UNITED STATES AIR FORCE

FLYING Safety MAGAZINE

Aug 2001

Maintenance Is The Issue

AIR FORCE RECURRING PUBLICATION 91-1 August 2001, VOL 57, NO 8

This Issue:

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UNITED STATES AIR FORCE
FLYING Safety
MAGAZINE

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Air Force Safety Center web page:
http://safety.kirtland.af.mil/
Flying Safety Magazine on line:
http://safety.kirtland.af.mil/magazine/htdocs/fsmfirst.htm

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DEPARTMENT OF THE AIR FORCE —
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DISTRIBUTION — One copy for each three aircrew members and one copy for each six maintainers and aircrew support personnel.
POSTAL INFORMATION — *Flying Safety* (ISSN 00279-9308) is published monthly by HQ AFSC/SEMM, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670. Periodicals postage paid at Albuquerque NM and additional mailing offices. POSTMASTER: Send address changes to *Flying Safety*, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670.

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

FSM Notams

WHERE NOT TO DO A RUN-UP

Courtesy ASRS *Callback* #246, Dec 99
NASA's Aviation Safety Reporting System

A general aviation pilot recently supplied ASRS with a compelling tale of "wrong way" ground navigation.

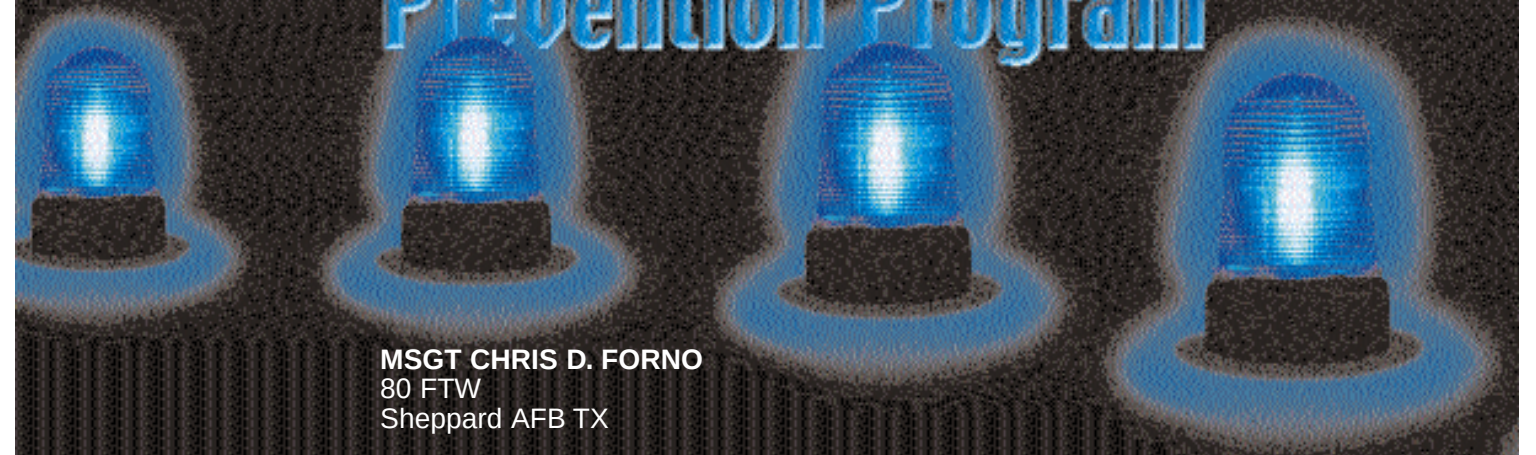
I had flown into [airport] for the first time two days prior [to incident]... The Ground controller gave me excellent progressive taxi instruction to the general aviation tiedown area. [On day of incident] I was cleared to taxi to Runway 03 via Bravo taxiway. Ground instructed me to follow the taxiway out of GA parking, and turn right at Bravo, which I did. I was unable to see a separate run-up area, so upon reaching Runway 03, I stopped behind the runway boundary, switched to Tower frequency, and began my run-up. Tower called...and said that I was blocking the taxiway...and told me I should move to the run-up area. I turned the aircraft around, pointing it now at the side of the taxiway away from the runway and asked if the direction I was now pointing was the direction of the run-up area (it was a wide taxiway, and I thought the far side might be the run-up area). Tower told me "No, just go to the end of Runway 03." I thought it was an unusual place for a run-up, but I visually confirmed that there were no aircraft on final for Runway 03, and the Tower frequency was congested, so I simply responded "End of Runway 03."

As soon as I was on the runway, Tower called and asked if I had entered the runway—evidently surprised that I had. I responded that I thought that's what he had told me to do. He responded that he hadn't... In discussion afterwards...[my passenger and I] concluded that the controller had meant that we should have gone to the extreme southern edge of the taxiway adjacent to the end of Runway 03.

The situation could have been avoided if; (1) I had asked Ground about the specific location of the run-up area; (2) Tower had indicated "the taxiway adjacent to the end of Runway 03" instead of "the end of Runway 03"; and (3) I had called for confirmation on what I thought was an unusual instruction.

Tower controllers, as well as pilots of large jet aircraft, have a better overall view of runways and taxiways than do light airplane pilots. ATC should keep this in mind when giving taxi instructions. Pilots of light airplanes should ask for progressive taxi instructions when uncertain of directions.

Running an Effective FOD Prevention Program



MSGT CHRIS D. FORNO
80 FTW
Sheppard AFB TX

FOD costs each year typically run in the millions of dollars.

Landing gear safety pins ingested by a running jet engine; a socket wrench jammed in a flight control bell crank mechanism; a stray piece of safety wire that shorts out a circuit breaker panel: All of these scenarios represent Foreign Object Damage (FOD) that could wreak havoc on combat or training missions. Even if AFI 21-101, *Maintenance Management of Aircraft*, didn't require it, we'd have no trouble recognizing that an effective FOD Prevention Program is vital to safe, successful flying activities in today's Air Force. FOD costs each year typically run in the millions of dollars. In Fiscal Year 2000 alone, FOD cost the Air Force nearly $24 million, diverting valuable resources needed for the readiness of our Air Expeditionary Forces.

What is FOD? When an item that shouldn't have been there—a foreign object—causes aircraft or support equipment damage, it's classified as FOD. "Foreign objects" is a term that includes just about anything that "doesn't belong," like tools, test equipment, scraps of safety wire, extra washers, or personal items—like pocket change—that get left behind during the performance of a job. FOD can easily damage jet engines, jam critical control mechanisms or short circuit electrical components.

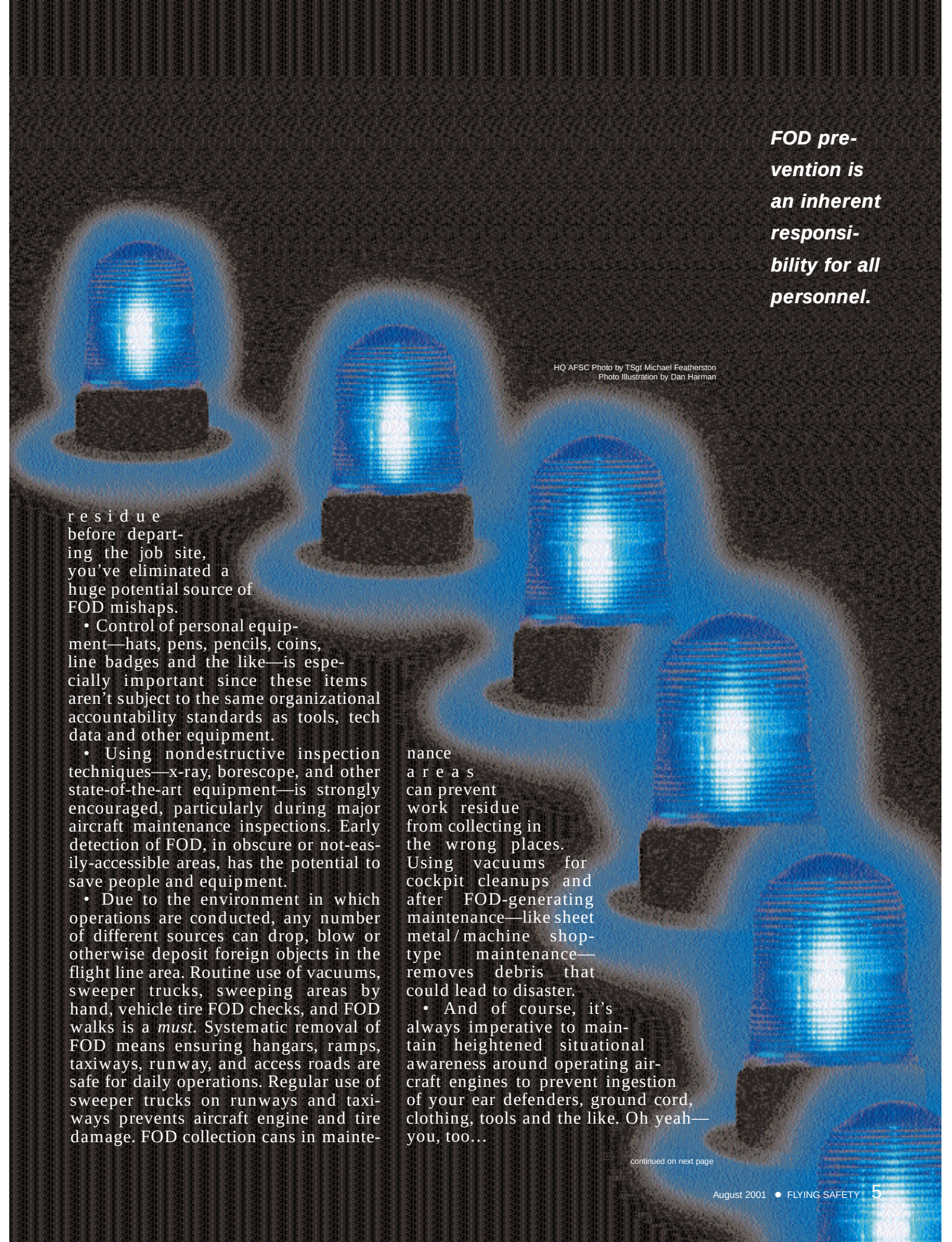
Doing Your Part

Supervisors of maintenance, operations and base support personnel are responsible for providing FOD awareness and prevention training to their troops who work in and around, or transit through, aircraft operational areas, as part of their daily job. But FOD prevention isn't just a supervisory, Quality Assurance or Wing FOD Prevention Program Manager's job—*it's an inherent responsibility for all personnel involved in Air Force aircraft and equipment operations.* Some "Big Picture" perspective on preventing FOD:

• Practicing good housekeeping habits is the most effective method of eliminating FOD. "Good housekeeping" is nothing more than keeping work centers and work areas clean and orderly, ensuring extra items are picked up after task completion and accounting for all equipment and hardware at the completion of a job. Thorough, regular flight line FOD walks which include all aircraft parking areas and aircraft hangars are fundamental to preventing FOD damage.

• A tool left inside an aircraft can kill. One of Murphy's Laws holds that a stray tool will migrate to the place where it can do the most damage—like FOD'ing an engine or jamming flight controls—resulting in loss of a crew and aircraft. Effective tool control programs throughout the unit are crucial. It may surprise you to learn that the Composite Tool Kit (CTK) concept hasn't always been in existence. It wasn't until the 1970s that Air Force guidance was implemented to curtail the number of mishaps occurring due to lost/unaccounted for tools. When you account for tools, equipment and work order

FOD prevention is an inherent responsibility for all personnel.



HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

residue before departing the job site, you've eliminated a huge potential source of FOD mishaps.

• Control of personal equipment—hats, pens, pencils, coins, line badges and the like—is especially important since these items aren't subject to the same organizational accountability standards as tools, tech data and other equipment.

• Using nondestructive inspection techniques—x-ray, borescope, and other state-of-the-art equipment—is strongly encouraged, particularly during major aircraft maintenance inspections. Early detection of FOD, in obscure or not-easily-accessible areas, has the potential to save people and equipment.

• Due to the environment in which operations are conducted, any number of different sources can drop, blow or otherwise deposit foreign objects in the flight line area. Routine use of vacuums, sweeper trucks, sweeping areas by hand, vehicle tire FOD checks, and FOD walks is a *must*. Systematic removal of FOD means ensuring hangars, ramps, taxiways, runway, and access roads are safe for daily operations. Regular use of sweeper trucks on runways and taxiways prevents aircraft engine and tire damage. FOD collection cans in maintenance areas can prevent work residue from collecting in the wrong places. Using vacuums for cockpit cleanups and after FOD-generating maintenance—like sheet metal/machine shop-type maintenance—removes debris that could lead to disaster.

• And of course, it's always imperative to maintain heightened situational awareness around operating aircraft engines to prevent ingestion of your ear defenders, ground cord, clothing, tools and the like. Oh yeah—you, too…

continued on next page

"The FOD*BOSS™ referenced in the author's story."

Photo by Gary Chaplin

"Here's a sample of the ramp trash that the FOD*BOSS™ picked up."

Official Photo by USANG

It's always imperative to maintain heightened situational awareness around operating aircraft engines.

Resources: FOD Prevention, Awareness and Education

Several companies offer equipment and tools that effectively counter the FOD threat. "FOD*BOSS™" is a great, new FOD prevention tool we (and several other wings) have put to use. This nifty tool, sold by the F.O.D. Control Corporation of Tucson, Arizona, is an amazingly effective and capable tool for picking up even the smallest bits of FOD from parking areas. You can get a preview of the FOD*BOSS™ capabilities at the company's web site at http://www.fodcontrol.com.

Initial and refresher awareness training are required for most personnel, so education is the cornerstone to a successful FOD prevention program. Placing posters in work centers and on bulletin boards, and rotating them regularly can educate and motivate. The DoD's Defense Visual Information (DVI) Directorate has several products that could be used in an education program, including training videos, awareness and education posters, CD-ROM programs and much more. You can visit the DVI Directorate's home page on the web at http://dodimagery.afis.osd.mil/ and access the search engine at http://afishp6.afis.osd.mil/dodimagery/davis/.

The organization known as National Aerospace FOD Prevention Incorporated (NAFPI) is another great source of information. NAFPI is a non-profit educational organization dedicated to flight safety and prevention of foreign object damage. This organization has a great web site that can be found at http://www.nafpi.com/. NAFPI hosts an annual conference whose primary objective is promoting FOD prevention awareness. It attracts representatives from throughout the aerospace industry: military, space,

Photo Courtesy of Author

"In case you ever wondered, paper FOD can also cause considerable engine damage."

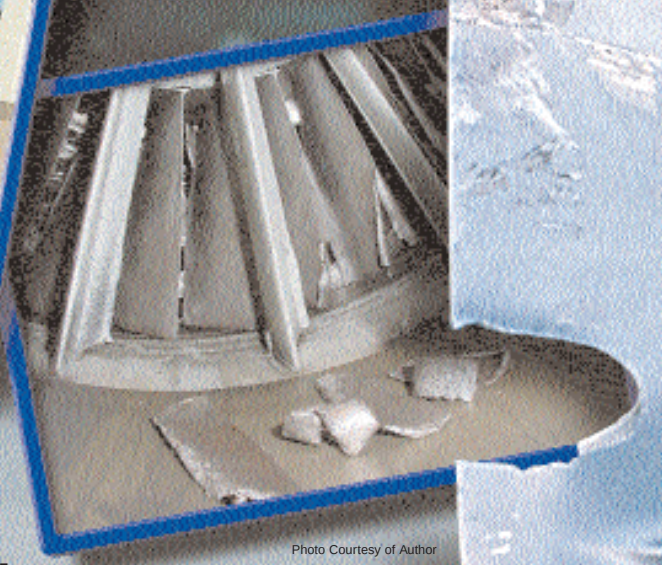


Photo Courtesy of Author

Education is the cornerstone to a successful FOD prevention program.

commercial airlines, cargo haulers, airport authorities and aircraft manufacturing, repair and support. The conference provides an effective forum for the exchange of ideas and solutions and, because of the expertise of the attendees, is a key resource for information, training and support.

Only *You* Can Prevent FOD!

An effective FOD prevention program is one that is AGGRESSIVE. Many resources are available to implement a successful program. Today's Air Force is ever changing and is always challenging: To be the best at what we do requires readiness. We *cannot* allow FOD to rob us of the valuable resources needed for the defense of our great nation!

(MSgt Chris Forno is the 80th Flying Training Wing's Flight Safety NCO and FOD Prevention Program NCO. If you'd like to know more about the 80 FTW's FOD Prevention Program, you may contact Sergeant Forno at: christopher.forno@sheppard.af.mil. Please note! Mention within this article of companies and their products, and organizations and their services, does not imply endorsement by the United States Air Force or Flying Safety *magazine. Ed.)*

HQ AFSC Photos by TSgt Michael Featherston
Photo Illustration by Dan Harman

Close Call:

An Aircraft Maintenance Human Factors Tale

(Illustration provided to give the reader a basic understanding of elevator trim interconnect as described in the following story. This figure doesn't necessarily represent the specific aircraft type involved in the mishap. Ed.)

Aviation Safety Maintainer, Issue 1/2001

(Overworked. Undermanned. Rotating shifts. Low experience levels. High Ops Tempo. Deployed location. Inadequate/incomplete tech data. Miscommunication. Someone who didn't perform the corrective action signs the "Corrected By" block in the forms. Any of this sound familiar? We urge you to read, heed and act—by applying ORM—if one or more of the preceding elements exist in your workcenter. The following narrative, taken from Civil Aviation, Transport Canada's newsletter "Aviation Safety Maintainer," provides a chilling account of how these factors all set the stage for a near-catastrophic mishap that would have destroyed an aircraft and killed several people if not for the skill of the aircrew and a measure of luck. Remember: Every accident is preceded by a series of events that link up to form a "mishap chain." Changing just one of those events means you can break the chain and prevent the mishap from ever occurring. And every single one of us has the power to break that chain—use it. If this tale doesn't get your attention, nothing will. Ed.)

The pilots of the Convair 580 cargo flight were confronted with a severe nose-up pitch tendency immediately after takeoff. The aircraft had been loaded, and documentation, including the weight and balance sheet, maintenance records, and flight plan, was checked by the flight crew prior to boarding the aircraft. It was noted by the flight crew that considerable maintenance work had been done to the aircraft and that some of the work had involved the elevator and elevator trim. Despite this information and the fact that the aircraft was nearing an uncontrolled condition, the flight crew diagnosed the problem as a weight shift. The pressure of hands and feet on the control column by both pilots was barely enough to get the nose down for a safe landing—an extremely hazardous situation.

Back on the ground it was determined that the (cargo) centre of gravity was within limits and not related to the actual problem. It was also discovered that the elevator trim tab was in the full nose-up position and moved in the opposite direction to the trim control wheel and to the trim indicator in the cockpit. A number of years ago, the Canadian Forces had several incidents resulting from inattention and carelessness during maintenance of flight controls on Cosmopolitan aircraft, the military version of the Convair 580.

At this point, a host of human factors come to light that I will list from the report, as follows:

1. The maintenance base was remote from the parent company and had operated for three years, during which time the company experienced rapid expansion and an increased workload without an increase in staff.

2. The expansion required new staff, but the company found that there were few licensed AMEs available, so they hired technicians in training.

3. There are no regulations regarding the ratio of licensed engineers to technicians in a company, so over half of the employees were under supervision.

4. To fulfill the requirement for 24-hr. servicing coverage, the crews worked rotating 10-hr. shifts.

5. The maintenance work involved in this occurrence took place on the second and third nights of a four-night work cycle. The crew had been work-

ing the night shift for a period of five weeks. They were on days, off for three days, and then started back on the night shift schedule. This was their last night shift before returning to the day shift cycle.

6. The occurrence aircraft was a Convair 440 that had been converted by a supplemental-type certificate to a Convair 580. This was an older generation aircraft for which the company had not yet developed a complete set of work cards.

7. The aircraft was acquired at the maintenance base five days before the occurrence for the completion of numerous maintenance tasks.

8. As a result of non-destructive testing (NDT), corrosion that required the removal of the elevator and stabilizer was found. These were removed as a single unit, which meant that only the elevator connection bolts, the stabilizer connection bolts, and the elevator trim cables needed to be disconnected. The elevator trim cables were not marked when they were disassembled; it is not a procedure specified in the maintenance manual, but is one that is considered good practice in the industry. The horizontal stabilizer and elevator were repaired as necessary and reinstalled.

9. The maintenance crew that removed the stabilizer assembly was not available when it was time to reinstall it, so the job was finished by another crew.

10. There were not enough qualified engineers, so the crew chief showed the technicians how to install the stabilizer and hook up the elevator trim cables.

11. The crew chief selected the cables, and the technicians installed the turnbuckles. The crew chief then provided them with the appropriate information on bolt torque and cable tension and left them to complete the job. It was his view that he was helping them with the routine but important task of installing and inspecting the stabilizer, elevator, and elevator trim systems.

12. The technicians, on the other hand, viewed their task as lending a hand to the crew chief, who was responsible for the work. All of the work related to the reinstallation of the elevator and stabilizer was completed on the night shift.

13. Everything seemed to be progressing OK at this point. The following night, both lead AMEs were available, so the crew was at full staff. On this shift, the crew chief instructed one of the AMEs to complete an "independent inspection" of the work. After inspecting the work, the AME pointed out to the technicians several items that had not been properly completed, including missing cotter pins and locking clips, a nut that was not fully installed on its bolt, and lockwire that was not of adequate thickness. They then re-did their work and presented it for reinspection.

14. Because of concurrent tasks, the AME did not reinspect the work until the end of the shift, and he did not have any assistance while accomplishing the inspection. Since the details had been completed satisfactorily, he checked the trim for freedom of movement but failed to have someone outside the aircraft to observe what was happening on the tailplane. As a result, he missed the most important failure in the process: the fact that the trim was operating in a reverse direction.

15. At the end of the shift, the lead engineer assisted the crew chief in filling out the aircraft logbook, indicating that the horizontal stabilizer and elevator were reinstalled and the rigging was checked as per the maintenance manual, although no one actually completed a rigging check because the crew chief had asked a technician to follow the rigging procedure as detailed in the maintenance manual, and he had highlighted two of the important tasks: special attention to the cable tension and dimensional check. The technician understood the instruction as a request to check the cable tension and dimension, which he did; however, the rigging was not performed properly.

In conclusion, the maintenance entry was signed as having been completed by the AME who had actually completed the "independent inspection," while the "independent inspection" was signed off by the crew chief who supervised the task. This occurred at the end of the shift when the logbooks from several aircraft were being completed and signed by the two AMEs.

Both AMEs felt confident in the other's work, and they simply signed off the work completed by the crew, regardless of their personal involvement.

There were five people who had a hand in the installation / rigging / inspection of the elevator trim tab control system of this aircraft, and it was still released with the elevator trim control operating in reverse.

The task of hooking up the control cables is, in itself, very basic. There are only two cables, and it does not require training to expert levels to understand the system and to recognize that the consequences of hooking the cables up backwards can be disastrous. This story could fill another page or two, but I think you have the main safety message related to managerial changes, shift changes, minimally trained technicians, inadequate supervision, poorly communicated instructions and log entries. This all added up to a simple but near-fatal mistake, and the whole mess could easily be avoided if manufacturers paid more attention to designing control hookups with different cable ends that could not be applied in reverse, if AMEs paid more attention to clearly tagging cable ends and connection points at the time of removal, and, finally, if those responsible applied some knowledge of aerodynamics with a physical check of the operation of flight controls before releasing the aircraft for flight.

Augmentor No-Light Troubleshooting on the F-100-PW-220/220E

Figure 1

Some F100-PW-100/200 Segment 1 spray rings have "migrated" into the F100-PW-220/220E fleet.

MR. RICH GREENWOOD
P&W Flight Safety
HQ AFSC/SEFE

A Maintenance Crosstell message, dated 280058Z Dec 00, from the Commander, 3d Logistics Group, Elmendorf AFB, Alaska, highlighted an unusual condition. Knowledge of this condition may help with troubleshooting the next time you have an "Augmentor No-Light" discrepancy (Event Code 1040 or Advisory Code 5002) on F100-PW-220/220E engines in F-15 or F-16 aircraft.

The condition? It seems that over the years some F100-PW-100/200 Segment 1 spray rings have "migrated" into the F100-PW-220/220E fleet. If a -100/200 spray ring gets installed in a -220\220E engine, there is a *slightly increased* propensity for augmentor no-lights to occur.

The most easily identifiable difference between the -100/200 spray ring and the -220/220E spray ring is the number of ignitor orifices—the holes upstream of the ignitors—that initially supply ignition fuel to the augmentor. The ignitor orifices can be identified by the *absence* of pintles in the fuel holes. These non-pintled holes ensure fuel delivery for proper augmentor ignition. Reference **Figure 1** to see orientation of the spray ring in the engine.

• The -100/200 engine has a *single* augmentor ignitor, hence its spray ring has *a single, non-pintled ignitor orifice* located at the 4:30 position. See **Figure 2**.

Figure 2

Figure 3

USAF Photos

If you suspect a mismatch in the spray ring and engine application, then verify the part number.

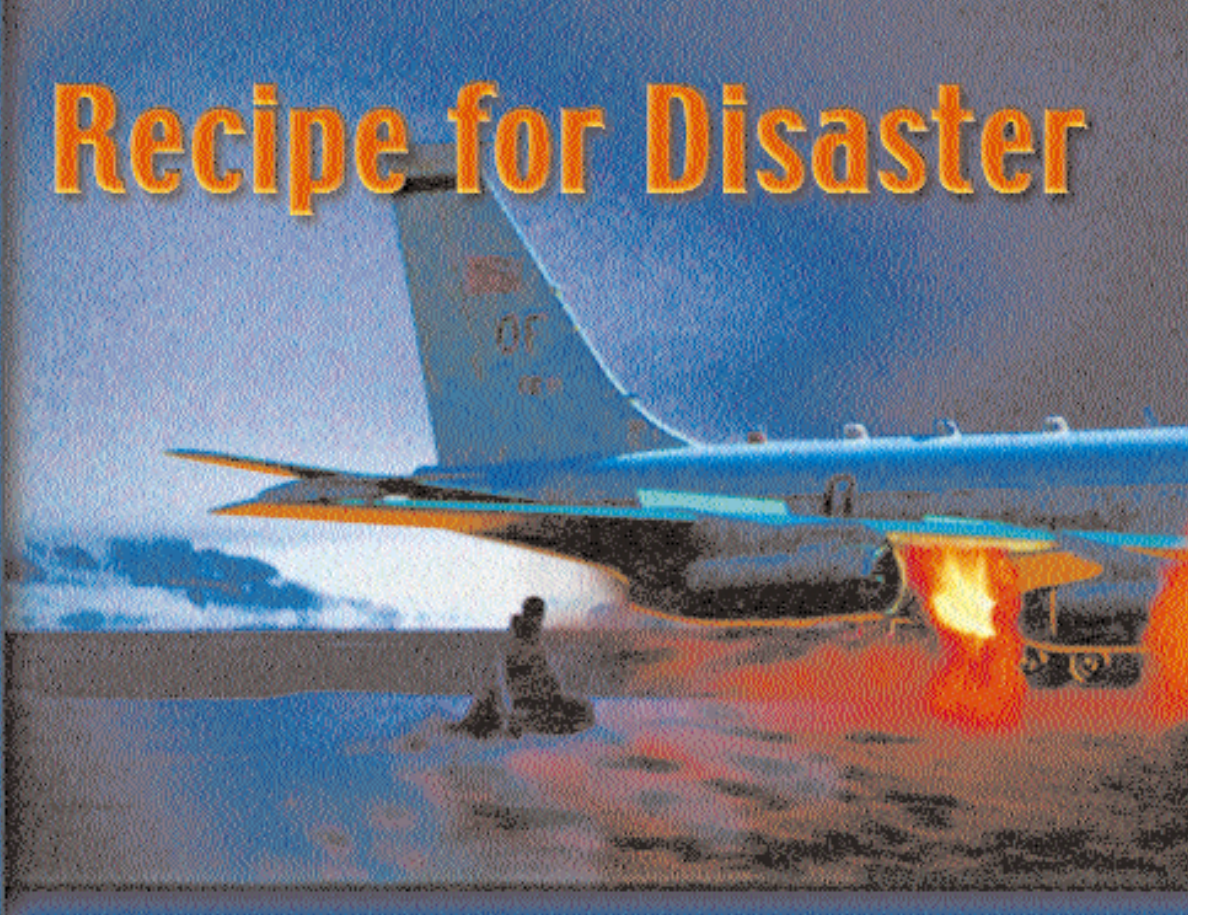
• The -220/220E engine has *two* augmentor ignitors, so the –220/220E spray ring has *two* sets of ignitor orifices. Just like in the –100/200 engine, there's a single, non-pintled orifice upstream of an ignitor at the 4:30 position. But take a look at the 7:30 position on the –220/220E spray ring and you'll see that just upstream of the second ignitor, are a *non-pintled orifice* and a *pintled orifice*, side-by-side. See **Figure 3**.

Remember: The –100/200 spray ring has a single, non-pintled hole at the 4:30 position. The –220/220E spray ring has a single, non-pintled hole at the 4:30 position, along with a *non-pintled orifice* and a *pintled orifice, side-by-sid*e, at the 7:30 position. Except for the differences noted above—and spray ring part numbers—all other fuel holes on both the –100/200 spray ring and –220/220E spray ring are pintled.

If you suspect a mismatch in the spray ring and engine application, then verify the part number, which is found on the spray ring feed tube mounts (feed tube mounts are highlighted in Figure 1). Part numbers for the -100/200 spray rings are 4051866 or 4074478. Part numbers for the -220/220E spray rings are 4056925, 4074497 or 4085197.

Next time you experience a no-light event this quick check could save you a lot of troubleshooting time. Thanks to the 3d Fighter Wing's Propulsion Flight, and its Flight Chief, CMSgt Tim Shannon, for taking time to put out the Crosstell on this issue.

Recipe for Disaster



Besides, what could go wrong? This was an easy launch.

MSGT ROBERT J. DEMPSEY
108 ARW/LG/LGQ

There I was… Thinking *I'll be so glad when this thing is gone. This will be easy*. It was time for this RC-135 to go to its home base for maintenance, and I wouldn't see it again for at least a week. That would finally give me time for some leave—and I could really use it. The last two months had been crazy and I'd made plans to get out of town and relax for the week. All I had to do was launch the aircraft, something I'd done hundreds of times before. Little did I know that it wasn't going to be so easy this time.

This was a flight home instead of a real-world reconnaissance mission, so this meant a lot less work for everyone, including the aircrew. Preflight inspection and servicing had gone just fine. In fact, things were going so well I decided to have my two new assistant crew chiefs perform the aircraft launch. Besides, what could go wrong? This was an easy launch. There I go with that *easy* line again.

The crew bus pulled up, and before it even stopped, the doors swung open and baggage began flying out. This bunch wanted out of here in a hurry! Of course it was February and 30 degrees below zero. We had a ground heater going to make sure the cabin was nice and warm, so I'm sure this had something to do with how eager they were to board the aircraft. With crew baggage flying, my two assistants ducked, bobbed and weaved their way to the bus to find the aircraft commander (AC). If they could impress him that would impress me, and all would be right with the world. Unfortunately, he was nowhere to be found. I could see the puzzled looks on my guys' faces as one crewmember after another shrugged his shoulders. I got the "What do we do now?" sign from both of them. Time for me to find the missing AC. Let's see… Now we'll add *in a hurry* and *cold* to *easy* and see what problems we get.

I made my way to the crew entry door ladder to see if he had gone up that way. When I got to the bottom of the ladder, I did the best imitation of a hockey puck you've ever seen, shooting across snow melted by the ground heater that had refrozen and turned into ice. This was a

Photo Illustration by Dan Harman

really big patch of ice, about seven feet in diameter. I was glad we had air stairs for the crew to use. *Someone could get hurt on this.* So, now let's mix in a little *ice* and *confusion* to the situation, shall we?

The AC appeared out of the shadows of the left wing. Remember, it's February in Alaska—20-plus hours of darkness—and there were no lights on one side of the ramp. His dark green flight suit caused him to disappear into the black hole that was that side of the RC-135. He had started his preflight walk-around without crew chief assist. One of my assistants spotted him as he emerged from the darkness and grabbed his partner to intercept the AC. To their surprise, the AC didn't want to see the aircraft forms. He didn't want to talk. He didn't even want to stop. All he wanted was to get his walk-around done and get inside the plane. I could see my assistants were at a loss as to what to do next.

Following him around the aircraft, they tried their best to be helpful and assist with the walk-around, but the AC wasn't very "helpful." He waited at the bottom of the stairway for my assistants to catch up, quickly snatched the aircraft forms from them and, without saying a word, made his way up the stairs. Standing dumbfounded, I got a "What did I do wrong?" look from the two of them. The best I could do was shake my head, slip and slide my way over to them and help get the air stairs pushed away so the crew could shut the door and keep their precious heat indoors. All of the links in the mishap chain were now in place. To bring the pot to a full boil, all we needed were *darkness, inexperience* and *not following standard procedures.*

I boarded the Expediter truck to monitor the launch, joining a few other folks who were doing the same. I listened on ground as one of my assistants called flight controls while the other assistant stood fireguard. I could tell they'd lost all their self-confidence during the confusion that was crew show, so while we sat in the Expediter van trying to stay warm, I worked to build it back up. My two assistants felt a lot better when I told them engine start would be a *piece of cake.* Boy, were we in for a shock!

Everyone was in position: Ground was ready, the fireguard was posted and I was driving the truck to pull the equipment away after engine start. This put

continued on next page

The AC didn't want to see the aircraft forms. He didn't want to talk. He didn't even want to stop.

me in a spot where I could see everything during the launch, but not so close as to make my guys feel as if I was looking over their shoulder. *Got to test their mettle.* Little did I know that this would be a *real* test.

Time for engine start. I heard the air rushing out of No. 3 engine's starter and called, "Control, engine start, spot 3." No sooner did I hear Control's acknowledgement than I heard another sound. A bad sound. No. 3 engine had just let out a *BANG! Compressor stall!* "What the hell…" was all I got out as I watched the RC-135 shake and buck. Flames shot out the wrong end of the engine, then flew out of the exhaust end! For what seemed like an hour, I sat there, staring at the engine, thinking, *OK, what's next?* I had seen this once before, and that engine spit its guts out the back end soon after. *So much for easy.*

Disbelief switched to running in high gear the second the aft underside of the wing lit up. I mean it was *bright!* Fireball orange bright! I managed to grab the truck radio and spit out information to whoever could hear me. "I need some help out here!" was how it started. Surprisingly enough, the rest of what I said came out clear and concise, albeit an octave higher. Help was on the way.

That fireball looked right out of a sci-fi movie. It seemed to have a life of its own, first floating in the air as a bright, spinning orb, taking its time to get past the wing. At that point it started to grow, changing color and shape. It was now spinning apart. No longer bright, it glowed like a huge distant firefly. When it hit ground it rolled, breaking apart, forming small, glowing deep-orange pools in the snow. I was in awe, my mouth hanging open, I'm sure, until the sight of flames licking the bottom of the wing brought me back to this very bad reality. I leapt from the Expediter truck to assist.

My assistant standing fireguard had run over to the No. 3 with the fire extinguisher, but had forgotten to pull the pin, and was fighting it instead of the fire! He quickly corrected his mistake and started spraying the extinguisher wildly, all over the *outside* of the cowling. But the fire was on the *inside*. I reached into the fog he was creating, grabbed him by the collar and pulled him towards the engine fire access door. I punched the door in and pointed to it. Lit by the glow of the fire, I could see his face clearly. I'd characterize the look as one of sheer terror. I had always said that a fireguard was committed to use one fire extinguisher to buy a little time for the crew. After that, he could run. It was obvious to me by the look on his face that one extinguisher was one too many. He shoved the extinguisher nozzle inside where it would do some good, and pulled the handle. Now it was time to get the crew.

Fortunately, the aircrew wasn't waiting for me. They had been given more than enough reason to leave the aircraft faster than they boarded. One by one, they were bounding down the entry ladder. I expected to find my other assistant helping them make it across the ice, but he was nowhere to be found. Was he hurt? Did he go over to fight the fire? I searched for the black interphone cord on the ice, hoping to find him at the end. I finally spotted him, some 30 feet out in front of the plane. He was running back and forth in a small arc at the end of the cord, like a dog straining at the end of its leash. He had mashed down the "Talk" button and was screaming wildly over the interphone system. That'll keep a crew calm. *Not!*

Suddenly, out of nowhere, two hands landed on my shoulders, pulling me down. I had no idea what was happening as I spun around on the ice beneath the crew entry door ladder. I wound up on hands and knees, face to face with a crewmember who used me to stop *his* fall. As we fumbled to help each other up I could see most of the aircrew was either on the ground or in the process of falling on the "ice rink." One guy was holding onto the ladder for dear life, his feet moving a hundred miles an hour in all directions. *I could almost hear the bongo drum sounds, like you do in cartoons.* I got to my feet, looked around and saw the crew now scurrying across the ramp to a spot far away. Now I had to find my assistant, who had been calling ground. To my amazement, the only sign of him was his headset, lying on the ground at the end of the interphone cord. *OK,* I thought, *he's with the crew*. I need to get back to my other assistant, the one I left by the burning engine.

Flames were still coming out the exhaust, but now little globs of fire were dripping out the bottom of the cowling.

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We had to get the extinguisher around to the back of the engine. The fire extinguisher was lying on its side, with the hose stretched out, away from the engine. *Where is my fireguard? Hmmm… This is a good indicator that I'm now alone, with fire dripping at my feet and the engine burning merrily away. I* have *had better nights.*

Two minutes into the emergency seemed like forever. And speaking of forever, *Where is the fire department?* I had no sooner sworn at them when I saw the approaching fire trucks' red lights reflecting off the side of the aircraft. As more trucks arrived, the dark side of the aircraft was lit up in swirling red beams. *It was like a scene from a bad disco.* I had never before been so happy to see so many flashing red lights behind me! The firefighters gave the engine one good shot from their hose and quickly put an end to the whole ordeal. I could have sworn the earth had stopped turning, but in less then five seconds the fire department had restarted time. And for the first time since I stepped out of the truck, I noticed just how cold it was. Now it was time to find my assistants—both of them.

I was moving to where the aircrew had gathered, but someone in another maintenance truck yelled for me. He knew what I was looking for. There, huddled in the back of the step van, were both of my assistants, just sitting, slowly rocking back and forth on the bench. They were looking down, staring at the floor, not making a sound. I couldn't be mad at them; they had never been through anything like this before. Besides, it was I who had told them this would be an easy night. *Boy, was I wrong!* "Are you guys OK?" I asked. Only one looked at me and nodded. I figured that was the best I was going to get right now, so I asked the guy driving the truck if he would take them to the clinic, have them checked out and then just take them home. He smiled, said, "No problem," and off they went.

Later, after the smoke had cleared and everyone stopped asking me "What happened?" I took some time to reflect on what went wrong. I consider myself very lucky for two reasons. First and foremost, no one was hurt. My assistants were pretty shaken up, but they lived to fight another day, and so did the aircrew and aircraft.

But most of all, the experience gained by this life's lesson made me a better Maintainer. I examined each link in the mishap chain, recognizing what had the potential to cause problems and learned how to break the mishap chain, and prevent things from going from bad to worse in the future. For instance:

• I couldn't have foreseen the engine would catch fire. But planning for that eventuality ahead of time can make the difference between getting hurt and getting home. And in this case, we had a repairable aircraft instead of a heap of scrap.

• I make sure everyone I train hears this tale. I make handling engine fires and aircrew egress something we practice, not just talk about.

• From that point on, my team and I discussed emergency procedures before every launch or engine run. We also made sure the team knew what the AC had in mind if something went wrong.

• I assess the aircraft *and the entire work environment* for hazards. The ice skating rink at the foot of the crew entry door ladder was an unacceptable hazard. In hindsight, we should have taken steps to ensure the aircrew had a safe egress path in the event of an emergency.

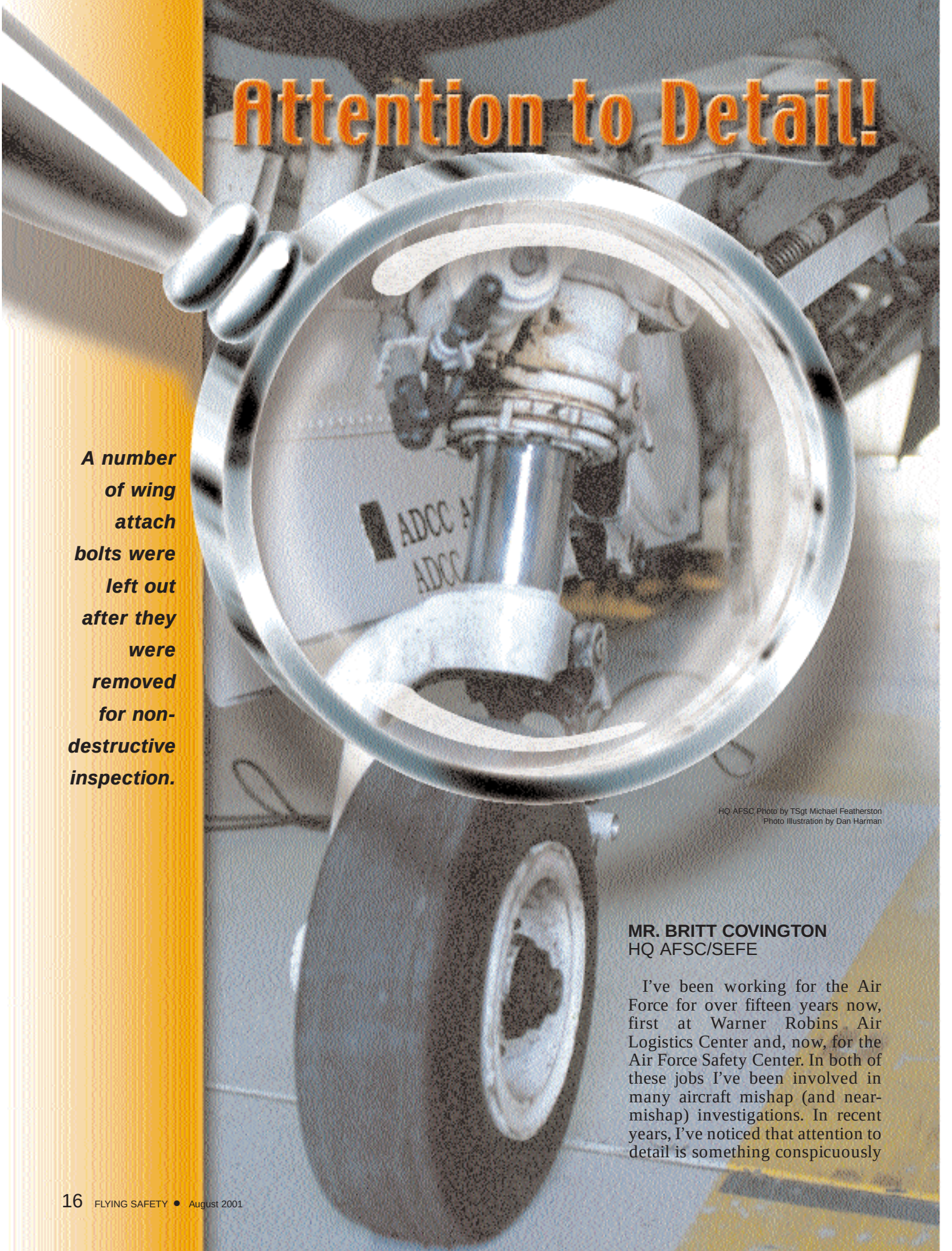
• I do everything with the worst-case situation in mind. All the planning we do and all the procedures we follow are meant to keep bad things from happening. Poor planning—or worse yet, complacency—simply ensures that bad things *will* happen.

Our profession has many inherent dangers. But we're trained to mitigate the hazards and respond to the unexpected. Aren't we? Remember the "Seven 'Ps.'" Proper Prior Planning and Procedures Prevent Poor Performance.

(MSgt Bob Dempsey is a full-time technician assigned to Logistics Group Quality Assurance in the 108th Air Refueling Wing, New Jersey Air National Guard. He entered service in 1978 as a crew chief on B-52s and KC/RC/EC-135s. He has seen action in Operations DESERT SHIELD/DESERT STORM, NORTHERN WATCH, ALLIED FORCE and DELIBERATE FORGE. He has an A&P license, civilian pilot wings and is finishing his Engineering Degree. Ed.)

There, huddled in the back of the step van, were both of my assistants, just sitting, slowly rocking back and forth on the bench.

Attention to Detail!



A number of wing attach bolts were left out after they were removed for non-destructive inspection.

HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

MR. BRITT COVINGTON
HQ AFSC/SEFE

I've been working for the Air Force for over fifteen years now, first at Warner Robins Air Logistics Center and, now, for the Air Force Safety Center. In both of these jobs I've been involved in many aircraft mishap (and near-mishap) investigations. In recent years, I've noticed that attention to detail is something conspicuously

lacking in a number of maintenance-related aircraft mishaps. I'd like to relate to you several real-world examples where maintenance errors or omissions—classed under the category of "Human Factors"—had serious consequences.

It's amazing how something as innocuous as failing to install a cotter pin can lead to the loss of a $35 million Air Force aircraft. Yet, it has happened. I'm familiar with one mishap that occurred because a maintenance technician either failed to install a cotter key, or failed to crimp the cotter key around the bolt, on the locking mechanism of a main landing gear assembly. The nut eventually backed off and the main gear collapsed on landing. The crew successfully egressed but the aircraft was destroyed.

I vividly recall one instance where a number of wing attach bolts were left out after they were removed for nondestructive inspection. The panel was "temporarily" replaced over the wing joint. Ultimately, lack of documentation and improper final inspection resulted in the aircraft flying with those wing bolts missing. It was pure luck the wing didn't depart the aircraft during flight.

Sometimes maintenance mishaps occur due to lack of training. In the case of high-strength steel landing gear parts, all Maintainers must be aware that hard contact with a concrete floor or other rigid surface may induce nearly-imperceptible, yet permanent damage to parts, causing them to fail at the worst times—while servicing, taxiing or, worst of all, during landing. Despite a belief that these parts are "high strength," when it comes to material handling, landing gear parts may be some of the most delicate of all.

Here are a few other memorable mishaps where deviation from tech data or inattention caused aircraft/equipment damage:

• A landing gear shock strut was improperly assembled. In this case, a split ring wasn't seated properly into its mounting groove during strut build-up. As a result, the ring bound and began to disintegrate inside the cylinder, resulting in failure of the gear and severe damage to the aircraft on landing.

• An aircraft lost a wing in flight, crashed and was destroyed, because Maintainers inadvertently left out four fasteners during a wing repair. Fortunately, the pilot ejected safely.

• Some high-pressure hydraulic lines were attached to the wrong strut during jacking operations for a tire change. The resulting damage required replacement of the landing gear vertical post.

• Instead of using the required low-pressure air during repair, high-pressure shop air was used that damaged honeycomb structure to the point where a major portion of an aircraft's tail departed in-flight.

• A maintenance crew failed to properly follow technical orders, and inadvertently overpressurized a large aircraft's fuselage, blowing it apart. The aircraft was a total loss.

• Because the arresting hook was not properly connected, an aircraft undergoing engine run broke loose and sustained severe damage.

• Inadequate lubrication led to a reverse propeller pitch condition and crash of a UAV.

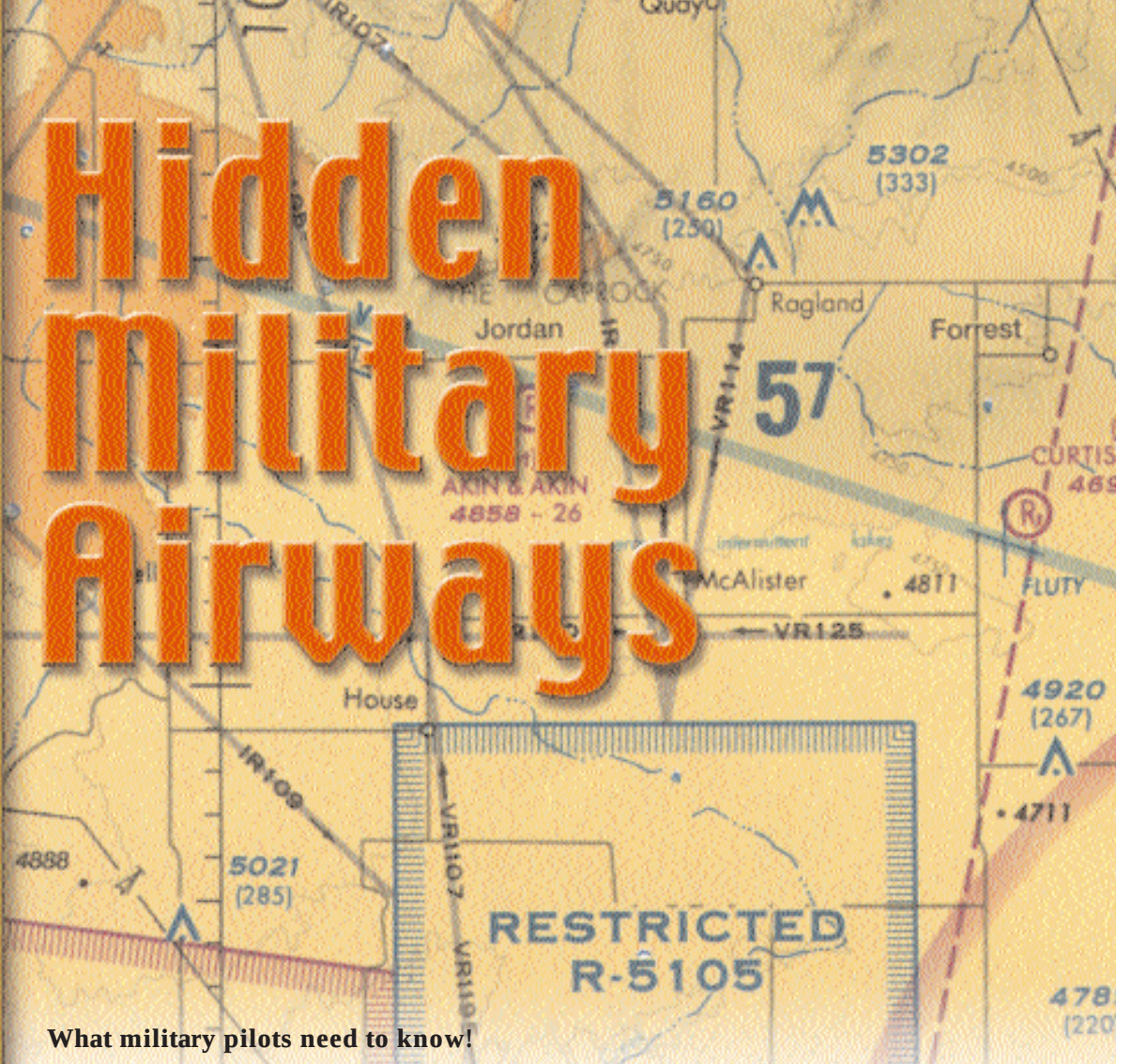
I'm sure that all of the Maintainers involved in the incidents I've mentioned never intended for, or even thought, their actions (or inactions) would result in a mishap. I'm sure that each of them was conscientious and many were probably well trained. So, what's common to all these incidents? *Lack of attention to detail.*

The days of "over-the-shoulder" Quality Assurance are returning and, in my opinion, not a minute too soon. *I am a firm believer that two sets of eyes are better than one.* People will make mistakes. Proper training, personal integrity, attention to detail and a strong, comprehensive Quality Assurance Program are the best ways to combat the inevitable human error. Whether you work in a back shop, on the flightline, or an air logistics center, as a Maintainer, you—repeat, YOU—are the one the US Air Force counts on for the safety of our crews, passengers and aircraft. Your personal attention to detail in every maintenance task you perform is what makes the difference between a safe, effective mission and disaster.

(Mr. Covington is an Aerospace Structural Engineer and aircraft mishap investigator in the AF Safety Center's Engineering Branch. He's an Aerospace Engineer by training and spent nine years as a structural engineer at WR-ALC before joining the AF Safety Center. Ed.)

I am a firm believer that two sets of eyes are better than one.

Hidden Military Airways



80 percent of reported military near misses occur with general aviation aircraft—"bug smashers."

What military pilots need to know!

MAJ NED LINCH
160 FS
Montgomery AL

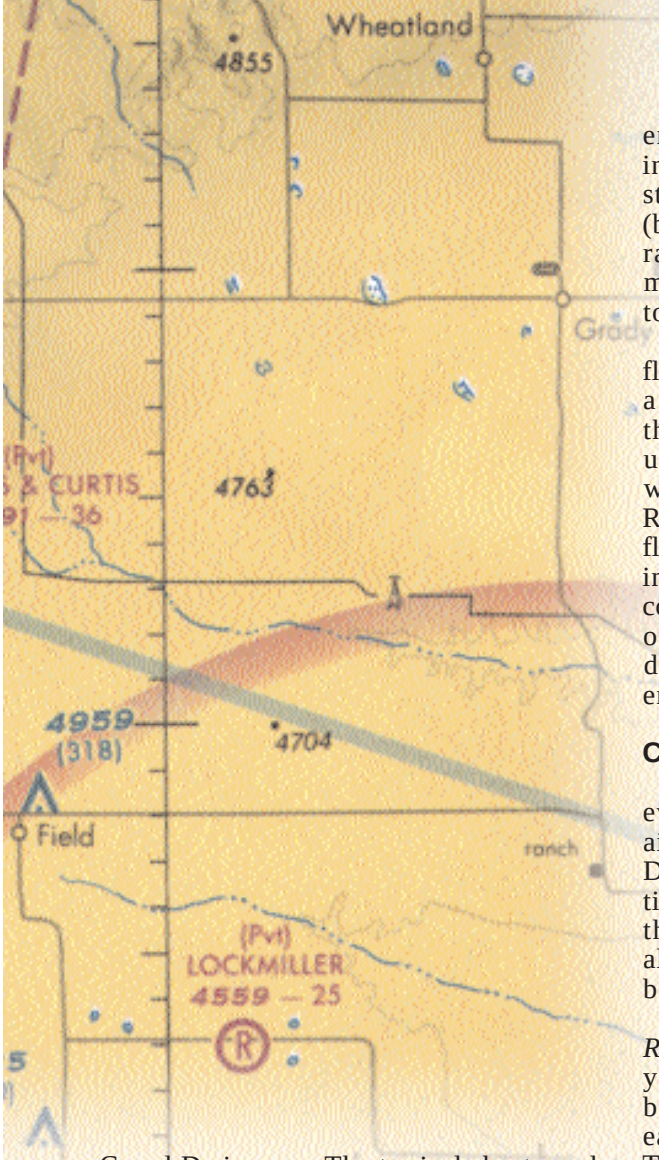
Between 1986 and 1995, there were three midair collisions and 51 known near-midair collisions between civilian and military aircraft operating on or near Military Training Routes (MTRs)—VR and IR routes. In 45 of the near-midair collisions (NMACs), the military pilots spotted the civilian aircraft and managed to avoid an accident. The actual number of midair collisions between military and general aviation aircraft is relatively low, considering the thousands of sorties flown each year by military aircraft. However, 80 percent of reported military near misses occur with general aviation aircraft—"bug smashers."

I personally know of multiple unreported close encounters between military jets and civilian light aircraft, and you probably do, too. What can we do to avert a near-midair collision? Here are three rules of thumb: 1) Effective Mission Planning; 2) Comply With the Rules; and 3) Report All Close Encounters.

Effective Mission Planning

It begins with mission planning: Many near misses can be averted if we effectively plan and utilize all available resources. Have you ever used a civilian sectional chart to plan your low-level? The sectional chart has all the MTRs (military training routes) printed on the chart. These thin gray lines, which can get lost in all the clutter, represent the centerline of your route. You should be aware that civilian aviators may not know you could be off your centerline.

A sectional chart can also be used as a reference for the actual boundaries of airfields, accurate location of special use airspace and the boundaries of Class B,



C and D airspace. The typical chart used by the military does not provide this information. When is the last time you really CHUMed a military map? The civilian sectional chart is updated every 56 days and depicts new obstructions and airspace data. Another reason to use the sectional chart is it saves time when planning a route.

Have you ever flown an MTR without booking the route or flown outside the booked time? Many of us probably have, due to forgetting to call or being unable to get through on the phone line. It's VFR and it's "see and avoid," right? Yes, but AP1/B (that thick book in your flight planning room with dust on it) requires pilots to schedule the route through the designated "scheduling activity" listed in the route description. If a civilian pilot is not aware the route is active, then you increase your chance for a near miss with the "slow mover." The bottom line is to schedule the route and meet your entry time—if you can't, then relay the information to the nearest flight service station (FSS). It is difficult for all pilots (both civil and military) to obtain accurate information on active MTRs. Don't make the situation worse by forgetting to book the route!

How many of you annotate the conflicting MTRs on your route? This can be a tedious and time-consuming activity that is usually disregarded (unless you use standardized route booklets). Here is where a sectional chart can assist as well. Remember, most routes are only deconflicted at the entry time by the "scheduling agency." Several bases are now using computer programs to deconflict routes owned by that "scheduling agency." But, deconfliction with routes owned by others is not common.

Comply With The Rules

Intercepting civilian aircraft. Have you ever locked and intercepted a civilian aircraft while in an MOA or on an MTR? Don't! Use your radar to ensure separation from civilian traffic. The last thing the military needs is an NMAC or TCAS alert due to a fighter pilot with a cowboy attitude.

Complying with Federal Aviation Regulation (FAR) speed restrictions. Have you ever exceeded the speed restrictions below 10,000 feet? Many of us have! It is easy to do in a high performance jet. Timely corrections to comply with the FARs may make the difference in preventing a mishap with another aircraft.

Report All Close Encounters

Should I report that near miss? Definitely YES. If we are to fix the problems associated with airspace and training routes, we have to report the information via the proper channels. See your flight safety officer for the proper HATR forms to fill out.

The bottom line is that civilians and the military have to share the same airspace. If you mission plan effectively, abide by the procedures and report all close encounters, then the *hidden military routes* can be seen by others sharing the same airspace.

(Major Ned Linch is an F-16 pilot and flight safety officer with the 160 FS in Montgomery AL and a Boeing 727 pilot for Delta Air Lines. Ed.)

Have you ever locked and intercepted a civilian aircraft while in an MOA or on an MTR? Don't!

A Near Mid—

Photo Illustration by Dan Harman

As we approached the river, I heard a Cessna call-sign ask Departure if he was supposed to fly underneath the helicopter.

MAJ ERIC BRAGANCA
551 SOS
Kirtland AFB NM

Of all nights to have a problem, it had to be on my checkride.

I'm an MH-53J instructor pilot at the formal schoolhouse at Kirtland AFB NM, and on this night I had a crew of ten, which included two student pilots (one in the pilot's—right—seat next to me and one in back waiting to finish a checkride later that evening), a flight engineer student, an aerial gunner student, my evaluator pilot in the cabin, and five instructor/evaluator enlisted crewmembers. Our five-hour mission was rather complex—with low-level formation, aerial refueling from a C-130, aerial gunnery, and then terrain-following/avoidance radar low-level flying and self-contained coupler approaches to round out the night, all using night vision goggles (NVGs). With 3500 hours of helicopter time, and about 1000 hours on NVGs under my belt, this wouldn't be that hard. I had seven years of flying MH-53s, and I'd done this kind of profile many times.

My show time was approximately 1400L for a 1600L crew brief. The early arrival let me review the weather, NOTAMs, etc., before sitting down with the students to review the mission plan for the night. Pilot prebrief and crew brief went well. After the crew brief, I spent additional time with the student pilots, while the enlisted crewmembers stepped to the flightline to preflight the aircraft and .50 cal and 7.62mm miniguns.

Aircraft run-up was uneventful. Because of a leak check on the main transmission, we took off about 12 minutes late. It was now after 1900L—approximately 30 minutes after sunset. Our lead had taken off on time and would be waiting in the remote landing zone for us to maximize his students' training.

Kirtland AFB is in Class C and D airspace controlled by the FAA and shared with a moderate-to-high volume of civilian (mostly airline) traffic. On this night, Tower delayed our takeoff to allow an airliner to land and a Cessna, who'd been waiting longer than us, to take off. We finally received clearance and the student pilot started our takeoff. As helicopters, we avoid the flow of fixed-wing traffic, so our departure is designed to go 90 degrees to the major

-Air...or Two

runway. We flew out on a heading of 170 degrees. As we cleared the airfield boundary, I took the controls to allow the student pilot to get out the map and focus on his mission. Tower called the Cessna at about two miles and 11 o'clock and authorized a frequency change if we had that traffic in sight. The Cessna had just taken off from the main runway (number 8) and appeared to be on a downwind departure—almost perpendicular to our path. We would be able to climb fast enough to go almost directly over him. I rogered Tower, calling the Cessna traffic in-sight, and switched to Departure Control.

When I checked in with Departure, they also asked if I had the Cessna in sight. I confirmed that I did, and flew almost directly over the Cessna, guessing we were 500 feet over him as we passed. This felt comfortable since I had seen him for a minute or so and he was flying a steady course and altitude. As part of our standard crew coordination, I alerted the right scanner (an evaluator flight engineer) that the Cessna was passing left-to-right and that he should see the traffic in a second. The right scanner tallied the aircraft and said it looked like he was heading away from us. We leveled off at 6500 feet MSL (about 2000 feet AGL), completed our gear-up after takeoff checklist, and made some minor intercom calls about the navigation system. I kept the intercom traffic light because too much crew talking can cause us to miss radio calls in a congested radar environment. Many student pilots like to try to accomplish power checks, combat ingress checks, and the like as early as possible, but tonight my students were doing a good job of focusing on the job at hand—exiting the Class C airspace.

We continued southbound, following our VFR helicopter departure to a large dry riverbed where we made a right 90 degree turn. This turn would take us west across the Rio Grande and under the approach path for Runway 3 (which was also active for landing traffic that night). As we approached the river—where we normally change frequencies off approach and descend low-level—I heard a Cessna call sign ask Departure if he was supposed to fly underneath the helicopter. I instinctively swung my head right to look out the pilot's cockpit window just in time to see a large black

continued on next page

I had just enough time to ask how close he was before the instructor aerial gunner called "Break left and descend!"

spot pass underneath us with a red and green light defining the boundaries of the blackness—the Cessna! The right scanner called out the traffic at the same time. It was hard to tell at night, but it appeared that the Cessna had passed within 200 feet of us vertically. We started talking about where he came from and how we'd lost him in the numerous city lights of Albuquerque, when my aerial gunner student on the ramp called out a large aircraft descending directly upon us from 6 o'clock. I had just enough time to ask how close he was before the instructor aerial gunner called "Break left and descend!" From 2000 feet AGL, we hit the deck fast and leveled out at 200 feet AGL, now past the Rio Grande and over the dark deserts of New Mexico.

When we leveled off and collected our thoughts, I asked the crew how close they thought the second aircraft was and what was it. Both the instructor aerial gunner and the student pilot in the back said it was a civilian Boeing 737 and that they could make out a small, specific part of the paint scheme lit by the landing light. Having seen these aircraft taxi by the military ramp hundreds of time, I tried to imagine how close he could've been to see that at night—and I didn't like the conclusions I was coming to. To the crewmembers looking out of the ramp, it appeared the airliner was descending and turning for an approach at Albuquerque and may never have seen us. Since our spotlight was on the nose and pointing forward, the only light clearly visible from a high 6 o'clock would've been the tail strobe. Might our strobe have washed out in the same city lights that prevented us from seeing the Cessna just a moment earlier?

I climbed back up to over 1000 feet AGL and talked to Departure. I mentioned only the Boeing 737 incident (the Cessna seemed like a distant memory by then) and explained my rapid descent. I don't remember what Departure said to me, except for clearing me off frequency. We continued west toward the landing zone and our formation partner. I kept the altitude above 300 feet AGL (the definition of low-level flying for us) and talked to everybody about what had just happened. The crew seemed pretty satisfied that the worst of the night was behind us. Everyone seemed pretty comfortable with continuing, and since I could think of no reason to return to base, I agreed and we continued. I notified the wing's Supervisor of Flying (SOF) of what had happened and pressed on. I did wonder what the rest of the night held for us after such excitement in the first 15 minutes of flying.

The rest of the night went as briefed—a rarity with so many events to cover. We accomplished our formation approaches to the remote landing zone. The C-130 met us on time on the air refueling track and actually gave us more time than we'd coordinated, which helped me get my pilot recommended for his NVG air refueling checkride. The gun range let us on early—an extremely rare occurrence—and all our guns worked well. Our radar worked well, so my other student pilot swapped into the pilot seat while we were shooting over the gun range. He accomplished his portion of the sortie on the way home and completed his final checkride so he could graduate. Boy, what a great night...after the first 15 minutes, that is.

When I returned home, my crew debriefed the night with great emphasis on the two near-midair collisions. How had we lost the Cessna in the city lights? Why didn't Departure tell us the Cessna had changed course and would be closing on us? We thought he was westbound when suddenly he appeared directly underneath us going south. Did the Boeing 737 see us at all? How close did they get? And most importantly, what could we have done better?

It's the answer to the last question which still eludes me. I think we were doing a good job on all accounts. We had our strobe, position and search lights on. We were flight following with Departure Control, squawking correctly. We had established communication with Departure and continued to hear radio calls throughout the departure. We felt we'd done what we could. All the scanners had been at their posts throughout the critical time and hadn't seen the Cessna until it was too late. The tail scanner on the ramp called out the Boeing 737 as soon as it appeared obvious that he was heading for us—the 737 was probably going twice our speed, so he closed on us quickly.

Did the Boeing 737 see us at all? How close did they get?

I filed two Hazardous Air Traffic Reports that night—one for each incident. I explained the entire scenario to the SOF and headed home. It was now 0300L and I was worn out. That was one of the toughest drives home. Along with the usual tiredness of being out so late—you sort of get used to that—I was also running those critical few minutes through my head. Fortunately, I didn't have long to wait for the answer.

When I arrived back at work the next afternoon to fly again that night, I was met by multiple messages from a wing flight safety officer. We linked up for a drive to meet FAA representatives at the Control Tower (where Departure Control was collocated). There, a supervisor met us. She had the voice tapes and a computer printout of each aircrafts' plot along with a chart of all the distances and altitude separations ready to review. Now this was customer service! However, I was surprised at what I saw.

I walked in hoping to hear an apology of some sort, but also very curious at what their information would reveal. The data showed us flying over the Cessna on our southbound leg, but only by 200 feet vertically, not the 500 feet I'd thought. And sure enough, the second time we encountered the Cessna, he flew right under us within 200 feet vertically without any warning from the controllers. But the ground track of the Cessna wasn't directly westbound as I'd thought. He was heading southwest the entire time. *He* never changed course—*we* did. We executed our departure procedure perfectly—on course and altitude the entire time, first south and then west. So when we saw the Cessna the second time, it was because we'd turned back toward his path.

The audiotapes revealed the Cessna pilot never heard of us coming off the airfield because he was on Departure Control when Tower cleared us to take off. He never knew we flew directly overhead on the first pass and that's why he was so surprised to see us later on. He was annoyed at the controllers for not alerting him to our presence earlier—a righteous claim. But why hadn't the controllers alerted either of us to the other before the second pass? After all, the radio traffic volume was rather light in the moments leading up to the second pass. The reason was, as the supervisor explained, I had called the Cessna in sight. The Cessna hadn't changed course or altitude, so the controller had every expectation that I still saw him. What the controller wasn't aware was that our distance had spread to over five miles between passes and that we'd lost him in the city lights. Another piece I didn't mention was that we'd really stopped paying attention to the Cessna because my right scanner and I thought he was going west, not southwest. Had I made that assumption and predisposed the right scanner to that when I passed the traffic off to him?

As for the Boeing 737, he never got closer than 1500 feet vertically although he did almost pass over us. I think poor night depth perception, along with the large distraction from having seen the Cessna so late, caused us to see the airliner as much closer than he was.

In the end, I believe we did most things well. We used sound crew communication to pass off the Cessna from copilot to right scanner and then later to make calls about the Boeing 737. We minimized the intercom chatter to focus on the higher priority of being vigilant for traffic. We kept our lights on. So how would I fix this so it won't happen in the future? I'll be more careful watching other aircraft at night having been reminded of the limitations of night vision—even with 1000 hours flying under NVGs. I'll double-check on traffic a bit more often. And mostly, I'll keep listening to the radios intently, since it was hearing the Cessna pilot's radio call that alerted me to his passing.

As for my checkride, I passed. He was satisfied and that's all I needed to know. This was one checkride where my success wasn't determined by the evaluator's opinion, but by simply surviving the night. I flew for five hours with NVGs under 200 feet AGL in formation with another helicopter, did aerial refueling with a C-130 under zero illumination, and shot guns in formation. Yet it was the departure from the airfield under radar control that caused me to age unnecessarily. Maybe it's time to head off to a cushy staff job and leave this sort of excitement to younger, more fearless pilots.

But the Cessna was heading southwest the entire time. He never changed course—we did.

Aircraft Towing

MAJ PAUL GALLAHER
HQ AFSC/SEFF

In recent years, the Air Force has seen numerous taxi and towing incidents resulting in expensive repairs.

They read like a bad novel.

Towing and taxi mishap reports keep reaching my desk with no end in sight… mishap messages with stories like: AWACS tail strikes hangar door during towing operation. C-5 towed into stair truck. KC-10 rolls backwards into maintenance stand during towing operations. B-1B taxis into fence. C-130 strikes floodlight during taxi. I could go on and on with a litany of taxi and towing mishaps that have occurred during the last few years. The sad part is that many of these expensive mishaps occured due to lack of checklist discipline or adherence to written guidance.

So now you're asking me, "What written guidance, other than the T.O.s, pertains"? Well, since you asked, I'll tell you. It's called Air Force Occupational Safety and Health (AFOSH) Standard 91-100. Its title is *Aircraft Flight Line - Ground Operations And Activities*. Never heard of it, you say? Maybe you have, maybe you haven't. I hope each of you is aware of the basics of Chapter 2, *Towing and Taxiing Aircraft*. In recent years, the Air Force has seen numerous taxi and towing incidents resulting in expensive repairs. Whether you're an aircraft maintainer or an aircrew member, you need to be aware of the concepts in AFOSH-STD 91-100. In an effort to ensure you all are aware of 91-100's concepts, I'll excerpt some of the key points:

Aircraft Towing:

"Aircraft ground handling personnel will be thoroughly familiar with all published towing procedures pertaining to the type aircraft being towed."

"The tow supervisor will be the only team member authorized to give the all clear to move order and will ensure all team members are qualified per requirements…"

"When towing aircraft, team personnel will be stationed to conform to applicable aircraft T.O. procedures for the type aircraft being towed…

"In all cases there will be a towing supervisor."

Other tow team members include: A brake person in the cockpit, a tow vehicle operator, a nose walker (usually the tow supervisor), wing walkers (in most cases) and sometimes a tail walker.

During night operations, luminous wands will be issued to tow team members requiring them. "The use of wands by the towing team supervisor will be required even when the aircraft interphone contact is established."

"Towing speed will not exceed that of walking team members, with a maximum of 5 miles per hour." This may mean you will have to *slow down* during turns for large aircraft, because the outside wing in a turn will move much faster than the aircraft. If the wing walker becomes a wing runner, you need to slow down.

HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

Control tower clearance is *mandatory* prior to towing an aircraft on or across an established taxiway or runway.

"…[A]ircraft brake systems will be charged before each towing operation. Aircraft with faulty brakes will not be towed, except to repair facilities."

"Only authorized equipment in good condition will be used in towing operations."

If towing into a dock, "Clear ramps of snow and ice for a distance of 100 feet in front of the dock doors and far enough to each side to accommodate all landing gear wheels." This would be prudent for towing into hangars as well.

Taxiing Operations:

"Wing walkers will be used when the aircraft is taxied within 25 feet of an obstruction. Wing Commanders may waive this provision for *locally-based* aircraft, if established taxi lines are marked and obstructions are either permanent or other aircraft are on established parking spots or lines."

"Aircraft will not be taxied within 10 feet of an obstruction, unless under one of the following circumstances:

"—During contingency operations when compliance would restrict the mission.

"—From alert, readiness, or protective shelters. A plainly visible centerline must be painted along the exit path and a marshaler will be used.

"—Operating locally-based aircraft from parking spots specifically designed for those aircraft. Parking spots will have a minimum 10-foot wingtip clearance… A marshaler will be used."

"Aircraft will not be taxied without clearance. Radio contact will be maintained with the (tower) throughout taxi operations."

"At night, ground crewmembers will use two illuminated wands for signaling taxiing aircraft."

"Pilots and taxi-qualified technicians will use minimum power when moving from a row of parked aircraft and will taxi in a way that prevents blast from propellers or jet exhausts from endangering personnel, parked aircraft, or other property." See aircraft T.O.s for recommended safe distance.

"Wing Growth"

This phenomenon is a factor in both towing and taxiing. It is especially prevalent on aircraft with a long wingspan such as the C-5, Boeing 747 and B-52.

"On aircraft with swept-back wings, the wingtip path extends beyond the straight line path when the aircraft is in a turn. The amount depends on the degree of turn and the degree of sweep on the wings."

Towing and taxi mishaps have recently been plaguing the Air Force. I urge everyone to do two critical things: 1) Consult your checklists; and 2) Use common sense. If you aren't sure if you have required clearance to tow or taxi, *stop* what you're doing and make the effort to do things correctly. This is one area we *cannot* afford to cut corners (no pun intended) to save a few seconds. AFOSHSTD 91-100 is available on the web at http://afpubs.hq.af.mil.

If the wing walker becomes a wing runner, you need to slow down.

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

Outta Control

Reprinted from *Flying Safety*, **October 1999**

How quickly can a high-performance jet get away from you? For your consideration, we provide this cautionary tale…

The F-16 driver was scheduled to fly as No. 6 of a 12-ship Red Air package in support of Weapons Instructor Course (WIC). From flight brief to engine start, everything was fine. Then, shortly before taxi, his F-16CJ—configured with only two wing tanks—developed problems that forced him to step to the spare, an F-16DJ—configured with (among other things) two wing tanks *and* a centerline tank. The aircraft swap would play a pivotal role in subsequent events.

Taxi, departure, and DACT were uneventful. Then, to meet regeneration criteria and rejoin the fight after being "killed," he initiated an Immelman to climb above 40,000 feet MSL. Starting in military power at 30,000 feet MSL at nearly 370 KCAS and with 6,000 pounds of fuel, he floated his entry and maintained only 3 Gs. Approaching vertical and slowing through 189 KCAS, the low-speed warning horn sounded. He had almost made it to 40,000 feet—39,150 feet MSL, to be precise—when he found himself inverted in level flight with zero airspeed. Then his aircraft started a slow right roll with a left yaw component. If you're thinking "Uh-oh," good call. The Falcon departed controlled flight and the engine compressor stalled. The mishap pilot promptly initiated the CAPs for out-of-control, recovered the aircraft, and leveled off at 27,950 feet MSL. The engine compressor stall cleared on its own once the aircraft was flying again.

After an expedited RTB, touchdown, and debrief, the engine was R&R'd. A thorough review of engine data revealed the in-flight compressor stall had been mild, and when coupled with the HUD VTR tape, pointed to disrupted airflow as the culprit. Although this Class C flight mishap didn't result in injury, or an ejection and a pranged aircraft, it was the trigger for an unnecessary engine change. Jet Shop couldn't find any damage to the motor, and it checked out okay on the Test Cell.

So, just how quickly *can* a high-performance jet get away from you? Whether you're an experienced stick actuator or not, it can happen pretty quickly if you're not careful and allow mission press to get the better of you.

"But Eagles Don't Practice Carrier-Arrested Landings!"

Reprinted from *Flying Safety*, **October 1999**

This experienced mishap pilot (MP) had more than 1000 hours in Air Force aircraft, most of those hours in C-130s. Because he was new to fighters and transitioning to the Strike Eagle, he was flying the B-course syllabus. This sortie promised to be a busy one.

Among other things, it included low-level ingress, low-level threat reactions, two fly-up air-to-air engagements, a wounded bird exercise and re-attack. The mission was uneventful until RTB, where the MP lowered the gear, reduced speed, and otherwise configured the aircraft for landing. He flew a normal final turn, touched down on

speed, and then came to a stop *almost immediately*. Why did the jet stop so quickly? While configuring the aircraft for landing, the MP had also lowered the tailhook...*and snagged the approach-end barrier*.

Maintenance crews and QA tested all related aircraft systems post-mishap and found everything to be in working order. After repairing more than $11 thousand dollars in landing damage to the No. 1 and No. 2 engine divergent nozzle segments, connecting links, and various seals, the F-15 was again airworthy.

Conclusion? Since the tailhook actuator switch and landing gear handle are within one inch of each other, *be careful.* 'Nuff said.

Night Time, Upside Down, Nose Low And Screaming

Reprinted from *Flying Safety,*
October 1999

The young mishap pilot (MP) was part of an F-16 four-ship Medium Altitude Navigation and Targeting Infrared for Night (MANTIRN) Surface Attack Tactics sortie. He had only recently completed Mission Qualification Training and this mission was to include his first night "dead-eye" deliveries.

Preflight, takeoff, in-flight checks, range entry and three LGB deliveries were all uneventful. The flight then transitioned to the pre-briefed dead-eye formation, where release parameters were set at a heading of 330 degrees, a speed of .85 Mach, and a release altitude of 16,200' AGL.

Eight seconds after one of his wingmen called bombs away, the MP began his run on the target. Shortly thereafter, both the CARA (set to alert at 8700' AGL) and ALOW (set to alert at 6000' AGL) systems started giving altitude warnings. In fact, this Fighting Falcon was flying nearly upside down, extremely nose low and already exceeding .85 Mach. Not exactly a preferred position from which to drop bombs. Previously setting up his CARA and ALOW systems to provide altitude alerting made the difference. Had he not taken immediate action to recover from the unusual attitude, this young pilot would likely have ended up a smoking hole in terra firma.

Lessons learned? Whether seasoned or inexperienced, flying at night can be hazardous to anyone's health. There are no better life preservers to arm yourself with than situational awareness and a good instrument cross-check.

Ten Percent Don't Get The Word

Reprinted from *Flying Safety,*
November 1999

Why is it there's always somebody who doesn't seem to get the word? Recently, an enlisted aircrew member with a mild cold decided to "self-medicate."

Three days prior to a scheduled flight, the crewmember admitted the cold was real. But darn! The clinic is closed. Time to try an over-the-counter brand of an antihistamine. The next day, the crewmember joined a deadhead crew to reach the staging base. During the descent, the crewmember got behind clearing the ears and finally resorted to a nasal spray to help. An hour after landing, the ears finally cleared. No sense in seeing a flight surgeon now.

Not until very sharp pain returned to the ears did the crewmember finally seek a flight surgeon. The flight doc prescribed the obvious—DNIF for 10 days. And for the 10 percent who still haven't gotten the word, "*Don't* self-medicate." Period.

Abort!! Abort!! Abort!!

Reprinted from *Flying Safety,*
November 1999

Did you ever notice how the tone of your voice rises when you have to call for an abort of the takeoff? It's probably related to some Doppler effect of the human emotions as they interact with the larynx. Most of the time, this rise in pitch is limited to your voice, and not your actions. Most of the time…

During the takeoff roll for a routine training flight, the pilot noticed a nose compartment door beginning to open. There was still time to abort, so the pilot immediately began max braking.

Although the aircraft was slowing, the pilot's emotions had shifted into high gear. Maximum braking was begun with the throttles still at "military" power.

When the jet began to skid due to the overly aggressive braking, the pilot failed to release brakes and eventually began to drift off the right edge of the runway. To stop the drift, nosewheel steering was engaged (with the rudder pedal deflected full left) and the aircraft swerved sharply back onto the runway. The aircraft continued across the runway until stopping six feet off the left edge. Some time later, in a cloud of dust, the throttles were brought to idle and eventually cut off during the ground egress.

Of course, aborts are not to be taken lightly. But you should review the procedures often enough to make your next abort a "routine" maneuver, not a comedy of errors.

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

"I Knew I Shoulda Listened To That Little Voice Inside My Head!!!"

Reprinted from *Flying Safety,* **November 1999**

The engine had been R&R'd for an oil leak. The leak was suspected to be in the area of the No. 1 bearing. JEIM disassembled the engine as necessary to replace the No. 1 bearing carbon seal, then reassembled it and towed it to Test Cell for leak and functional checks. Test Cell did the required engine prep, intake and exhaust (I&E) inspections, and proceeded with operational checks. During the course of the first hour, the engine was started up and shut down three times in order to perform minor servicing. Everything was fine until 10 minutes into the fourth run, when the Test Cell operator noticed a puff of white smoke followed by a few sparks coming from the tailpipe. The Test Cell operator shut down the engine, did an I&E inspection, and found damage to the first and second stage fan areas. The engine was impounded, and an investigation was launched to determine the extent of damage and learn why it had happened.

After a complete teardown, JEIM gave investigators an evaluation in *de rigueur* good news-bad news fashion. The good news: Damage to the LPT and augmentor could be repaired locally. The bad news: Extensive compressor and fan damage would require depot-level repair. Then the *really* bad news: All of the havoc wreaked inside the now-ENMC engine was self-inflicted. Price tag for the repair placed this mishap in the Class A category.

Investigation revealed that all of the required FOD (foreign object *debris*) inspections, in-process inspections (IPI), and supervisory inspections had been performed and documented in accordance with directives during each step of repair and reassembly. Investigation also revealed that Test Cell had performed I&Es before and after each of the three runs prior to the ill-fated fourth run. The mystery of how the foreign object *damage* (FOD) had been done to the engine was discovered during a look-back on how the engine teardown and buildup was accomplished.

One shift had disassembled the No. 1 bearing area and put attaching hardware in parts bags. A second shift replaced the No. 1 bearing carbon seal and reassembled the seal support area. It was during this reassembly stage that a single piece of attaching hardware was discovered missing. The buildup team was faced with some choices: (a) Determining whether or not the attaching hardware had originally been on hand and placed in the parts bag; (b) Initiating lost tool/hardware procedures; or (c) Doing neither

of the above. The team chose option "c" and simply got a replacement piece of attaching hardware from bench stock. Despite all of the FOD, IPI, supervisory, and I&E inspections, and the three previous Test Cell runs, something had been overlooked. And the rest is history.

When you're confronted with similar choices in the future—and you will be—we hope you'll choose the path of "better safe than sorry." We're willing to bet that this unit has beefed up its missing tool/hardware policies and now places lots and lots of emphasis on better communication.

Safety Crosstell: Aircraft Wash Hazards

Reprinted from *Flying Safety*, **June 1999**

The Wash Rack poses lots of well-known hazards to skin and eyes, but here are a couple more that you may not have thought about before now. Maintainers were washing a C-130 in an enclosed hangar and applying an authorized cleaning compound, using both pressurized washing equipment and manual washing techniques. An hour or so into the wash, one of the wash crew members started experiencing vision problems, facial numbness and difficulty breathing. When the other members of the wash crew noticed his disorientation, they got him out of the work area. That's when they realized they were experiencing some of the same symptoms too, only to a lesser degree. The stricken member was taken to a nearby hospital, where he was treated and released.

Exposure to the cleaning solution was fingered as the culprit. A written report states that continued exposure might have led to "…unconsciousness, central nervous system effects, asphyxiation, and death." So, how did this brush with near-death occur? Investigation uncovered a number of practices that, alone or together, were responsible.

• At the Wash Rack, SOP was to partially fill a bucket with the cleaning compound—a thick, gel-type liquid—and then add hot water (estimated temp 200 degrees) to make it easier to use. It made the solution easier to work with, but it was also contrary to Material Safety Data Sheet (MSDS) warnings which stated heating would release hazardous vapors.

• The MSDS stated the compound should only be applied using a "coarse" spray, since "misting" the cleaner—as happened when the wash crew used their pressurized cleaning equipment—created further likelihood of inadvertent chemical agent inhalation.

• It wasn't uncommon for Wash Rack personnel to finish an aircraft wash and then wear their cleaning compound-saturated clothing for the rest of the duty day. The MSDS cited continued contact with contaminated clothing as a hazard and dictated a change to clean, uncontaminated clothing.

• During the public health survey, Wash Rack personnel were observed eating and drinking in the work area while an aircraft was being cleaned, further increasing the possibility for ingesting harmful chemicals.

These Wash Rack personnel didn't willfully disregard MSDS-identified hazards. Investigation revealed none of them had received workplace-specific Hazard Communication (HAZCOM) Training. HAZCOM Training would have included a review of applicable MSDSs for the chemicals used around the Wash Rack and alerted personnel to hazards posed by them.

How effective is the Hazard Communication Program in your workcenter? Ensure your folks are aware of workplace hazards and help them protect themselves from unreasonable exposure. How? Contact the base Bioenvironmental Engineering Flight (BEF). The BEF is the office of primary responsibility for overseeing the base chemical hazards surveillance program. BEF personnel are thoroughly familiar with AFOSH and federal OSHA standards and they can perform occupational health surveys in your workcenter, identify and evaluate hazardous chemicals used in your work processes, and recommend ways for controlling the hazards. "Chemical Hazards in the Work place: Are You Protected?" appeared in the August 1998 issue of Flying Safety magazine (available on the WWW), and it spotlights how the BEF can assist in making your workcenter safer.

(Thanks to TSgt G.C. Malinowski for putting out the initial alert/crosstell on some aircraft wash practices that could have had fatal consequences. TSgt Malinowski is the Ground Safety NCO for the 352d Special Operations Group. If you have specific questions about this crosstell, you may e-mail him at: gerhard.malinowski@mildenhall.af.mil.)

USAF Class A Flight Mishaps

FY01 Flight Mishaps (Oct 00 - Jun 01)	FY00 Flight Mishaps (Oct 99 - Jun 00)
16 Class A Mishaps	**11 Class A Mishaps**
4 Fatalities	**5 Fatalities**
12 Aircraft Destroyed	**8 Aircraft Destroyed**

04 Oct	♣✶	An RQ-1 Predator UAV crashed while on a routine test mission.
12 Oct	♣	An F-16C crashed during a routine training mission.
23 Oct	♣✶	An RQ-1 Predator UAV went into an uncommanded descent.
03 Nov		An F-15C experienced engine problems on takeoff. The pilot successfully RTB'd. Both engines sustained damage from FOD.
13 Nov	♣♣	Two F-16CJs were involved in a midair collision. Only one pilot was recovered safely.
16 Nov	♣	An F-16CG on a routine training mission was involved in a midair collision.
06 Dec	♣	A T-38A impacted the ground while on a training mission.
14 Dec	♣	An F-16C crashed shortly after departure.
12 Jan	♣	An A-10A crashed short of the runway.
09 Mar	✶	During a ground maintenance run a KC-135E's No. 2 engine suffered catastrophic damage.
21 Mar		An F-16B experienced a bird strike but recovered safely. A fire developed after landing. The aircraft suffered structural and engine damage.
21 Mar	♣	An F-16C experienced engine problems soon after takeoff and crashed.
23 Mar		A C-17A sustained Class A Mishap-reportable engine damage.
26 Mar	♣♣	Two F-15Cs crashed during a routine training mission. The pilots did not survive.
03 Apr	♣	An F-16CJ crashed while on a routine training mission.
04 Apr		An F-15E on a routine training mission recovered safely after sustaining a bird strike.
07 May		An F-15E sustained Class A Mishap-reportable bird strike damage. It recovered safely. (Revised repair costs resulted in this engine damage being downgraded to Class B mishap status.)
07 Jun		A KC-10A sustained Class A Mishap-reportable engine damage.
14 Jun	♣	An F-16CG crashed during a routine training mission. The pilot was fatally injured.
21 Jun		A C-130H sustained Class A Mishap-reportable damage during landing.

- 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.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only military fatalities.
- "♣" 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.
- Flight, ground, and weapons safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/statspage.html
- **Current as of 27 Jun 01.**

U.S. GOVERNMENT PRINTING OFFICE 2001-673-404/53013

THE Well Done AWARD

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Mishap Prevention Program.

Lt Col Scott Baldwin
158th Fighter Wing
Burlington IAP, Vermont

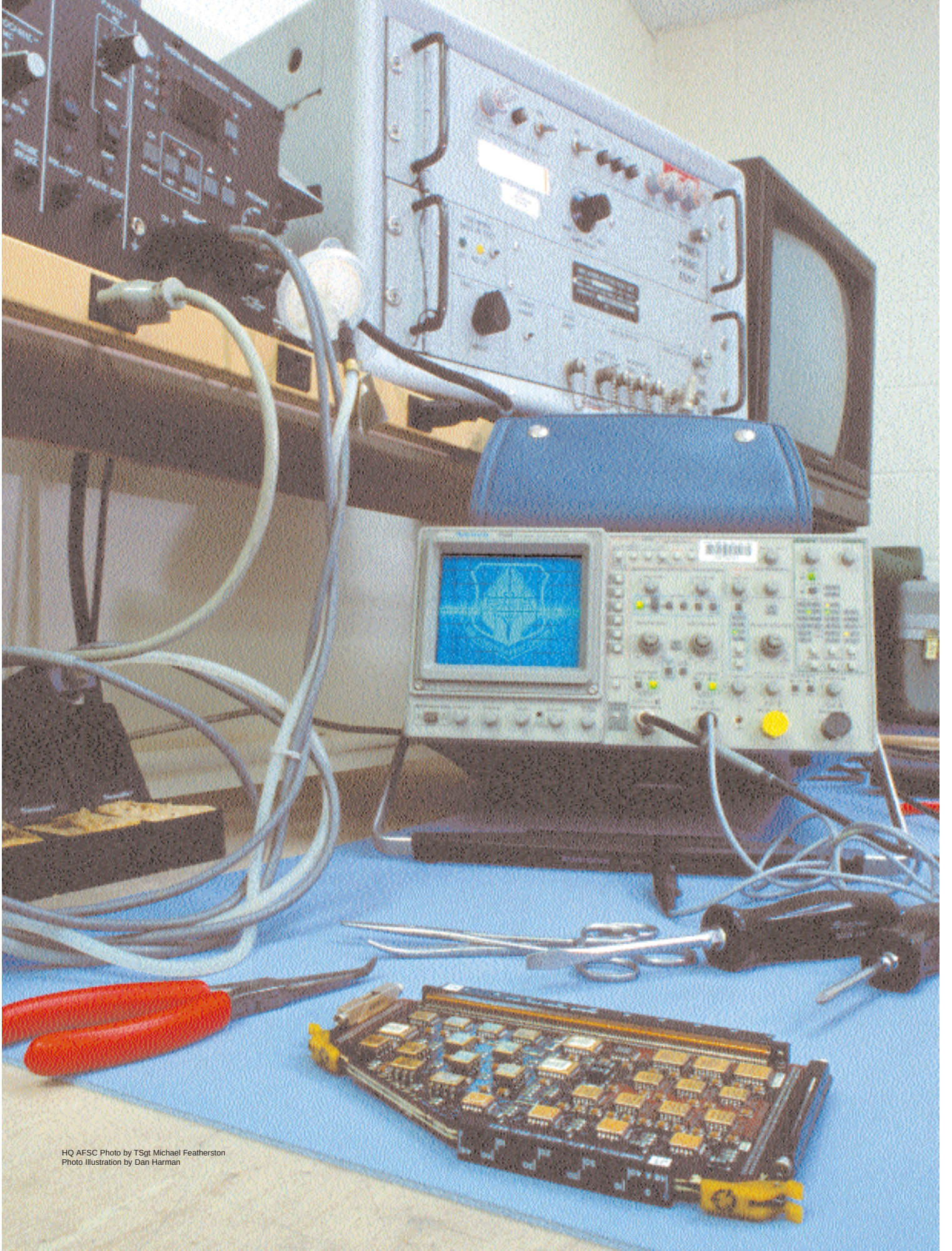
Lt Col Scott Baldwin was returning single ship in his F-16C from a routine night training mission when the flight became anything but routine. Leveling off from a descent at 11,000 feet, approximately 20 miles west of the airfield, the engine stopped responding to throttle commands. He noticed military power indications on the engine instruments when the throttle was positioned at idle. He repositioned the throttle to no effect, confirming throttle motor disconnect. With approximately 2800 pounds of fuel remaining, and the motor stuck at military power, the aircraft had only 20 minutes of flying time.

Lt Col Baldwin declared an emergency and ran the "Abnormal Engine Response" checklist with assistance from the SOF and Top Three. Engine power was stuck at full military thrust and the Abnormal Engine Response checklist had no effect on the throttle problem. He was able to get his airspeed under 350 knots only with the speed brakes deployed.

Weather at the airfield was 6000 feet broken, tops at 11,000 feet, winds 230/15, and good visibility. Lt Col Baldwin descended below the cloud deck to assess the weather around the airfield and was able to maintain VMC above the airfield at 6500' MSL (6200' AGL). With 1800 pounds of fuel remaining, he flew out over frozen Lake Champlain and jettisoned the empty external 370-gallon fuel tanks to reduce drag. He returned to the airfield and, through the use of speed brakes and available "G," got below 300 knots and lowered the landing gear. It is ANG policy to wire open the main fuel shutoff valve on all ANG F-16s. With the engine not responding to throttle commands, there is no way for the pilot to shut down the engine. Military thrust is too high a power setting for landing; therefore, he was forced to choose between a night flameout approach after fuel starvation, or ejection. With existing airfield conditions, Lt Col Baldwin felt more comfortable with an overhead flameout approach than a straight-in approach.

Lt Col Baldwin orbited the field while the Top Three called the Flameout Approach checklist and, in anticipation of the engine losing power, started the emergency power unit (EPU) and lowered the tailhook. When the engine flamed out due to fuel starvation, he was in a downwind position. Lt Col Baldwin accomplished a flawless night overhead flameout approach and stopped the aircraft with 2000 feet remaining on the 8300 foot long runway.

On a night where cloud cover and considerable crosswinds created extremely challenging conditions, Lt Col Baldwin used outstanding airmanship, excellent energy management and real-time ORM to execute a perfect, night, dead-stick approach, avoid injury to himself and others and bring home an irreplaceable Air Force combat asset. WELL DONE!



HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman