and evaluators, operating the finest equipment, outfitted with every conceivable safety feature, and flying under the most favorable circumstances—still commit errors.

Error is universal. Error is inevitable. One cannot engage in human performance of *any* form without human error.

A second, and equally critical, premise of error management is that error *does* not, *has* not, and *will* not cause an incident, an accident, or a fatality. *Consequences* cause incidents, accidents, and fatalities. While error is universal and inevitable, consequences are *not* universal or inevitable. The logic of this premise is beyond dispute. Errors happen all the time. Incidents, accidents, and fatalities do not. Error management targets the gap between the errors and their consequences.

Error management holds the view that *any*

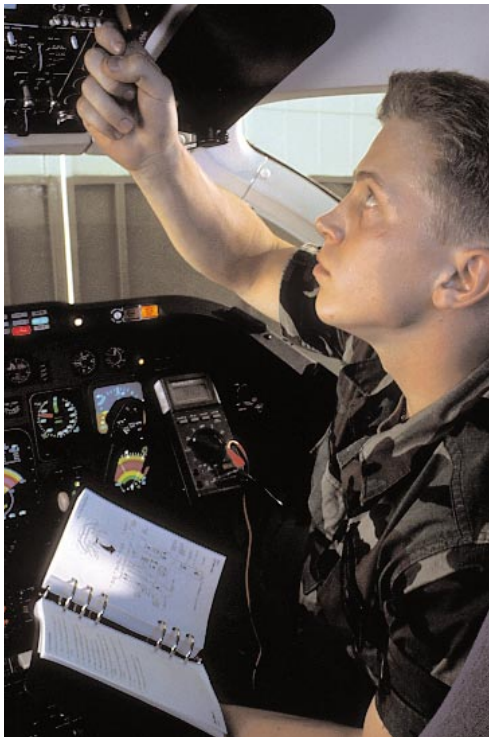
attempt to address flight safety which does not acknowledge universal and inevitable human error will fall short of the mark. Just as the successful treatment of alcoholism must be based upon a sincere acknowledgement of the problem ("My name is…. I am an alcoholic"), so too any attempt to address human error must likewise be based upon a sincere acknowledgement that error is both universal and inevitable ("Every member of this crew will commit an error on this flight").

What do we gain as an aircrew when we acknowledge universal and inevitable error? Is this merely an exercise in psychology? Not at all. The acknowledgement removes the stigma associated with error. It *depersonalizes* error. The focus shifts from "my/his/her/error" to simply *"the error."* Error is no longer a reflection upon the crewmember. Just as the sun will rise in the east and set in the west, errors will occur. (A caveat: Error management is not a license to "skate." Error management assumes technical proficiency. Technically proficient crewmembers commit errors. Incompetent crewmembers shouldn't be flying airplanes.)

This notion of universal and inevitable error runs counter to traditional aviation thought. From our first days of flight training, our instructors have spoken of the "error-free flight" and how we would "water the evaluator's eyes" with a flawless performance. The focus was generally upon error *prevention,* via this procedure or via that technique. As students, we bought into the notion of the error-free ride. And one day, years later, as an instructor or evaluator, we too preached the virtues of an error-free ride. Error management speaks in terms of a *consequence-free ride.*

While instructors and evaluators sought to produce the *error-free ride* via this procedure/technique, aircraft designers and human factors folks likewise sought the *error-proof aircraft* via this safety feature or that enhanced system design. Consider the progression from barometric altimeter, to radar altimeter, to ground proximity warning system, to the recent unveiling of the "enhanced" ground proximity warning system. Despite the efforts of instructor and designer alike, *error remains a constant.*

Many of us bought into a very simple algebra lesson: If A = B, and if B = C, then A = C. Put another way: *If I am an excellent crewmember (A = B), and if excellent crewmembers commit no errors (B = C), then I commit no errors (A = C).* Organizations have frequently chosen to write this simple algebra lesson in stone, as manifest in their flight standards departments. Here is an example from one major airline's Flight Operations and Training Manual:



USAF Photo by MSgt Fernando Serna

> EXCELLENT: All checklists performed flawlessly. All crew briefings conducted perfectly. All ground and flight maneuvers performed exactly as specified. No perceptible deviations in planned versus flown altitude, heading, airspeed. No performance data errors.

Notably absent is *any* acknowledgement of error. Indeed, the only mention of error is the statement "no performance data errors."

Error management is a rewrite of that basic algebra lesson: *I am an excellent crewmember (A = B). Excellent crewmembers commit, recognize, and resolve errors (B = C). Therefore, I, an excellent crewmember, will commit, recognize, and resolve errors (A = C).*

How do we get from the first algebra equation to the second algebra equation? How do we reverse the "error-free ride" mind-set? Each of us has likely rewritten the equation within our own minds: We are excellent crewmembers, yet we commit errors whenever we fly. We intuitively know error is not incompatible with excellence. However, as aircrew members, we do not operate within our own minds. We operate within

continued on next page

Checklists are not merely checklists. Rather, they catch the universal and inevitable errors and prevent consequences. Standard operating procedures are not merely "standard." Rather, they too catch these errors and help prevent consequences.

Crewmembers can commit error and still be excellent crewmembers. Commission of an error is not a reflection on the crewmember, while a failure to recognize and resolve error in a timely manner or a failure to properly employ the tools of error management *does* reflect upon the crewmember.

the context of a crew. And, within the context of a crew, we frequently encounter the "error-ego" linkage, the "screw-up" stigma, the "my/his/her error" reality. Enter the organization.

The organization, be it airline or squadron, plays a key role, for the organization can influence which version of the algebra equation governs our operation. Back to our earlier quoted major airline and excerpts from its revised Flight Operations and Training Manual:

EXCELLENT: Errors are recognized and resolved immediately.

ABOVE AVERAGE: Errors are recognized and resolved in a timely manner.

AVERAGE: Errors are recognized and resolved so that safety of flight is not diminished.

In each of the above standards, error is explicitly acknowledged. Error is universal and inevitable. Crewmembers can commit error, and still be excellent crewmembers. Commission of an error is not a reflection on the crewmember. But a failure to recognize and resolve error in a timely manner, or a failure to properly employ the tools of error management, *does* reflect upon the crewmember.

By "de-coupling" the person and the error, eliminating the stigma and rightfully labeling error as universal and inevitable, the organization enables—indeed *energizes*—aircrews to openly and jointly "manage" their errors. Rather than each individual aircrew member debating his/her response to "my/his/her error," the entire aircrew works together to manage "the error."

An NTSB study of 37 major accidents suffered by US air carriers between 1978-90 in which the aircrew was cited as causal found 84 percent of all errors committed by the aircrews went unmonitored/unchallenged by fellow crewmembers. This is a mind-blowing statistic. Consider for a moment the role stigma and ego may have played in that startling 84 percent statistic. Would an error-management mindset have prevented any of these accidents or saved any of the lives lost?

An organization which "talks the talk" with explicit acknowledgement of error, as our major airline example has done with its Flight Operations and Training Manual rewrite, must likewise "walk the walk." Enter the evaluator/check-airman. The yesteryear check ride debrief was likely a recitation of errors. The evaluator might have sat down with a cup of coffee, pulled out a list of errors, and opened with, "Okay, let's talk about what went wrong today." Or the evaluator might have opened with, "So, Julie, how did the ride go today?" Julie's response would generally have resembled a list of errors, arranged in neat, chronological order. In both cases, the focus of the debrief was on the errors, with perhaps a discussion of how to prevent such errors in the future.

A check ride debrief under the error-management philosophy would focus not upon errors but upon management of those errors. This form of debrief illustrates the changing roles under the error-management philosophy. Crewmembers become the primary error detectors/correctors (previously an evaluator/check-airman role), while evaluators/check-airmen become error-management observers (a previously nonexistent role).

Any aircrew on any particular mission can employ the error-management philosophy. Any crewmember can convey the simple message: Error is universal and inevitable. The sun rises, the sun sets, errors happen. No stigma. No ego. Manage the error. Target the consequence.

While error prevention has a worthy role in flight safety, error management takes a lesson from history (error is universal and inevitable) and focuses not upon the error but upon the interval between error and consequence, with the goal of minimizing the number and severity of consequences.

If we envision universal and inevitable errors flowing, as in a river, toward consequence, error management seeks to "resist" the flow with speed bumps, checkpoints, dams, and barriers. Aircraft manufacturers, flying organizations, and the aviation infrastructure provide numerous tools with which aircrews may attempt to "resist" error. These tools include checklists, standard operating procedures, flight manuals, training, cockpit design, redundant systems, stall margins, limitations, GPWS, TCAS, FARs, gear warning horns and lights, navigation aids, takeoff configuration warnings, and ATC radar. Each of these "resist" tools can "trap" an error and avoid a consequence.

Crewmembers bring tools of their own: crosschecks, preflight preparation, focus, teamwork, communication, discipline, little reminders, personal bottom lines, systems knowledge, and lessons learned. These tools "resolve" or "trap" errors which manage to work their way through the "resist" tools. Missed the hydraulic pumps on the in-range checklist, but caught them with your little

reminder ("gear, flaps, hydraulics") at 500 feet. Inadvertently exceeded a limitation, but caught the overspeed in your cross-check. Missed the gust increment on the ATIS, but good teamwork on the part of a fellow crewmember corrected the threshold airspeed on final. TCAS failed to warn of an intruder, but your lessons learned (see and avoid) spotted the intruding aircraft. GPWS failed to warn of steeply rising terrain, but your preflight chart study was warning enough. Inevitable errors, avoidable consequences.

On any given day, several aircrews may commit a given error (failure to select hydraulic pumps at top of descent), yet only one lands "gear up" as a consequence. Dozens of aircrews may commit another error (misinterpret an ATC clearance), yet one aircrew suffers the consequence and perishes through controlled-flight-into-terrain. A few crews may commit still another common error (failure to select takeoff flaps during taxi), yet one aircrew experiences the consequence of fatal rotation and climbout. Error management does not focus upon the error—for many aircrews commit the same error—but upon the management (or mismanagement) of those same errors.

Error management gives new meaning and breathes new life into often mundane elements of flight safety. The elements of flight safety come to life, leaping from the pages and shouting, "We have meaning, we have a mission, we are your friends, we resist and resolve error, we prevent consequences!" The flight safety tools of the trade enjoy the luxury of a specific target (error) and an active mission (avoid the consequence). Checklists are not merely checklists. Rather, they *catch the* universal and inevitable errors and *prevent* consequences. Standard operating procedures are not merely "standard." Rather, they too catch these errors and help prevent consequences. Equally so with cockpit design, limitations, teamwork, focus, communication, systems knowledge, and preflight preparation. Target the universal and inevitable error. Avoid the consequences.

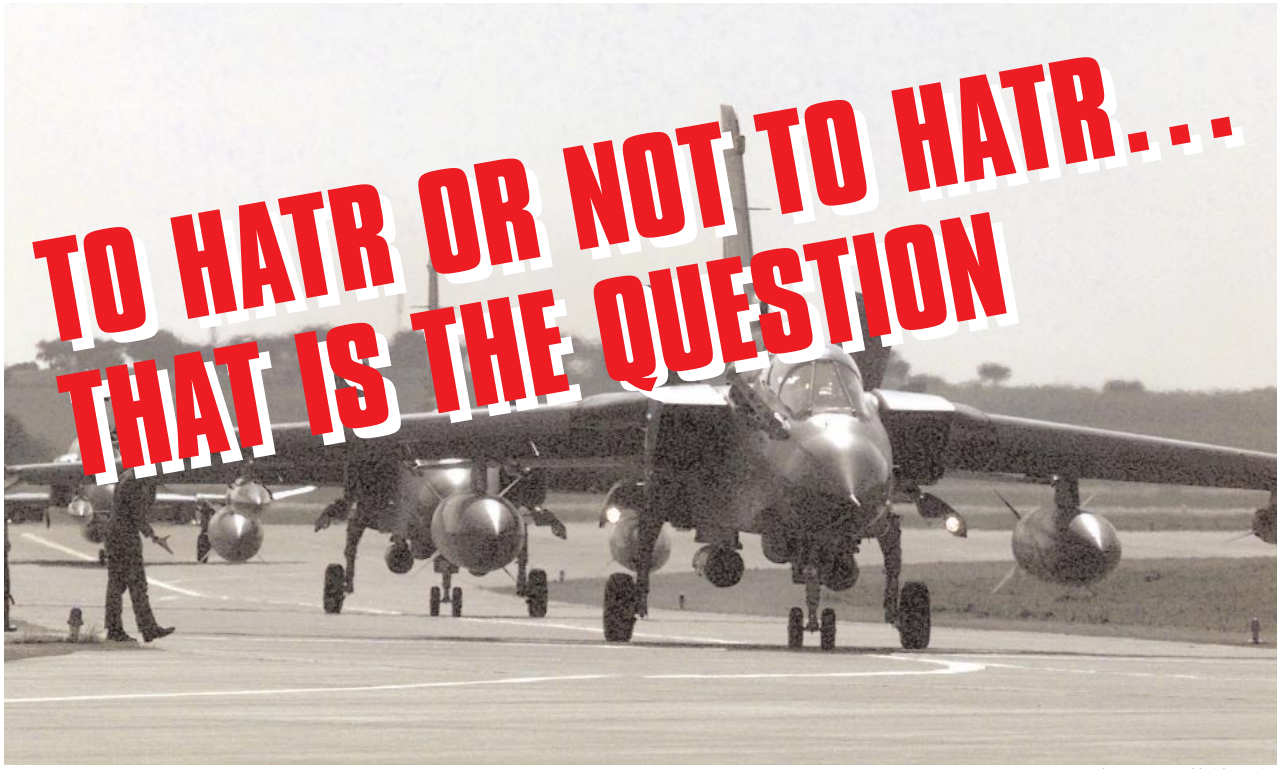
Indeed, "error management" is an odd-sounding phrase. One can easily envision a "psych-type" or an "MBA-type" tapping away at a keyboard as he or she develops the concept. However, error management is, first and foremost, an aircrew concept with a series of messages crewmembers know all too well. Error is universal and inevitable. Eliminate stigma. Depersonalize error. Rewrite the algebra equation. Manage the error. Target the consequence. ✈

FLY SAFE.

("J. T. Ragman" is a pen name. The author is a C-130 pilot in the Air Force Reserve. He is also a Boeing 757 pilot and Human Factors instructor for a major airline.)

Any aircrew on any particular mission can employ the error-management philosophy. Any crewmember can convey the simple message: Error is universal and inevitable. The sun rises, the sun sets, errors happen. No stigma. No ego. Manage the error. Target the consequence.

TO HATR OR NOT TO HATR... THAT IS THE QUESTION



USN Photo By PH1 Todd Cichonowicz

This base was in enemy hands during Desert Storm, and much of it was wrecked, including the control tower. Through the efforts of our Kuwaiti Air Force hosts, the base is slowly and steadily being rebuilt.

MAJ DOUG "CODE" MORSE
Chief of Safety
9th Air Expeditionary Group
Ali Al Salem Air Base, Kuwait

It was a dark and stormy night at the 9th Air Expeditionary Group, Ali Al Salem Air Base ("The Rock"), Kuwait. Navigating my way through Windows NT, I surfed upon a Hazardous Air Traffic Report (HATR) that my predecessor, Maj Robert Duncan, had written. He described a scenario where a flight of GR-1 Tornados played chicken with a C-130.

This base was in enemy hands during Desert Storm, and much of it was wrecked, including the control tower. Through the efforts of our Kuwaiti Air Force hosts, the base is slowly and steadily being rebuilt. The Kuwaitis currently operate out of an adequate, but short, provisional tower while awaiting the construction of a taller permanent facility. As it is now, rows of sunshades—large, carport-type metal structures, designed to shield aircraft from the constant sun—block the controllers' view. Since the tower is "vertically challenged," controllers are unable to see about 50 percent of the runway and parallel taxiway (yes, that's right, **half** of the runway isn't visible from the tower).

Everyone who's been in the tower remarks, "One day we're going to have an accident." However, this hazard has been around for years. The controllers' can-do attitude means they work around the hazard so often that it becomes routine. "One day" nearly came. Here's what happened.

After landing, Flash 06, a C-130, rolled out into the tower's blind spot. Since the parallel taxiway was partially closed for construction, the normal procedure was to back-taxi down the runway to parking. Flash 06 started executing a 180-degree turn **on the runway** before receiving clearance from the controller. Tower told Flash 06, "…continue ahead to end of runway." Flash 06 had almost completed the 180-degree turn by this time and **assumed** tower meant for the C-130 to **continue** back-taxiing. Because the controller couldn't see the aircraft, he **assumed** the C-130 had exited the runway. The tower controller attempted to confirm the C-130 was clear by saying, "Confirm active clear." Flash 06 responded with "Active's clear, and confirm we are cleared to back-taxi to exit the runway."

Due to the communications mixup and because tower didn't have a visual on the C-130, the controller subsequently gave per-

mission for a flight of two British GR-1 Tornados to take the active. (It's not known if tower cleared the Tornados onto hold or to take off.) So, we had a C-130 going beak-to-beak with two Tornados. Fortunately, the C-130 back-taxied far enough down the runway that the controller could see the aircraft, hold the Tornados, and direct the C-130 to exit the runway. No harm, no foul.

All players could have chalked it up to bad luck and hoped it would never happen again. (This has never happened, right?) Instead, a forward-thinking C-130 Aircraft Commander stepped up to the plate, opened himself up to a little embarrassment, and filed a HATR.

Now you know the (nearly) sad story, but there's more. Among other things, the HATR investigation concluded:

1. The taxiways weren't marked or labeled by alphanumeric identifiers. If they had been, it would've been easier to communicate and confirm the clearances (i.e., "Flash 06, continue to departure end of runway and exit at taxiway Alpha).
2. If the controller had seen Flash 06's rollout, the miscommunication would have been obvious, and the situation would never have developed.
3. If the aircrew had known the tower had a significant blind spot, they may have communicated more carefully with the controller.

In a few short months, there have been significant improvements to safety here at Salem—all because someone took the effort to file a HATR. With Kuwaiti Air Force assistance, the taxiways were labeled, allowing aircrews and controllers to refer to the same sheet of music. The new taxiway designations are already included in the 9 AEG Salem In-Flight Guide. A camera system is also being installed so tower controllers can see the entire runway. A Flyer's In-Brief is required for all 9 AEG aircrews as they rotate into Salem. Due to frequent turnover, this "lesson learned" would eventually be lost unless passed on to incoming aircrews. The Flyer's In-Brief stresses current tower visual blind spot and language challenges. In other words. the HATR resulted in real and significant changes for the better.

Besides the obvious communications buffoonery, I've learned a lot about the pitfalls of working at a bombed-out air base. Operating at Salem requires extra diligence and good judgment. Crews should expect unusual things to happen and be flexible enough to work around problems. To safely do the job requires creativity, hard work, and aggressive ORM.

I've also learned the power of the HATR; how it can educate, and be a forceful engine for change. The HATR is a tool for ANYONE to highlight a potential problem. Unfortunately, many changes brought about by unsafe practices occur AFTER a mishap. Wouldn't it be better to raise the flag and enact change without having an accident first?✈

(Much thanks to TSgt Athena "Alpha X-ray" Cody and TSgt Robert "Mike Echo" Moore for their Air Traffic Control expertise and assistance with this article.)

USAF Photo by SrA Richard M. Heileman

Due to the communications mixup and because tower didn't have a visual on the C-130, the controller subsequently gave permission for a flight of two British GR-1 Tornados to take the active.

Little-known HATR factoids, according to AFI 91-202, *The US Air Force Mishap Prevention Program:*

- Report the HATR on AF Form 651 within 24 hours to the nearest US Air Force Base Safety Office after landing.
- The investigating safety office must send a preliminary or final message within 10 work days.
- Individuals who submit HATRs are granted immunity from disciplinary action if:
  - Their violation was not deliberate
  - They committed no criminal offense
  - No mishap occurred
  - They properly reported the incident

Take Another Look—Self-Assessment

CAPT GLENN E. BROWN
352 SOG
RAF Mildenhall, United Kingdom

Not another survey, you say! Can you remember the last time you were handed a survey inquiring about your number of trips to the store, your eating habits, your exquisite taste in the latest fashions? When was the last time you were asked specifically about your job, FLYING? Were you asked before or after the investigation?

How many people have been through either a safety investigation or an accident investigation as either the interviewer or most likely the interviewee? Hasn't happened to you yet, you say. What if someone asked you about your job—FLYING—and asked for inputs on how to improve your work day/environment/routine. Ease the pain of flight planning. Reduce the number of TDYs. Provide an avenue for your opinion without attribution.

Each and every flier I know has a routine. They eat, sleep, and converse, some more than others. In that daily routine, we perform our jobs as aircrew members and oftentimes think of our preparation for flight and duties in flight as routine. Our job is not routine—it's familiarity that makes it seem like what we do is routine. Within those routines, how can we improve them?

As commanders, evaluators, or safety personnel, how do we know when a process is not correct or out of alignment and needs a little adjustment? We all know our own routines and when they are disrupted. Have you ever thought, "D---! That wasn't right! We shouldn't have flown that close to the tower (other aircraft, tree)!" If this happened to you, be guaranteed it has happened to someone else.

Okay, you've had a break in your routine and are going out on a limb thinking this same break in routine may have occurred to another flier in your squadron. How do you bring it to the boss's attention? You were just at the bar last week and heard Danny tell the boss about flying within 20 feet of another airplane on extended final, and boy! did the commander take his head off! "What do you mean you almost had a midair? Weren't you paying attention?" Come to find out the controller was in training and had become overtasked. Of course, this situation is fictitious. A commander would never take your head off for a near miss!

How do you bring issues to your supervisor, your stan/eval rep, your flight safety officer, without incriminating yourself? How does your commander, stan/eval rep, flight safety officer assess your routine, flying environment, base, airfield, aircraft, supervision, and your operations tempo?

How do you perform a self-assessment? What is a self-assessment? How do you conduct a self-assessment? Who sees the self-assessment? Can you effect change?

A self-assessment can be as simple as looking at one's career, routine, personality, and identifying the good and bad past experiences. What do I mean by looking at one's career? Self-reflection is an attempt to look at one's past today to change or effect change tomorrow.

I know everyone is familiar with the adage, "Those who cannot remember the past are condemned to repeat it." By taking the time to assess where one has traveled to determine where he is,one can attempt to get to where one is going. Oh, not so, you say! And you are right! You do not have to reflect on your past to make it through another day. You only have to continue to wake up. However, to positively CHANGE tomorrow, or to make an improvement, you must reflect on your past. Now you know the simplicity of a self-assessment, Grasshopper! It does not involve risk matrices, it does not involve higher math or flow charts. It does involve reflecting on your past experiences.

Conducting self-assessments can be as simple as that. A survey can achieve similar results by asking aircrew where there are problems in the system and what they would change.

Step 1. Work with commanders to develop a survey that reflects issues concerning the environment the squadron operates/deploys/employs into. If you do not get the commander's support, it could make implementation of changes hard. Tailor the survey to fit the unit. Make it simple, and make it short. Provide room for comments and encourage comments when administering the survey.

Step 2. Administer the survey to as many people as possible. Your goal is 100 percent of the fliers. Administer it in one setting, and allow sufficient time to complete the survey.

Step 3. Ensure confidentiality! Tell each person who completes the survey who will see the results. Ask to include names if they want a response. Do not fold when a commander asks who said what. Ensure commanders are briefed on confidentiality prior to administering the surveys.

Step 4. Provide feedback as soon as possible to commanders and aircrew. Let them know what they have identified as risk factors. You may want to identify biases or place weighting factors later. A breakdown of the number of crew positions that placed high risk against a factor may place more weight on a factor. For example, if four out of five crew positions on a five-crewmember aircraft placed the highest number against this factor. Or identifying experience levels by hours may add weight to a risk factor. For example, there were 20 percent of the most experienced (i.e., crewmembers with over 5,000 flying hours) aircrew who placed the highest number against a specific risk factor. However, DO NOT start a front end/back end war by placing blame on other crewmembers for their shortsightedness. It defeats the survey purpose, which is feedback.

Step 5. FOLLOW UP! You will possibly identify areas you have no control over. Work the issues you control. Ask your supervisor/commander for guidance/assistance on how to tackle the problems not within your authority. At a minimum, emphasizing the areas identified as high-risk factors creates awareness! If you are conducting a survey for squadrons from a group perspective, tackle the issues at the group level, identify issues at the squadron, and assist the squadron FSO. Do not, however, step on the squadron's toes. You may not be asked to come back. You may also have misidentified risk factors. Let the squadron CC/DO ask for your help. If you choose to fall on your sword for an issue of importance, you may want to use the following guidance: When falling on your sword, (1) make sure it is worth it, (2) make sure someone sees you, and (3) make sure you don't miss.

Step 6. Reevaluate your survey once the results are in and you have forwarded your results. It may not have been the all-encompassing survey you desired. You may want to add or take areas away from the next survey.

Step 7. Take another look. Conduct the survey again, perhaps in a year's time. Reevaluating/reflecting on how you do business is an important goal in self-assessment.

Who should conduct a survey? A commander may direct stan/eval or flight safety. Either office is qualified to conduct a survey. Both offices are needed to effect change and enforce decisions.

The bottom line is to be proactive and conduct a survey to eliminate risk factors in your flying environment *before* a mishap occurs rather than after you lose an aircraft or crew. You may not be able to make all the changes you identify. Your efforts may increase awareness of the risk, a major part of the risk management process. ✈

Editor's Note: *This article was submitted for publication in* Flying Safety *in 1996. It was misfiled and recently rediscovered. Our apologies to Capt Brown.*

FLIGHT SAFETY SURVEY

Crew Position _____ Total Hours _____
Hours in current aircraft _____

Of the factors listed below, provide a rank for each of the following areas from (0 through 5) with "5" being the factor(s) most likely in your opinion to cause the next mishap.

_____ Bird Strike
_____ Human Factors—Overaggressive flying/lack of aircrew discipline
_____ Human Factors—Incompetence/Lack of systems knowledge
_____ Human Factors—Fatigue
_____ Human Factors—Complacency
_____ Instructor's Action—Not stopping a student from dangerous action
_____ Mechanical Failure—Broken part/no one's fault
_____ Mechanical Failure—Improper maintenance
_____ Midair Collision—Between aircraft in formation (same aircraft)
_____ Midair Collision—Other aircraft (refueling, gliders, fighters, etc.)
_____ Mission—Inherently dangerous/cost of doing business (risks)
_____ Mission—NVG-related problems/illumination/visibility
_____ Mission—Emphasizing the mission/sacrifice safety
_____ Mission Planning—Inadequate mission planning due to time
_____ Mission Planning—Inadequate support for mission planning
_____ Supervision—Pushing too hard
_____ Supervision—Too casual
_____ Scheduling—Poor crew mix
_____ Scheduling—Poorly thought-out mission
_____ Student's action—Doing something dangerous
_____ Training—Inadequate permanent party continuation training
_____ Training—Inadequate student training (upgrades, theater indoctrination)
_____ Weather—Thunderstorms/hail/lightning
_____ Weather—Turbulence/winds
_____ Weather—Visibility problems
_____ Other

Comments:_____
_____
_____

(Optional): Name_____ **Duty Phone:** _____

How Effective Is *Your* Tool Control Program?

MR. BOB BLOOMFIELD
GE Aircraft Engines Field Service Representative
HQ AFSC

Tool control has been with us for more than 30 years. In that period of time, tool control programs have been responsible for significant reductions in aircraft mishap rates. Tool control is an integral part of the young technician's training and is a staple in everyday maintenance, from the flightline to the back shop to the depot. We inventory our tools, account for our consumables, and even count the rags we take to a job. All is well in the world of tool control—or is it?

During a recent phase inspection on an F-16, the lube and scavenge pump filter was removed. Caught in the filter screen was a $^{9}/_{16}$-inch, six-sided, nonlocking nut. "Good catch," you say? Well, not really. "Lucky catch" is a better description. Take a look at the pictures below.

How much longer do you think it would have taken for that nut to finish punching through the screen? Once through, the nut would have entered the lube and scavenge pump cavity itself. Luckily, the phase inspection was pulled 31 hours early. When I heard about this case, it triggered a memory for me.

Photos courtesy Mr. Tom Hartstein, GE Field Services Rep

This same type of thing had happened before at another base 5 years ago.

We weren't as lucky then. The nut made it through the screen, lodged in the pump, and caused it to seize. Once the pump seized and stopped providing lube oil to the engine's bearings, *they* seized, followed a short time later by the engine itself. This type of event is known as a Non-Recoverable-In-Flight Shut-Down (NRIFSD). In a single-engine fighter, this is not good. Fortunately, our pilot was able to locate a runway and make a successful deadstick landing. Considering an NRIFSD event in an F-16 results in a Class A mishap more than 75 percent of the time, I would say we were very fortunate.

As I researched the archives further, I discovered this situation has occurred at least two other times. On one occasion, an engine was in the back shop for repair at a USAF base. A nut was found in the filter screen and removed before it could migrate and do damage. On the second occasion, in a foreign military F-16, a nut did migrate, resulting in a "Low Lube" fault. In that case, the pilot was able to land under power, but was literally seconds from an NRIFSD—the gearbox seized shortly after touchdown.

"What has all of this to do with tool control?" you ask. The nuts found in each of these cases were not engine parts—*they belonged to support equipment used during engine repair.* Which brings me to the question: "How do you account for attaching hardware on your support equipment?" Take a look at the picture below.

Top photo and above courtesy Mr. Bob Bloomfield

Does your shop have a method to account for this hardware? One method I've seen work is to attach a hardware bag to the support equipment with an inventory of its contents. Another was to etch the inventory right on the equipment itself. A third was to have an inventory at the equipment's storage point. The photos and events in this story directly involve aircraft engines, but this same situation could exist in any number of day-to-day operations. The results may not be as potentially catastrophic, but then again, maybe they could.

So, how effective *is* your tool control program? ✈

As the author states, stricter methods of tool accounting have been responsible for major strides in reducing aircraft mishaps. The author then illustrates why tools aren't the only hazard to safe flight. Remember: It doesn't matter whether a piece of FOD (foreign object debris) comes from a CTK, an item of support equipment, or the change you may be carrying in your pocket. FOD from any source is bad news. —Editor

Aircraft Maintenance Training Today and You

USAF Photo by MSgt Fernando Serna

CMSGT LARRY FUNK
Aircraft Maintenance Career Field Manager
HQ USAF/ILMM

The MRT program reflects a basic change in three-level training philosophy, where emphasis is now placed on performance-based courses rather than theory-based courses.

The Air Force spends a great deal of money every year on education and training. Yet, if you think training is expensive, then consider what ignorance would cost in terms of aircrew safety and our ability to accomplish the mission. With the smaller size of our armed forces and a fundamental shift in organization from a garrison-style Air Force to an expeditionary one, our training has had to evolve to meet the new challenges facing our technicians in the field.

Aircraft maintenance career fields comprise about 20 percent of the force and require a large chunk of the Air Force training budget. Since we also train on some of the Air Force's most expensive and complex equipment—such as fighter avionics systems and advanced composites—changes in our training philosophy and equipment result in increased costs. In other words, it simply costs more to train on F-16s and C-17s than T-38s.

Over the past several years, we've made significant changes in our training philosophy. I'd like to talk briefly about a few of them and dispel some common myths. The Mission Ready Technician (MRT) program is one I'm frequently asked about. The MRT program reflects a basic change in three-level training philosophy, where emphasis is now placed on performance-based courses rather than theory-based courses. Another question I am frequently asked is "how do we identify core tasks for five- and seven-levels. Perhaps the most misunderstood aspect of aircraft maintenance training is the requirement for mandatory in-residence schools for seven-levels?" There were some initial problems refining course content, but we've listened to your feedback and made adjustments to better meet students' needs. You need to know that the students themselves have major influence on course revisions. Finally, if I could do one thing with this article, it would be to increase understanding of the Utilization and Training Workshop (U&TW) process and explain how U&TWs drive course improvements.

The Mission Ready Technician Program

When I assumed the duties of Air Force Career Field Manager for aircraft maintenance in early 1996, I wasn't a proponent of the MRT program. I simply didn't believe AETC could train an apprentice to the five skill-level on any task. But as I learned more about it, I became a convert and am now convinced the MRT program is simply the best thing to happen to initial maintenance skills training in 30 years. The MRT program currently applies to the fighter crew chief, most heavy aircraft crew chiefs, F-16 avionics, and Aerospace Ground Equipment (AGE) initial skills courses. It's planned for several other courses, including Electro-Environmental and Metals Technology. Task certification does extend the length of MRT courses, but many MAJCOM functional

continued on next page

USAF Photo by SMSgt Bob Wickley

A key element of the MRT concept is this: Instead of having the trainee observe the trainer perform a task, the trainer does over-the-shoulder evaluations of the trainee's ability to perform given tasks.

managers like the higher training levels. For example, the proposed Metals Technology MRT training will extend the course by about 24 days, but it will task certify trainees on 27 five-level items, including welding on three types of metals.

This is a marked difference from hands-on training in the seventies, which was conducted entirely through OJT. During my first 6 months in the field (after getting over the shock of how big a B-52 is), I carried a tool box, watched my trainer doing work, assisted in tasks, and filled out AFTO 349s. Our far-reaching missions of today demand that we provide better initial skills training.

As a result, the MRT program has caused initial skills training to shift from theory-based (70 percent or more) to performance-based (much more hands-on task performance). A key element of the MRT concept is this: Instead of having the trainee observe the trainer perform a task, the trainer does over-the-shoulder evaluations of the trainee's ability to perform given tasks. When I went to tech school in the "old days," many maintenance courses were almost entirely theory based. I learned a lot of theory about automatic flight control system operation, but the closest I ever came to an aircraft was when we marched past a B-36 "Peacekeeper" every morning (no, I never worked on B-36s).

One of the biggest myths I'd like to dispel is this: "The goal of the MRT program is to provide a qualified five-level to the field." That's not true. In fact, the term "technician" is probably a misnomer, but let's not quibble about one word. The real purpose of the MRT program is to reduce OJT time in the field and certify apprentice airmen on those high-volume tasks that are typically performed by apprentices during their first 6 to 12 months in the field. For crew chiefs, those tasks include launch, recovery, servicing, and preflight, thruflight, and postflight inspections. To graduate from the MRT program, students must perform these tasks solo, correctly, and to the satisfaction of an AETC instructor on an actual aircraft.

F-16 crew chiefs do their MRT training at Luke AFB, preparing, launching, and recovering scheduled sorties. When these course graduates complete MRT and arrive at their first permanent duty station to work for you, they're already over the shock of working around aircraft on the flightline. They understand how to use the tools in the tool box and perform some tasks unassisted, and many can clear their own jobs in CAMS (the Core Automated Maintenance System). Working in the flightline environment is not a brand new experience for them, and they understand basic flightline safety concepts. But don't forget that the trainee remains an apprentice airman with no field experience. Supervisors at the first duty station must still perform initial evaluations and satisfy themselves that the trainee is capable of performing tasks in line with local requirements.

Implementation of the MRT program depends quite a bit upon the particular career field, with some career fields easier to do than others. Career field size, types of tasks to be done, and equipment availability are factors that must be considered. For example, it's much easier to task-certify a crew chief on F-15s than it is to task-certify structures repairmen on all aircraft types. Implementation of an MRT program track for your career field and determining core tasks are best discussed at U&TWs for your AFSC.

The feedback we're getting from trainers and supervisors on the MRT program is very good, so the program is healthy. The MRT program is here to stay, and I predict it will expand into most other maintenance AFSCs as we fine-tune the program and work with you at future U&TWs.

Five- and Seven-Level Core Tasks

By far, the item we discuss most at U&TWs is core tasks—mainly five-level core tasks. Prior to 1992's "Year of Training" (YOT) initiative, we didn't have AF-established minimum upgrade requirements. Duty position requirements determined at

shop/flight level *were* the minimum upgrade requirements, so the idea of "core tasks" was a new concept. Today, minimum upgrade task requirements are comprised of AF core tasks and unit-identified duty position tasks.

Quite frankly, we didn't do a very good job of specifying core tasks initially, and it resulted in unrealistic training burdens being placed upon active duty, ANG, and AFRC field units. For example, while all F-15 crew chiefs should be qualified to launch, recover, and service the F-15, one core task required *all* F-15 crew chiefs to be qualified to rig flight controls. But it isn't necessary for *every* F-15 crew chief to rig flight controls. *Some* F-15 crew chiefs need to know how to do this, but not *every* one. On the other hand, we allowed personnel to avoid core tasks in duty areas they weren't assigned to. For example, we didn't require shop personnel to be trained on flightline core tasks, and vice versa. Unfortunately, this ran contrary to what we learned from the Gulf War when we deployed large numbers of flightline folks who couldn't meet mission requirements due to lack of training on critical shop tasks. Equally important, shop personnel weren't qualified to support sortie generation. As a result of these and other lessons learned, we narrowed the definition of core tasks applicable to aircraft maintenance.

The best working definition I've heard on what should constitute core tasks is "What do you expect to get to fill a mobility requirement for a five-/seven-level in this career field?" (Credit to CMSgt Brian Bastow, HQ AETC/DOOI, for that definition.) Of course, the debate begins from there. Does every crew chief need to know how to launch and recover an aircraft? Sure. Does every Electro-Environmental troop need to know how to charge and service a battery? Absolutely! We learned that lesson in the Persian Gulf War. But does every crew chief need to know how to rig flaps on a C-5? No. Does every engine troop need to know how to borescope an engine? Of course not! The philosophical arguments go on from there and become more intense as each task is discussed.

We've used Chief Bastow's definition very successfully over the last 3 years to define core tasks more clearly. We've recognized the *R code (identifies optional core tasks for AFRC and ANG personnel) in CFETPs (Career Field Education and Training Plans) as a strong indicator of poorly defined core tasks, and most have been eliminated. A strong indicator of a well-defined core task is an MRT task. MRT tasks now make up about 70 to 80 percent of most five-level core tasks.

We've also refined core task exemptions so folks don't waste time on training that isn't essential for the wartime mission. Aircraft maintenance personnel aren't required to go TDY for core task training unless it's mandated by their MAJCOM or unit. (However, if the equipment/capability necessary for core task training is in another unit on base, then it must be completed.) Also, maintainers aren't required to complete core tasks on more than one MDS. To support deployments, we want each person to complete all core tasks relevant to at least one airframe. For example, if you're an Electro-Environmental troop on a base with F-16s and F-15s, and you work F-16s, then aircraft battery training is required for upgrade. On the other hand, if you work F-15s, battery training isn't required since F-15s have no aircraft battery. Likewise, if you work an aircraft with a self-generating oxygen system, then LOX cart training isn't required. Our goal with this policy is to ensure that a person is deployable against an airframe and has completed all core tasks relevant to that airframe (within the base's capability).

Seven-Level In-Residence Schools

Like core tasks, another new item for most AFSCs was the mandatory in-residence seven-level schools. All maintenance AFSCs now have a seven-level course—most of them are primarily technically oriented—

continued on next page

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USAF photo courtesy of Randolph AFB

We received several complaints about the crew chief courses, so AFRC and ANG career field managers and I met at Sheppard with 40 upset crew chiefs and did about 3 hours' worth of listening. Crew chief feedback to us was very clear: "Either give us the training we need, or don't waste our time."

and they typically run 10 days. Many of them are conducted at Sheppard AFB, but Aberdeen Proving Grounds hosts the course on Metals Technology, NAS Pensacola hosts NDI and Structures, and Keesler is home to the "seven-avionics-AFSCs-in-one" course. Some career fields, like AGE and Maintenance Analysis, had seven-level schools before the Year of Training mandate, so not surprisingly, those two schools received great feedback. Here again, in some cases, we did a poor job defining the training requirements for the new seven-level schools. We didn't do so well with the students on schools like the crew chief course. Maybe a little history is in order here.

We received several complaints about the crew chief courses, so AFRC and ANG career field managers and I met at Sheppard with 40 *upset* crew chiefs and did about 3 hours' worth of listening. Crew chief feedback to us was very clear: "Either give us the training we need, or don't waste our time." Coincidentally, I already had an action item to eliminate one crew chief seven-level course from an earlier U&TW, but to our surprise, every one of the students who would be affected by eliminating that school was unhappy about it. Nearly all of the students wanted to keep the seven-level school, they just wanted it made more relevant. As a result of that meeting—and a particularly accurate critique from one student—the crew chief courses were redone from top to bottom. And we've redone many courses since then. Based on feedback we receive now, I believe today's maintenance seven-level courses are as good as any offered in the Air Force.

AFRC, ANG, and active duty (me) career field managers meet with students quite often and typically receive very few complaints. But when problems are identified, we work hard to fix them. We currently have five separate crew chief courses, two avionics test station courses, and a variety of other courses like egress, structures, and metals technology that have been vastly improved. In every case, students have supported the course but demanded revisions. Believe me: We're committed to not wasting seven-level students' time.

Training that is suitable for distance learning (DL) through CDCs, Interactive Courseware, or other media, will be done through DL channels. As for the "management topics" covered in earlier classes, most of them have been placed in the generic 2AX7X, *Aerospace Maintenance Craftsman* CDC. It covers a wide variety of topics generally applicable across many maintenance career fields. The course writer, MSgt Brian Cronin, told me he learned a lot while writing the 2AX7X CDC. Although it still needs some fine-tuning, it does provide a lot of supervisory information and is available now. Get yourself a copy and look it over.

Utilization and Training Workshops Drive Improvements in Training

A U&TW is nothing more than a focused discussion on career field utilization and training. How do U&TWs work? Myth: "Bunches of maintenance career field chiefs sit around a table, decide what we'll train, and how we'll train it." Ain't so. Although we do need to have the MAJCOM functional managers there (many of whom aren't chiefs), participation by maintainers currently working the flightline is *critical* for making a U&TW a success. We simply can't have an effective discussion on career field training requirements without a sufficient number of knowledgeable people there. We like to see a good mix of grades, from senior airman through chief, at these gatherings. Having no more than 30 to 35 people is desired, but we've rarely had to limit attendance.

We emphasize that inputs from everyone are important to the U&TW. After properly preparing for the U&TW per AFMAN 36-2245, *Managing Career Field Education and Training,* all that's required is for you to engage your brain, state your case, and defend your position. I always open a U&TW by telling attendees *not* to leave nursing an ulcer over something that was decided unless they've stated their concerns. It's important for the good of the career field.

Here's a recent success story. At the recent Metals Technology U&TW, one ANG attendee wasn't happy about the revised three-level course being 106 days long. Because of financial impact on their folks, AFRC and the ANG prefer courses be 99 days or less. For several hours, we discussed how to cut the course, but were seemingly unable to do so without hurting quality of training. I could see the ANG attendee was very unhappy. As it turned out, he suggested a side meeting with Metals Tech instructors and a couple of other people to discuss ideas for getting the course length to 99 days or less. They succeeded! But more importantly, the other U&TW attendees and MAJCOM reps stated the 99-day course was much better than the 106-day course. Through his professionalism and the commitment he demonstrated to the good of the

career field, that Air National Guard staff sergeant impressed quite a few folks. Most importantly, the revised course does a better job of meeting the Air Force mission.

U&TWs are an indispensable tool for making training improvements. If you want to learn how to improve training in your career field, then review AFMAN 36-2245 and the U&TW process chapter in the 2AX7X CDC. You should be able to get a copy from your maintenance training person or orderly room. By the way, it is WAPS-testable material for some AFSCs.

Maintenance Training Will Continue to Evolve to Meet New Technologies

What does the future hold? It doesn't take a rocket scientist to know we'll continue to face more change. As weapon systems modernize and new systems are fielded, there will be less of a need for intermediate-level maintenance. Self-generating oxygen systems, maintenance-free batteries, and vacuum-packed parachutes will greatly reduce equipment and training requirements.

As we become more expeditionary, there will be a greater need for more people who can launch, recover, and service aircraft. For example, on the F-22, I would expect everyone in the fighter squadron to have launch, recovery, and servicing as core tasks.

I think seven-level schools are here to stay. The students want and—more importantly *need*—advanced training. Here's the path I see ahead: Our three- and five-level maintainers will be "specialist" oriented, with seven-levels more "generalist" oriented. A quick review of the "heavy" crew chief AFSC (2A5X1) gives a good idea of how this might work. A C-130 apprentice (AFSC 2A531B) becomes a "cargo" five-level (AFSC 2A551J) and then grows to become a "heavy" crew chief (AFSC 2A571). Although this structure isn't without problems, it does seem to work well.

And just in case you're wondering, here's why I wrote this article for *Flying Safety* magazine. Our strongest ally in getting the job done *safely* is doing it *correctly.* An apprentice airman taught by the book, in a total training mode, won't be distracted by the pressure of the mission. We're finding that the self-confidence and task certification MRT graduates gain make them contributors to the safe conduct of the mission from the very day they arrive at their first duty station. MRT graduates who are taught well also help ease the workload on everyone, further contributing to safety. Well-defined core tasks reinforce discipline in the OJT program and help ensure trainees gain hands-on experience in the areas most needed. Mid-tier NCOs with strong technical skills (experience and seven-level schools) and strong supervisory skills (PME and CDC 2AX7X) are keenly aware of how well-trained personnel ensure jobs are done safely and done right the first time. And the U&TW process is the foundation for developing and refining needs-responsive training programs that provide up-to-date training on modern equipment.

USAF Photo by MSgt Fernando Serna

"When trainees are taught to do a job the correct way, they're automatically trained to do it the safe way."

When trainees are taught to do a job the correct way, they're automatically trained to do it the safe way. I don't need to tell you that aircraft maintenance is serious business. We carry the lives of many folks and the futures of their families in our tool boxes. We owe it to them to teach our profession well. Keep them flying safely! ✈

About the author: *Chief Funk started his aircraft maintenance career in 1971 as an Automatic Flight Control Systems repairman. He has worked A-10s, B-52s, variants of the C-135 and C-130, C-141s, most F-4 variants, F-5s, T-33s, T-38s, T-39s, and F-16s at various CONUS and PACAF locations. Chief Funk has been the Air Force's Maintenance Career Field Manager at HQ AF since 1996. He has a CCAF degree in Instrument Systems Technology, a BS degree in Electronics Technology, and an MS degree in Management. E-mail and mailing addresses and training information are available on the maintenance training website: www.hq.af.mil/AFLG/LGM/acmaint.html.*

Class A Mishaps FY99

FY99 Flight Mishaps (Oct 98 - Jun 99)	FY98 Flight Mishaps (Oct 97 - Jun 98)
25 Class A Mishaps	17 Class A Mishaps
8 Fatalities	4 Fatalities
20 Aircraft Destroyed	12 Aircraft Destroyed

6 Oct	✶	An airman suffered a serious back injury during a helicopter training exercise.
21 Oct	♣	An F-15E crashed during a SATN training mission killing both crewmembers.
22 Oct	♣	Two F-16Cs collided shortly after departure. One F-16 was destroyed and the other F-16 recovered uneventfully.
29 Oct		A C-9A's No. 2 engine failed and caught fire shortly after a touch-and-go.
9 Nov	♣	An F-16CG crashed during a day BFM training sortie, killing the pilot.
17 Nov	♣	An F-16C experienced engine failure and crashed during a day training sortie.
19 Nov	♣	An F-16CJ experienced loss of thrust shortly after takeoff and crashed.
4 Dec	♣	An F-16D experienced engine failure 25 minutes into flight and crashed.
15 Dec	♣	An F-16C on a day training sortie experienced loss of thrust on RTB and crashed.
29 Dec		An OA-10A's No. 1 engine throttle cable failed during flight. The pilot had difficulty landing, the aircraft departed the prepared surface, and all three gear collapsed.
7 Jan	♣	An F-16DG experienced an engine malfunction shortly after gear retraction and crashed.
13 Jan	♣	A KC-135E crashed northwest of the departure end of the runway. All four crewmembers were fatally injured.
20 Jan	♣	An OA-10A entered an uncommanded, nose-low attitude. Unable to return the aircraft to controlled flight, the pilot ejected, and the aircraft was destroyed.
21 Jan	♣	An F-16CJ conducting low-level tactical navigation struck trees on a ridgeline. The engine failed, and the aircraft was destroyed on impact with the ground.
28 Jan	♣♣	Two F-15Cs were flying a Dissimilar Tactical Intercept Training sortie against a three-ship of F-16Cs. The two F-15s collided during the first intercept and were destroyed.
3 Feb	♣	An F-16C on a training mission had an engine malfunction. The pilot ejected after an in-flight fire developed, and the aircraft was destroyed on impact with the ground.
24 Feb	♣✶	An RQ-1A UAV departed controlled flight, crashed, and was destroyed.

17 Mar		On climbout, a U-2S canopy shattered, FOD'ing the engine and damaging the vertical stab. The pilot RTB'd and made a safe landing.
18 Mar		An F-16C suffered major damage on landing.
26 Mar	♣	An F-16C on a day training sortie suffered loss of thrust, crashed, and was destroyed.
29 Mar	♣✶	A Global Hawk UAV crashed and was destroyed.
30 Mar		A U-2S experienced loss of hydraulic pressure and suffered major damage on landing.
7 Apr	♣✶	A KC-135R sustained major fuselage damage. (Ground Mishap)
10 Apr		An AMRAAM and No. 1 launcher were liberated from an F-16CJ during flight.
18 Apr	♣✶	An RQ-1K UAV crashed and was destroyed.
26 Apr	♣	An F-16DG experienced a landing gear malfunction while attempting to land. The pilot executed a successful go-around and proceeded to the controlled bailout area, where both pilots ejected. The aircraft was destroyed on impact with the ground. (The 7 May C-5B hot brakes Class A mishap reported here last month has been downgraded to a Class B.)
19 May		An F-117A caught fire on takeoff roll (takeoff was successfully aborted).
2 Jun	♣	An MH-53J impacted the ground while landing at an LZ. One crewmember was killed.
15 Jun	♣♣	Two F-15s crashed while on a local training mission.
18 Jun	♣	An F-16 crashed while on a local training mission.

- ❑ *A "Class A Mishap" is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million dollars.*
- ❑ *These Class A mishap descriptions have been sanitized to protect privilege.*
- ❑ *"♣" denotes a destroyed aircraft.*
- ❑ *"✶" denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.*
- ❑ *Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.*
- ❑ *Flight, ground, and weapons safety statistics are updated daily and may be viewed at the following web address by ".gov" and ".mil" users: http://www-afsc.saia.af.mil/AFSC/RDBMS/Flight/stats/index.html.*
- ❑ *Current as of 18 June 99.* ✈

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MAINTENANCE MATTERS PRESENTS...
The Personal Injuries Edition

Aircraft maintenance is serious business. Besides taking pride in—and loving!—what we do, knowing that aircrews trust their lives to us every time they fly is strong motivation to do all we can to ensure they have well-maintained aircraft. Aircraft maintenance can also be hazardous to your personal well-being, as the following examples illustrate. Whether you're busting butt to make an on-time launch or working Day One of an Isochronal/Phase inspection, remember: Unless you and your troops are around tomorrow, USAF aircraft are nothing more than expensive static displays. Look out for yourself and your buddies!

The F-16 Kabuki Dance

On Day Two of a wing exercise, the crew chief reported to work for his 12 hours on the night shift. He had been dressed in full CWDE (Chemical Warfare Defense Ensemble) garb for an extended period when he was finally green-lighted to launch his F-16, and (since the pilot was waiting) hurried to wrap up last-minute tasks. He had finished prepping the ejection seat and was climbing down the crew ladder when he missed the second rung. The crew chief tried unsuccessfully to arrest his fall and slid/fell 6 feet to the ground, doing something akin to a PLF (Parachute Landing Fall). He landed on his right wrist, fell back onto his tailbone, and continued backward, hitting his helmet-clad head on the ground. The helmet prevented him from cracking his coconut, but he did suffer a broken tailbone and sprained wrist. Working in full CWDE is difficult enough. But factor in night-time conditions, combine with a little haste, and you've set up the requisite chain of events for a mishap to occur.

Oh, Wow, Man! He Stuck an F-16 in His Eye!

It's often the routine tasks that lull one into a false sense of security, and here's a case in point. The crew chief was on the ramp behind an F-16, working on some engine covers. He stood, started walking toward the aircraft without looking up, and walked right into a horizontal stab static discharge tube. With his right eye. The discharge tube penetrated his right eyelid, causing injury to the eyelid and cornea, but we're happy to report that the damage wasn't permanent. After 3 days on quarters, he returned to work with a cautionary tale of on-the-job safety for his pals.

Lifting and Your Back

Here's some good lead-in info about lifting—and how fragile our backs *really* are—that fits well with the next two Maintenance Matters articles. According to the National Safety Council's "Back Power Trainer's Manual," two-thirds of our body weight is carried from the hips up. A 150-pound person standing upright exerts a pressure of 100 pounds per square inch on his spine's lumbar discs. Bending from the waist at a 45-degree angle doubles that pressure, while bending far forward (90 degrees) *triples* it to 300 pounds per square inch. Here's another way of looking at it, as reported by the US Navy in its safety periodical, *Safetyline* (Sep-Oct 97): Bending forward at the waist to pick up 70 pounds places 1,500 pounds of force on your lower back. Training on proper lifting techniques and applying them every time you lift is the key to preventing back injuries.

MA-1 One, Lower Back None

Four Fuel Cell personnel were detailed to load an MA-1 air cart (used in purging fuel cells) into the rear of a step van. The plan was for three of them to lift and push the 180-pound dead-weight from outside the vehicle, while the fourth person would pull and lift from inside the step van. With a maintainer on one side, two others on the opposite side, and the fourth maintainer in the truck to lift the MA-1 by the handle, they did

ce Matters

a coordinated heave-ho. Immediately thereafter, the first Fuel Cell troop realized he had wrenched his back. Alas, had the work center incorporated AFOSH-required training on lifting heavy objects, the injury and 2 lost workdays might have been prevented.

(No!) Drum Roll, Please! (Part 1)

Some maintainers were tasked to move three 55-gallon drums filled with aircraft cleaning solution from a storage area to the aircraft wash hangar across the street. Since it was winter and the storage area was outside, recent snowfalls had covered the drums and ground with large accumulations of snow and ice. The crew found the two-wheel hand truck they normally used to be impractical, so they pushed/slid the first two drums of cleaning solution from the storage area to the wash hangar. The third drum was frozen to the ground. In an effort to free it, one of the maintainers (mishap worker, MW) stood facing the upright drum, leaned over it, placed his hands on the top, far side of the drum's rim, and pulled backward. The drum didn't budge, and although he didn't realize it at the time, something in MW's back had moved instead. Working together, the crew finally got the drum free and moved it to the wash hangar. The next day, the MW was unable to get out of bed for work, and after 4 days of what was certainly some pretty intense pain, sought medical attention. Diagnosis? He had injured an inter-vertebral disc in his lower back, and the swelling from that disc was pinching spinal nerves. The MW was able to return to work after missing 57 workdays, but is still undergoing steroid injections, physical therapy, and is restricted to light duty. Never underestimate how fragile your back can be. Nor should you forget how quickly a moment's inattention can make *you* "not mission capable."

(No!) Drum Roll, Please! (Part 2)

Using brute strength to muscle 55-gallon drums around can definitely be hazardous to your health, and here's one more example why. Two G.I.s were tasked to tip four drums (approximate weight: 450 pounds each) from a horizontal ("prone") to an upright position, so that the end-cap could be removed and a tube inserted to siphon out the hydraulic fluid. They brought the first three drums upright without incident, but while trying to position the last drum, one of the troops had a finger in the wrong place at the wrong time. As a result the tip of his middle finger was crushed. But there's more. Not only did the drum and its contents fracture the bone in his fingertip; their combined weight also "de-gloved" the fingertip, removing skin and fingernail. Applying a little ORM would likely have spared this troop a lot of pain. We suspect this mishap was a wake-up call for the unit and that they've found better—and less risky methods—to move heavy objects around.

Arrgh! Shot With My Own Gun!

Finally, here's one more reason to be on your guard when involved in "routine" tasks. The maintainer was lubricating the slats on a C-5. He had completed three of them and was preparing to move the air-powered mobile lubricator to the next slat. He removed his PPE (gloves), grabbed the lubricator nozzle with his right hand, and picked up the lubricator with his left hand. While moving forward, he accidentally bumped the trigger handle and injected grease into his right index finger. Feeling no discomfort, he pressed on and finished out the workday. He was experiencing pain in his finger the next morning and reported to his supervisor what had happened. Luckily for him, the supervisor knew how serious these injuries can be. The maintainer was taken to the hospital, admitted, and surgery to save his finger was performed. After 2 days in the hospital and 9 days on quarters, the maintainer returned to duty and was able to add an emphatic exclamation point to subsequent work center safety briefings about how important it is to (1) Wear necessary PPE; and (2) Never forget that there are no "small jobs" in maintenance. ✈

Yada, Yada, Yada

Cartoon from original article

This article originally appeared in the May 1949 issue of *Flying Safety* magazine under the title "Three on a Match." Its message is timeless and bears retelling. The only thing we changed was the title. If "Yada, Yada, Yada" caught your eye and drew you into reading this article, then we accomplished part of our mission. If you *learn* something from it and share the message with others, then we hit the bull's eye. The Editor.

■ Most of us look with amused contempt on the superstitions of uncivilized or uneducated people—the way they rely on amulets and other medicine man defenses against evil and bad luck. If someone pins us down on the subject, we're scornful of any belief in such bugaboos as "three on a match" or walking under a ladder. Superstition with us is in reality a matter of fun and nonsense.

Without realizing it, however, it's possible for either a pilot or a mechanic to be a victim of a dangerous type of nonsense—absolute blind faith in his own infallibility, a complacent self-assurance that the number of hours recorded on his Form 5, (*Official Flight Record*) or his years of mechanical experience hold almost magical qualities. This foolish attitude is acquired anytime he convinces himself that he has the business down pat.

This blind faith in his own ability may creep up on a pilot after he logs his first 500 hours, or he may get that way with the additions of a *star* or a wreath on his *wings*.

What has happened is that rather than continue to learn, rather than subject himself to checks by qualified instructors, he flies on his self-created reputation and depends upon the past to get him through the future.

"I was working on airplanes when you couldn't fix your kiddy-car," is a statement that has been heard in more than one hangar. If the mechanic who said it believes it, there is little doubt that he has hypnotized himself into believing that he knows so much he can do no wrong. He may have just acquired his stripes, or he may have serviced Jennies. Age doesn't have any monopoly on this belief in one's own infallibility.

History has pretty well demonstrated that the most successful method of ridding people of superstitions is by education or replacing wrong beliefs with intelligent faiths. A man has to have faith in his own ability, certainly in flying as much as in any other field of endeavor, if he is to progress. But what we have to do to be as aware of our ignorance as we are of our knowledge is keep our minds open all the time. The Air Force will never freeze itself to one certain airplane, flight procedure, or maintenance technique, so no man can be allowed to call a halt to his learning.

You probably met a man at one time who told you he had forgotten more about flying than you would ever learn. There is a good chance that his name is now on page one of a Form 14, *Report of AF Aircraft Accident*. His blind trust in the number of hours logged on Forms 5 just isn't powerful enough medicine to keep his name off an accident report.

A universal characteristic of really great men in all fields of endeavor, including aviation, is an undying curiosity about what they do not know and a humble realization of their own shortcomings. The more a really smart man knows about a subject the more he realizes there is for him to learn.

If you laugh at the idea of three on a match being unlucky, you can't help but know that any idea of your own personal infallibility is a superstition with even less basis and one with infinitely graver consequences. ✈

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THE CHIEF IS SMILING

CMSGT WILLIE E. YATES, JR.
100th Aircraft Generation Squadron
RAF Mildenhall, United Kingdom
Courtesy *Air Scoop*,Oct/Nov 98

***(Editor's Comment:** Chief Yates is the Maintenance Superintendent for the 100 AGS. He's been in maintenance about 23 years. When I asked him if he had anything else to add, he said, "The only other thought I have is the longer I stay in this business, the more I see younger NCOs making the right calls with less supervisory input. They are running me out of a job, and that's definitely okay with me." Let's read about a fine example of what Chief Yates is talking about.…)*

I was listening to my two-way radio the other day when a call came in from Tanker 5 to hold a jet at the hammerhead for a lost tool. Of course, my first thought was "here we go again"—another lost tool. Then a few minutes later, MOC called Tanker 5 to say that the crew could not wait long for us to search the aircraft, or they would not make their mission. As my blood started to boil, and I reached for my radio, Tanker 5 came over the air with "MOC, tell that aircrew they cannot launch until we finish the search of the aircraft!" At this time, a smile came over this chief's face.

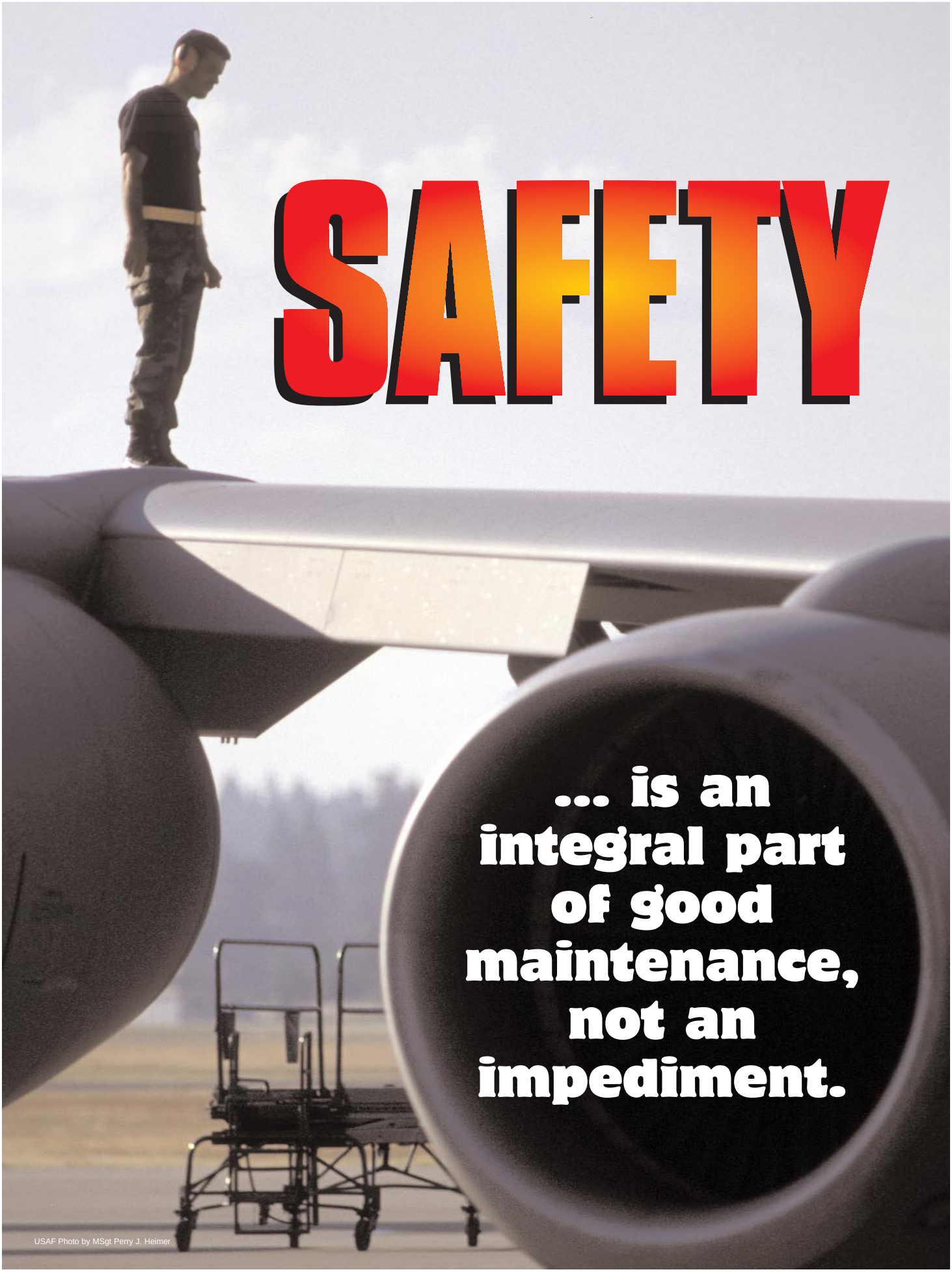
Later, I asked who had lost the tool and what was the notification time. I was told that it was a training class who had launched the aircraft, and as soon as they noticed the tool was missing, they immediately notified Tanker 5. At this time, an even bigger smile came over the chief's face.

You might ask yourself why did this chief get this big, ugly grin for a mistake that almost caused a jet to be late for takeoff. Well, I'll tell you. The missing tool, a flashlight, was found in the aircraft wheel well when the search was conducted. As just about all of us know, if this tool had remained in the aircraft, it could have produced catastrophic consequences.

All of the people involved did everything RIGHT. The technicians who lost the tool did not try to cover up a mistake by dragging out the search prior to notification, and the Pro Super stood his ground and did not hesitate to make the right call under pressure.

The squadron maintenance officer and myself give a quick newcomer's briefing to all personnel during their in-processing. Three areas are stressed whenever maintenance is being performed: safety, security, and integrity. Compromise of any one of these can cause serious consequences.

This scenario is an excellent example to show our new troops how to do it RIGHT. Now, maybe you can see why this chief has the big, ugly grin. These people are my *"unsung heroes"* for doing it RIGHT! Thanks.✈


SAFETY
... is an integral part of good maintenance, not an impediment.
USAF Photo by MSgt Perry J. Heimer