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Runnin' On Empty?

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SAFETY sage

CMSGT JEFF MOENING
HQ AFSC/SEMM

In the December 2002 issue we showed a photo of an engine troop at his toolbox with two co-workers behind him at an engine. One of the troops was standing on the rails of the engine trailer. We have received many calls and e-mails about this being a safety violation, and it *is* a safety violation. Thanks for the keen eye in spotting safety violations. Why did we use that photo? Two reasons. First, it shows engine troops hard at work repairing an engine, and the engine troops have been critical to reducing engine mishaps in 2002. (Read the end-of-year summary in the Jan-Feb 03 issue to see the good news.) Second, we have seen a lot of accidents/incidents in the last year where accepted practice has been a player. This means workers and supervisors look the other way when troops are violating safety rules in order to "accomplish/complete the mission." Just like in the picture.

The people who contacted us talked about how this would never be accepted at their location, and that is great. But here is a case where it was accepted. Where was the supervisor? Why didn't the other people involved in the task stop the person from committing an unsafe act? Why wasn't the proper equipment provided? You tell us, and maybe we can fix this problem.

Aircraft maintainers are a proud group of professionals who pride themselves on accomplishing the mission, and we have continually shown that dedication. Unfortunately, we have injured a bunch of people in the process, even killed one last year, for no reason other than we accepted less than safe work practices. People may have thought, "It's okay to take shortcuts if the mission gets accomplished." *It is not okay* to take shortcuts at someone's expense. Only we, the maintainers, can stop this trend. We must be safe at all times and never accept less than compliance with the rules provided to keep us safe. I know of no commander who will accept less than compliance with tech data and safety regulations. If there is one out there, let us know. I'm sure Major General Hess would love to discuss safety with that commander. Keep them flying, but do it safely! V

USAF Photo by TSgt Cedric H. Rudisill

USAF Photos by SSgt Greg Suhay
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"Go Pills," Fatigue and Aviator Safety

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In late '96, we prepared to launch F-117s to an undisclosed location 16 or more hours across the ocean. About 48 hours from launch time, the Wing CC asked whether we thought such a deployment was "do-able" or not, and we said yes, although we were concerned about pilot fatigue. The boss told me to talk to the flight surgeon about the possible use of Go Pills and to interview each pilot to ensure they knew the duration of the mission and the potential hazards.

When we briefed the mission, everyone said they were ready to go, and when I talked to the flight doc, he said he would make the Go Pills available, so I focused on planning and making sure the jets were ready to go.

At our departure time of 1600 Central, the weather wasn't great, but the mission was too important to cancel. We took off into low clouds and joined up approximately 50 miles east of Holloman to continue toward the tanker rejoin point. Weather delayed our first refuel, which put us an hour behind schedule and caused a faster fatigue onset. Later off the coast of Boston, more poor weather slowed the tanker swap to the KC-10s that would take us the rest of the way to our destination, and overcast conditions throughout the night portion crossing the Atlantic further complicated things by obscuring our visual cues. Things got better as we approached the Rock of Gibraltar, and after receiving our destination via secure radio link and digging through three feet of pubs to find the approach plate for Al Jaber, we crossed the Mediterranean Sea in beautiful skies, flew through intermediate ceilings across Egypt, and finally approached Kuwait in a "red out" caused by 35-knot winds whipping the desert sands into a frenzy.

As we approached Kuwait under instrument conditions, we were low on gas and fighting weather that was below minimums and a fierce crosswind. To make matters worse, fatigue was becoming a real problem because we were approaching 18 hours of airborne time, and I could feel the last Go Pill wearing off. It took every ounce of concentration to come up with a plan, but I knew we had to get our planes on the ground. I announced that we were going to split for individual ILS approaches, use the IRADS (Infra-Red Acquisition and Detection System…a bombing sensor, not an instrument approach aid) to find the runway, make the landing, deploy the drag chute, and hit the brakes. I'm sure I sounded more confident in this plan than I actually felt, but it was the only chance we had to get our jets on the ground before either running out of gas or suffering the debilitating effects of fatigue. So in we pressed. As soon as I landed, I exited the runway and pivoted my jet to be able to see the final approach course. I waited breathlessly as each stealthy aircraft appeared out of the dust and made its landing. Thankfully, all eight jets made it to the ground safely.

—Col Gary Woltering

Col Woltering's account of this first-ever 18-hour F-117 sortie is a great example of the modern mission requirements that are increasingly a part of Air Force operations. Long flights, unpredictable destinations or target locations, poor weather, and unforeseen events are "facts of life" throughout the aviation environment, but especially in combat and contingency operations. Besides the routine stress of facing the unknown under less-than-optimal conditions for an unspecified period of time, the situation is often further complicated by potentially dangerous levels of fatigue from disruptions to the body's clock and sleep deprivation. Most of us try to get the sleep we need, but job demands, anxiety, uncomfortable sleep environments and other problems often get in the way. Anyone who has ever flown long-range sorties or been deployed in some far-away place knows about the "real world" causes of fatigue and the problems associated with being overly tired. Why is fatigue a particular concern for the military, and what can we do about it? The Air Force has decided that Go Pills are at least part of the solution, and despite recent media hype to the contrary, many scientists, physicians, decision makers and operators feel that stimulants have a rightful place in our armament of fatigue countermeasures. Is this the case, or should we just rely only on other strategies?

This article will briefly review the problem of fatigue during intense military operations and discuss a countermeasure (i.e., Go Pills) that is being used in some sustained aviation missions. The overall objective is to inform aircrew members about the research that has been performed on Go Pills so they can make educated decisions about the use of this fatigue countermeasure in demanding flight operations.

Although different people have different opinions about the wisdom of using Go Pills to maintain alertness and performance, the fact is that at some point in your career you may well have to decide whether you will use these medicines which are currently approved for some types of air operations. (The Air Force does not *require* the use of Go Pills under any circumstance.) At various times in our military history, the U.S. has relied on Go Pills to maximize aviator safety and effectiveness while accomplishing difficult missions (Cornum, Caldwell, and Cornum, 1997). Nothing much has changed about the intensity and unpredictability of combat throughout our history except that technology has placed even higher demands on aircrews, so Go Pills likely will continue to be used to counter high levels of operational fatigue in the future. Assuming that Air Force policy and your chain of command have decided that these medications will be an authorized alternative for your unit, you might want to consider the information presented here before you decide what you will do when the "crunch" comes.

Military Sustained Operations are a Tactical Necessity Despite Some of the Problems They May Cause

U.S. superiority on the battlefield in part stems from our ability to maintain pressure on the enemy by making them fight around the clock. By keeping up a 24-hour-a-day operational tempo, we can virtually guarantee that enemy forces will suffer from the severe sleepiness that leads to procedural errors, sloppy judgment, poor planning and a general inability to react properly to rapidly changing situations. This gives us the tactical advantage, but only if we guard against severe fatigue ourselves. Unfortunately, this is difficult because fully staffing three eight-hour work shifts with well-rested personnel around the clock for seven days a week in combat and contingency operations is a daunting task. Prolonged work bouts are common, shorter-than-normal sleep periods are unavoidable, and fatigue from both of these factors threatens to impact operational readiness (Department of the Army, 1991; Krueger, 1989). It is well established that sustained wakefulness and the resulting sleep debt increase the likelihood that personnel will briefly (and uncontrollably) nod off on the job, even during flights (Dinges, 1995). The longer someone remains awake, the more likely he/she is to experience these uncontrollable periods of drowsiness. In addition, sleepiness takes a heavy toll on reaction time, motivation, attention, memory, endurance and judgment (Naitoh and Kelly, 1993). Even in peacetime, overly-tired pilots are thought to be responsible for four to seven percent of civilian U.S. aviation incidents or accidents every year (Kirsh, 1996), and a recent report identi-

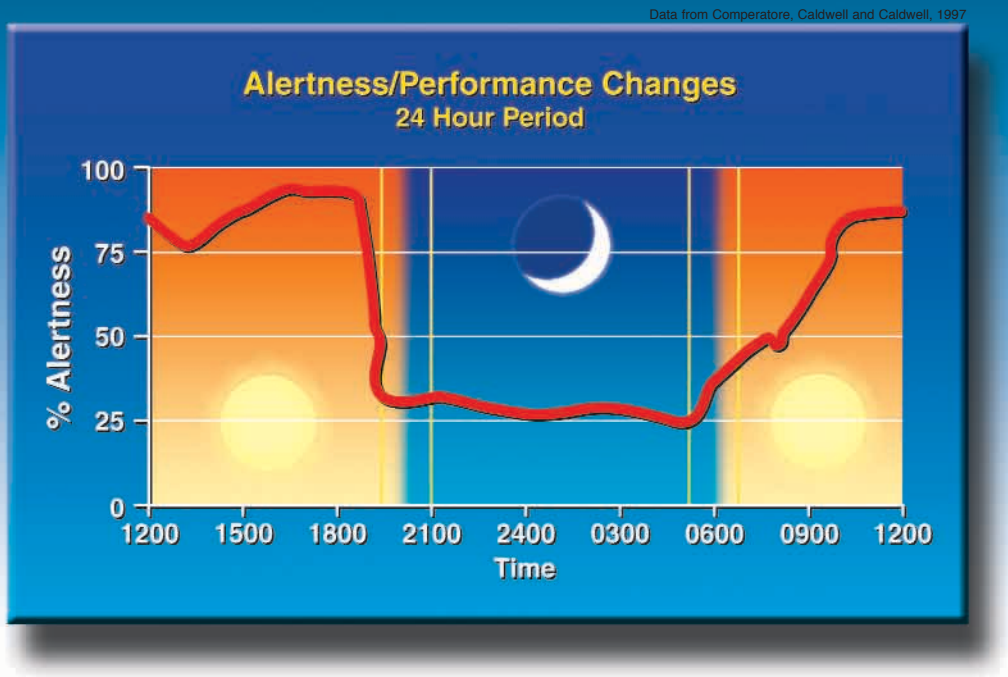

Figure 1

fied fatigue as a contributing factor in four percent of Army aviation mishaps from 1990-1999 (personal communication, U.S. Army Safety Center help desk; helpdesk@safetycenter.army.mil) while fatigue was cited as contributing to 7.78 percent of Air Force Class A reportable aircraft mishaps from 1972-2000 (personal communication, Lt Col Thomas Luna, U.S. Air Force Safety Center).

Severe Sleep Loss Creates Serious Problems

Although predictions about the exact effects of fatigue are difficult to make, most researchers agree that fatigue-related performance and alertness decrements follow a fairly reliable time course. Canadian researchers have reported that certain mental abilities decline about 30 percent after one night without sleep and 60 percent after two nights without sleep (Angus and Heslegrave, 1985). Scientists at the Walter Reed Army Institute of Research predict soldiers lose about 25 percent of their ability to perform useful mental work for every 24 hours without sleep (Belenky et al., 1994). A Norwegian field study found the fighting capability of soldiers dropped a full 80 percent after four consecutive days of sleep loss (Roussel, 1995). Thus, it seems clear that one to two days of sleep deprivation will seriously degrade aircrew performance while three to four days of sleeplessness will produce virtual incapacitation in the operational environment.

The Body's Circadian Clock Is Important

Anyone who has worked reverse cycle knows that sleepiness and fatigue are worse in the early morning hours (from about 0200-0500) than at other times (Akerstedt, 1995). This is because the body's internal rhythms are programmed to "wind down" at night (since this is when we are usually asleep) and "rev up" during the day (when we're usually awake). As any shift worker will testify, it takes several days to adjust to a new working and resting schedule, and many people never fully adjust no matter how long they stay on the night shift in particular. People who aren't adjusted to their working and resting schedules suffer in terms of their feelings (tired, upset stomach, poor mood, etc.), their alertness (slow and drowsy), and their performance (reduced accuracy, poor vigilance and slow reactions). People who transition from one time zone to another experience similar problems.

Disruptions to the body's clock compound the fatigue associated with long hours of wakefulness so that someone who is trying to work early in the morning (after being awake since the previous day) is suddenly vulnerable to involuntary "sleep attacks" even though they were fine just a few hours before. These same people might deceive themselves into thinking they've overcome fatigue after the sun comes up even though they haven't slept a wink during the night. Unfortunately, this sets them up for even greater problems later in the day, and since they don't expect the next drop in performance, their safety is more at risk than it was in the first place.

An Example of the Effects of Fatigue

An example of the performance decline associated with sleep loss and the circadian cycle is shown in Figure 2. This graph was produced by the Air Force Fatigue Avoidance Scheduling Tool™ which predicts performance efficiency based on the amount of sleep obtained and the circadian phase (time of day). The schedule used in this example is based on a schedule from a recent field exercise.

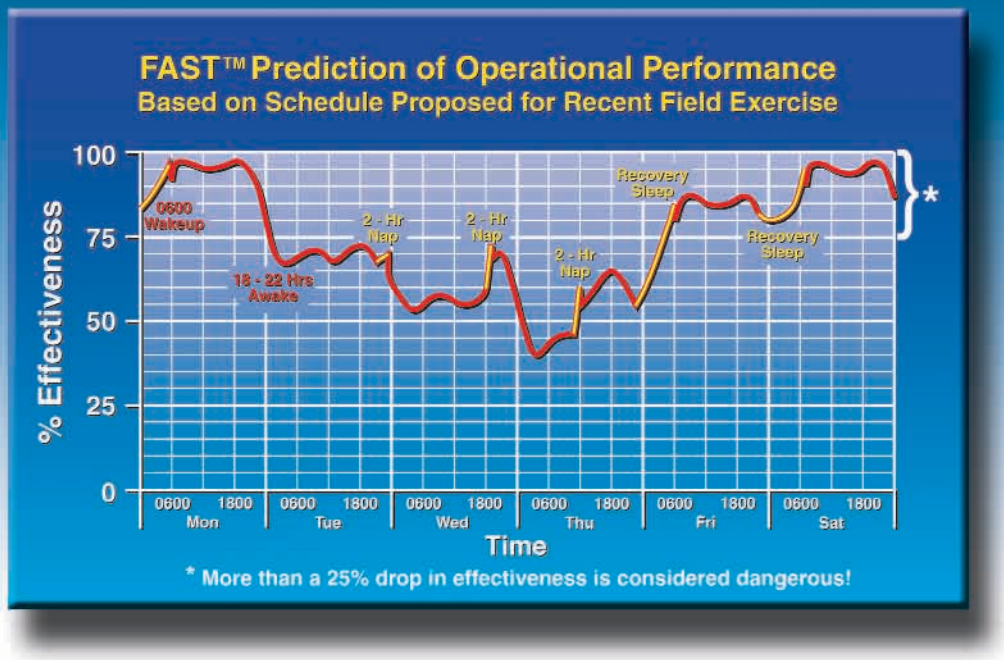

Figure 2

Serious deficits in operational effectiveness were predicted by 0300 on the morning of the second day. At this point, effectiveness was expected to fall below 75 percent of normal. Also, due to the subsequent lack of sleep (with only a two-hour nap on days two and three), performance likely would have declined until it degraded to less than 50 percent of optimal levels. Decrements of this magnitude could create serious problems in the operational environment unless a proven fatigue countermeasure is implemented. Note that the greatest decrement on Tuesday was predicted to occur after 18-22 hours of continuous wakefulness, a time associated with fatigue-induced performance losses similar to those produced by blood alcohol concentrations (BACs) of .05 to .10—the legal level for "driving while intoxicated"!

Clearly, fatigue is an important issue, especially during actual real-world missions. It is for this reason that feasible countermeasures must be developed and implemented.

What are the Strategies for Dealing with Operational Fatigue?

Nonpharmacological (or "Natural") Strategies

A number of fatigue remedies have been proposed, but few are easy to correctly use, especially in intense military operations. Emphasizing proper sleep management and controlling the duration of duty periods constitute the first line of defense against fatigue, and the Air Force rightfully places a great deal of emphasis on this approach. However, when the intensity of operations reaches a certain point, or long-range flights are required, it can be very difficult to properly control sleep periods, and this can lead to a huge problem with fatigue in the cockpit. Evidence of this has been found in almost every military conflict. Fatigue was definitely a problem in Desert Shield and Desert Storm, and subsequent operations have led to similar reports. Even during peacetime, a recent survey of Army pilots revealed that 26 percent complained of poor sleep while in the field or while traveling compared to only five percent complaining of poor sleep at home (Caldwell and Gilreath, 2002).

In addition to sleep difficulties, it is often impossible to avoid working at times when circadian factors increase the prevalence of attentional lapses and involuntary sleep episodes. Attempts to remedy fatigue have included several novel approaches such as a reliance on exercise (LeDuc, et al., 1998), work breaks (Angus, Pigeau, and Heslegrave, 1992), or high levels of physical fitness, as well as the use of strategic naps (Angus, Pigeau, and Heslegrave, 1992). Unfortunately, exercise appears to offer only temporary relief from fatigue, and work breaks offer short-lived relief as well. Ensuring a high degree of physical fitness, while excellent for sustaining physical work capacity, has almost no impact on the ability to maintain the mental performance of sleep-deprived people. Naps, while excellent for improving alertness, often are not feasible in high-ops-tempo settings. These are just some of the reasons why the military has explored the feasibility of using pharmacological (or "drug-based") fatigue countermeasures.

Go Pill (Pharmacological or Drug) Strategies

Although the rule of thumb is that "drugs and flying don't mix," Go Pills may be the only reliable method for temporarily maintaining the performance of aviators during those lengthy sustained

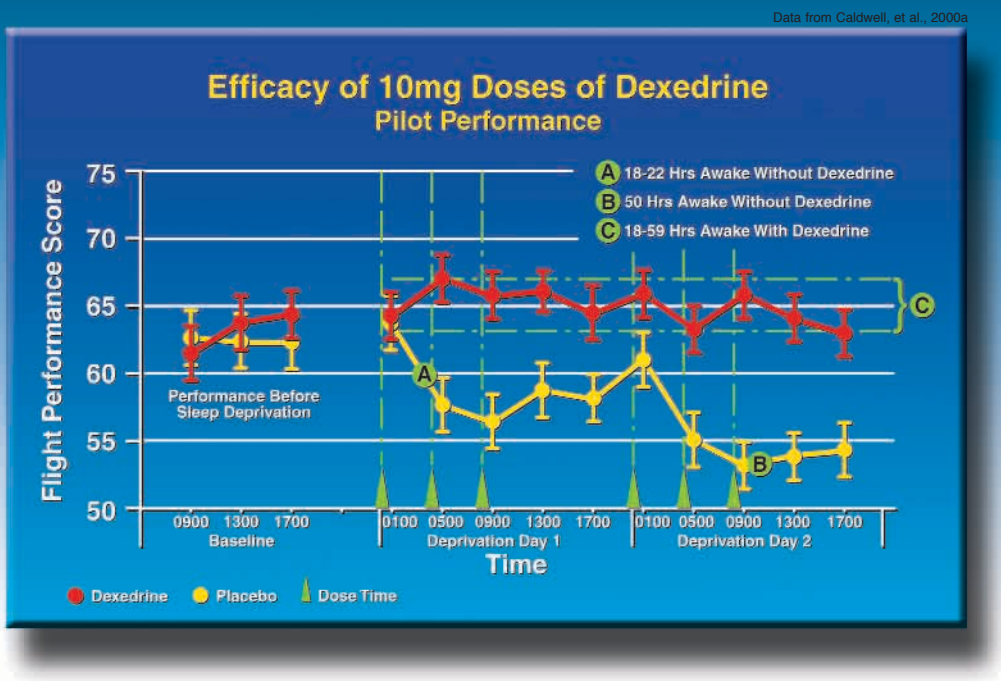

Figure 3

operations when, despite everyone's best efforts, adequate sleep is simply not an option. In these situations, after every other countermeasure has been tried, Go Pills should be considered for a variety of reasons. They are effective and easy to use. Their feasibility is not dependent upon environmental manipulations such as creating comfortable daytime and nighttime sleep quarters in the middle of the desert (or next to an active runway, or in the back of an aircraft). Their effectiveness does not depend on making complex modifications to work schedules in order to ensure that everyone works only eight to 12 hours a day, while simultaneously making sure each individual has enough time off-duty to get at least eight hours of sleep. Also, Go Pills have been proven effective for temporarily overcoming sleep deprivation in laboratory studies and in field environments. This explains why medicines such as amphetamines have been used extensively in several military conflicts. Despite debate on this topic, dextroamphetamine (Dexedrine®) remains one of the best Go Pill choices because its actions are well understood and its effectiveness in sleep-deprived personnel is well known. However, there are other possible alternatives that deserve mention.

• **Amphetamines**. Amphetamine psychostimulants have been available in the U.S. since 1937, and these drugs have been widely used to treat the symptoms of medical conditions such as narcolepsy (with excessive daytime sleepiness) and hyperactivity/attention deficit disorder. In the 1940s and 1950s, studies were undertaken to explore the military significance of psychostimulants, and the general consensus was that they were effective for restoring or maintaining the performance of sleep-deprived subjects at well-rested levels. Recently, their positive reputation has been tempered by the recognition that they can have significant abuse potential if they are not used properly, and they are not completely free of side effects, but despite this fact the military has successfully used dextroamphetamine for years. There are reports that amphetamines were used in combat in World War II, and it is an established fact that the Air Force authorized the use of dextroamphetamine to sustain the performance of sleep-deprived pilots as early as 1961. Dexedrine continues to be authorized under Air Force policy for certain situations today, and its successful track record has been maintained by ensuring that it is provided in accordance with carefully planned guidance and used in a well-controlled fashion.

The effects of Dexedrine have been extensively studied in the laboratory and in the field (Weiss and Laties, 1967). In the laboratory, single doses (20 mg) of dextroamphetamine have been shown to return alertness and cognitive performance of non-aviators to near baseline levels and maintain this recovery for seven to 12 hours, even after 48 hours of total sleep deprivation (Newhouse et al., 1989). In addition, a single 20-mg dose has been found to temporarily prevent performance decrements in people kept awake for approximately 34 continuous hours, and to restore the performance of volunteers deprived of sleep for 48 continuous hours (Pigeau, et al., 1995). Studies conducted by the U.S. Army Aeromedical Research Laboratory (USAARL) determined that multiple 10-mg doses of Dexedrine, administered prior to the onset of fatigue degradations, will sustain the performance of pilots throughout 40 hours without sleep

(Caldwell, et al., 1995; Caldwell, Caldwell, and Crowley, 1996; Caldwell and Caldwell, 1997). In addition, a recent USAARL study showed that Dexedrine maintained the flight performance of pilots even after 60 hours of continuous wakefulness (Caldwell et al., 2000a).

A flight surgeon who administered 5 mg of Dexedrine to EF-111A Raven jet crews (used for electronic jamming) during an Air Force strike on Libya in April of 1986, reported crews were able to overcome the fatigue of the mission itself and the sleep deprivation which occurred during mission preparations (Senechal, 1988). There were no in-flight or landing problems, and all of these aircraft returned safely to base[1]. When Colonel Kory Cornum, an Air Force flight surgeon, provided Dexedrine to F-15C pilots flying lengthy combat air patrol sorties, it was clear that the medicine enabled flight crews to overcome the fatigue from sleep deprivation and circadian disruptions (Cornum, 1992). (In practice, the pilots self-administered 5-mg doses at a frequency of one tablet approximately every two to three hours.) The unit commander concluded Dexedrine administration contributed to the safety of air operations. There were no reported adverse effects, even in personnel who took 10 mg at a time, and no aviators reported a need to continue the drug once proper working and sleeping schedules were reinstated. This agrees with the results of a survey of Air Force pilots which indicated that Dexedrine was helpful in maintaining performance during sustained operations without unwanted side effects (Emonson and Vanderbeek, 1993).

Because of such reports, the U.S. Air Force recently approved Dexedrine for sustaining the performance of pilots in single- and dual-seat aircraft. Under this policy, doses of 10 mgs are authorized. The number of doses issued to the aircrew member by the flight surgeon is appropriate to the mission duration.

• **Caffeine.** Caffeine is another alertness-promoting compound that is suitable for fighting fatigue particularly in relatively short periods of continuous wakefulness (i.e., 37 hours). However, some scientists have found that caffeine may not be appropriate for longer sustained operations (i.e., 64 hours or more) (Lagarde and Batejat, 1995). As with everything in life, no clear-cut answer is available; there are people who believe caffeine is a better alternative than amphetamines, and others who feel caffeine is less effective and more prone to produce unwanted side effects like "the shakes," dehydration and a frequent need to urinate.

Every day, Americans consume various amounts of caffeine in all sorts of products (Griffiths and Mumford, 1995), and they may not even be aware of it. Everyone knows about the caffeine in coffee (100-175 mg per cup), but what about the caffeine in Coke (31 mg), Mountain Dew (55 mg), and tea (about 40 mg) (Lieberman, 1992)? Also, few people may realize that over-the-counter medications often contain caffeine. For instance, just one Excedrin tablet has 65 mg. Compare these amounts to the caffeine found in stimulants such as NoDoz® and Vivarin® (200 mg per pill). By the way, 200 mgs of caffeine is the minimum amount recommended to sustain alertness in sleep-deprived people. Be aware that your body may quickly adjust to the effects of daily caffeine consumption, so if you are a heavy caffeine user, you may not get the boost you really need from those two cups of coffee when you're fighting off sleep in the middle of the night. People who find they frequently need some help staying alert on night shift or when doing those extra long missions should only use caffeine during the times when they really need it. Although this is tantamount to sacrilege, such people should switch to decaffeinated products on normal work days.

The bottom line is that when operational demands make pre-mission sleep difficult or impossible to obtain, caffeine could be considered a "first-line" approach to sustaining alertness and performance in sleepy individuals. In other words, caffeinated products such as coffee, soft drinks, caffeine-containing candy and gum, or caffeine tablets often can help to manage the fatigue that stems from unavoidable sleep deprivation[2].

• **Modafinil**. Modafinil may someday be an alternative to Dexedrine and caffeine for use in situations where a prescription medication is needed to sustain performance during prolonged periods of total sleep loss. This new drug was only recently approved for use in the United States (as of December 1998), so more research is needed before the military will use it on a widespread basis. However, there is great interest in modafinil (sold under the brand name Provigil®) because it supposedly has the positive benefits of amphetamines without the drawbacks of increasing heart rate and blood pressure (and without the possibility of disturbing the quality of any sleep that is taken too close to the most recent dose). Researchers have found that Provigil maintains the alertness of people with sleep disorders and it improves the functioning of people who can't sleep because of night work or really long duty periods. It does this without increasing heart rate and blood pressure. Also, people seem to be able to use Provigil without worrying about "getting hooked."[3]

The USAARL conducted an aviator-performance study in 1999 (with three 200-mg doses of modafinil during 40 hours of sleep deprivation), and the results were promising. Provigil sustained the alertness and performance of pilots, and kept them working at well-rested levels even at 0500 in the morning after they had been awake for 22 straight hours (Caldwell, et al., 2000b). However,

there were some side effects (dizziness and vertigo) that may have been related to the high dose. It seems likely that a lower dose of modafinil may provide the same alerting benefit with fewer problems, but this has yet to be determined in an aviation context. However, both Walter Reed Army Institute of Research (Wesensten et al., 2002) and the Air Force Research Laboratory (Eddy, et al., 2001) have performed modafinil studies (with non-aviators) in which the results were positive with no side effects related to dizziness and vertigo.

After more research, modafinil may become a suitable alternative to Dexedrine. However, until these studies are performed, Dexedrine may be a better choice in terms of what is known about the drug and its proven potential for sustaining alertness for relatively long periods in sleep-deprived subjects.

What is the Bottom Line?

Fatigue will probably always be a problem in combat and contingency operations because of the intensity and unpredictability of these missions. There are solutions for operational fatigue, but the most appropriate countermeasure depends on several factors.

Obviously, the best way to prevent fatigue on the job is to ensure that everyone gets enough sleep before the mission even starts (sleep experts recommend eight hours of sleep per day to maintain top-notch performance). It is best for this sleep to occur during the normal nighttime sleep period whenever possible because this is the time the body is "programmed" to sleep. Also, there should be a comfortable place to sleep that is dark and free of noise and activity. When this is impossible, earplugs and sleep masks can help. Remember, proper sleep is the only sure way to avoid a buildup of fatigue.

If a full eight-hour sleep period is not possible, naps are a great compromise. Naps should be long enough to provide at least 45 continuous minutes of sleep, although longer naps (two hours) are better. In general, the shorter each individual nap period is, the more frequent the naps should be. Once again, to promote the most restorative sleep during these naps, the same rules about environmental comfort apply to them as they do to the longer sleep episodes.

When it is simply impossible to obtain any sleep, stimulants or Go Pills may be the only realistic alternative to falling asleep at the controls. Although stimulants cannot replace the need for sleep, they can temporarily postpone it. This is especially important in sustained aviation operations because sleepiness in the cockpit is a serious problem which cannot be overcome through motivation, training or experience. Once the body reaches a certain point, involuntary lapses into sleep will occur, and these can last anywhere from a few seconds to several minutes. Research has shown that people often aren't aware that they are lapsing into sleep until the lapses stretch into periods of a minute or longer! Go Pills can stave off these effects for a while.

If your chain of command makes a decision to provide Go Pills, the basic choices are caffeine or Dexedrine. Modafinil may be an alternative for the future. Of these choices, only caffeinated beverages can be used without explicit flight surgeon and command authorization. Caffeinated tablets can be used following flight surgeon clearance. However, the long-term efficacy of caffeine has not yet been established, especially for people who normally consume a lot of caffeinated products. Dexedrine is likely a better choice for extreme cases of fatigue, but while Dexedrine is highly effective, it also is a controlled prescription drug that can only be used under specific circumstances. Dexedrine is not a perfect, 100-percent solution, but it certainly beats falling asleep at the controls.

When you find yourself in a situation where the mission simply must be accomplished but sleep is impossible either because of the lengthy flight duration, circadian factors or environmental circumstances, your flight surgeon may offer the option of using a stimulant, and it may be Dexedrine. This will only be done on a time- and/or mission-specific basis and only with the approval of the senior flight surgeon and Wing Commander (or deployed equivalent) operating under MAJCOM guidance. If you feel that you may potentially elect to use Dexedrine you will first be educated on Dexedrine and its effects. If you elect to proceed you will be asked to sign an informed consent form and will be provided a test dose to take on the ground to familiarize you with how it will make you feel and ensure that you do not have any unexpected adverse effects. Your Dexedrine ground test as well as any operational use will be documented. The final decision about whether to take advantage of this option will be left to you. Hopefully, you can now make an informed choice about whether or not you will use it.

The views expressed in this paper are those of the author and do not necessarily reflect the official stance of the Department of Defense. Mention of specific drug products should not be construed as an official endorsement of these compounds.

[1] Although one of the strike F-111s involved in this mission was taken out by a surface-to-air missile, all of the EF-111s and the remaining F-111s returned safely.

[2] Aircrew are required to inform their flight surgeons about any nutritional or dietary supplementation (including caffeine tablets) that they are using in accordance with AFMOA Policy Letter, 28 Oct 1999, Use of Nutritional Substances.

[3] Although the absence of addiction potential associated with modafinil is a widely-touted benefit of this medicine, the reader should know that HQ Air Force Medical Operations Agency has no evidence that any U.S. Air Force aviator has ever become addicted to the Air Force's current stimulant of choice, Dexedrine.

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There I Was...

In The Good Old Days

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COL DONALD C. WINDRATH, USAF (RET)

The Korean War introduced jet fighters into the military arsenal, and when it was over the Air Force began vigorously to train its pilots in T-33s rather than piston fighters. This article is about the difficulty we experienced with the faster aircraft in a training system designed for piston aircraft. But first, some background information about the Training Command and Greenville AFB, where I was a student and later an Instructor Pilot.

The bulk of the instructors when I was in T-33 training were young veterans from Korea, and they weren't a happy lot about their assignment to Greenville. Thus, the students were considered more or less as a fifth wingman and were trained in tactics more designed for combat than proficiency. In-trail formation became a rat race, with each instructor trying to shake off the "attacker." In close four-ship, the IP would place Number 4 so he had to look directly into the sun and still hold position. Then the IP—without a signal—would pop the speed brakes, and if three or four dropped out they were certain to get chewed out on the ground. Since we didn't wear G-suits, pulling seven to 7.5 Gs was an exercise in grunting hard to keep from blacking out. Survival kits consisted of a Prince Albert tin filled with fishhooks, etc., stuffed in a leg pocket, and low quarter shoes were the norm. Even though we flew over the Mississippi, oxbow lakes and swamps, we weren't issued life vests. There were no overruns to prevent short landings or barriers to slow an aircraft from sliding off the far end.

The only radar for flight following were military Air Defense Identification Zones (ADIZ). Thus, a cross-country flight under IFR conditions required the pilot to report to each Flight Service Station (FSS) and always on 255.4, the standard (and sometimes very congested) frequency. Long waits for IFR clearances were routine because FAA had to make room for you to get accepted into the system (usually done by land line). The NAVAIDS were all low-frequency and subject to static and other spurious signals. Knowing Morse code was a must to make certain that you had the right station tuned in. More than one guy crashed because he misidentified the station. GCAs were rare and RAPCONs practically non-existent. Weather conditions, both current and forecast, were marginal at best. The fastest way to get airborne was to cheat and file for

a VFR climb to VFR on top. Never mind that the ceiling was usually 1000 feet and solid up to 35,000. We had planes all over the place in the clouds with no idea how near they were to a mid-air. Once above the clouds, we flew by quadrantal separation to avoid hitting each other. Having said all that, here is a trilogy of hairy flights that I experienced during those times.

Hairy Story 1. We filed from Greenville to Griffiss AFB on a winter night, a trip of about 900 miles, which was just about the range of a T-Bird. However, a 120-knot jet stream pushed us northward at a good clip that would allow plenty of reserve fuel at destination. To stay comfortable, we stashed our winter jackets in the forward bay along with a couple of hang-up bags. The night was bright and clear, and we were confident that the flight would be routine and uneventful. Crossing Pittsburgh FSS, I asked for the Griffiss weather and was given 15,000 and 15 miles, and a few minutes later I was given clearance to begin penetration and letdown. At about halfway through the penetration, Griffiss advised that the weather was 1000 feet, one mile in blowing snow, braking action nil, and they asked for my intentions. I replied that we would probably engage the barrier if we saw the runway. We didn't, of course, and asked for clearance to Syracuse, the alternate. Advised that Syracuse was also down, we then asked for the nearest available airfield, which turned out to be Ethan Allen at Burlington, Vermont—126 miles away. On the climb-out, the low fuel warning light indicated that we had 80 gallons remaining and were supposed to be on the ground. I called Stargazer (ADIZ) and asked for a vector. We leveled off with about 30 gallons, still 70 miles out. Ethan Allen was reporting 3500 overcast and 15. My buddy in the back seat said he was going to jump out. I reminded him that he would most likely land in Lake Champlain, which was not frozen but very wet and cold. He allowed he would stick around until we saw a light on land.

With five gallons remaining we started at high key at 5500 feet (flame-out pattern) under Stargazer's guidance and hit low key at 3500 feet, just below the clouds. The problem was that we couldn't find the runway among the lights on the ground, even though I asked tower to turn them to full bright. At the very last moment on a high base—and close to jumping out—we spotted the airfield as the engine wound down. We landed uneventfully, only to be towed off the runway to fly again. After thanking Stargazer profusely, we went to the bar to calm the nerves. They took a lot a calming.

Hairy Story 2. Sixteen IPs with students were off to West Palm Beach AFB to get out of the cold and damp of Greenville. We took off legally in VFR conditions to VFR on top in four flights of four, with the students in the lead aircraft practicing instruments and the other three on the wing. As we approached West Palm Beach, the clouds kept getting higher until they were at 45,000. Miami Center instructed us to hold, and this we did for what seemed an eternity. Meanwhile, the fuel was getting lower and lower until all of us were down to 80 gallons or less. We called "bingo" to Miami Center and requested clearance for an immediate penetration to West Palm Beach. Miami Center denied clearance due to other traffic, so we called departing 45,000 and headed east out over the Atlantic. At 15,000 we reversed course and turned west, still in the clouds and raining like all get-out. We broke out at 1000 feet, and 16 T-Birds in elements of two lined up with the runway about ten miles out. When lead landed, the runway was very wet, and two slid past lead. It wasn't too long after that we had airplanes slipping and sliding, trying to get out of way of those in front while yelling, "Move left!" or "Move right!" Luckily, there were no collisions, and again we headed for the nearest bar to recount our war stories.

Hairy Story 3. A student and I filed for Griffiss AFB on a summer day flying IFR in VFR conditions on top so the student could practice instruments. Again, we had a good tailwind and the trip was uneventful along the low frequency airways. During the last leg, after passing Youngstown, Ohio, I didn't notice that the heading indicator had slewed off about 60 degrees. Of course, the penetration got all screwed up because the headings we were flying were 60 degrees off. As we broke out of the clouds, the airfield was nowhere in sight, and I had no idea where we were, although I was familiar with upstate New York. I requested a DF steer (direction finder) from the tower. In this procedure, the pilot keys the radio for about ten seconds and the tower gives a heading towards the airfield. Again the headings we took were erroneous, and after milling around for half an hour at low altitude we were down to ten gallons. Ejection seemed a certainty. At the last minute my student spotted the airfield. We landed on the fumes and flamed out in the chocks. Cheated death again.

So if someone starts talking about the good old days…they weren't all that good. A lot of pilots bought the farm during those uncertain times when flying by the seat of your pants, and a lot of luck, was the norm. Today we have TACAN, GPS, transponders, automated approach systems, RADAR flight following and a host of many improvements to make flying easier and safer. We had a saying then that flying, like the sea, was very unforgiving. How true.

Be careful what you ask for, you just might get it.

Illustration by Dan Harman

CMSGT RON FROSETH
HQ AFSC/SEWOI

You have heard the old saying, "Be careful what you ask for, you just might get it." We are in the process of changing weapons maintenance *back* to what it was before the early 1990s, but with different names and a lot of folks who grew up under the "Objective Wing Concept." So when you, as an old head, start talking to folks who have been in the Air Force for less than 12 years, remember that they don't know the "old" way. This is a whole new concept for them and they have a lot to learn.

But the real question is; what is your approach going to be? Are you going to take the attitude that this is just another change the Air Force is going through? If you have been around as long as I have (29-plus years), you have seen the Air Force change several times. One thing I have learned from change is that we always find better and more innovative ways to do things. We grumble and gripe — we wouldn't be GIs if we didn't — but we dive in and make it work.

I believe this change in the way we are doing maintenance is for the better. We will again grow true maintenance officers and we will also help focus commanders on their core areas. I believe that under the "Objective Wing," we had some great operations and logistics group commanders who listened to their maintenance officers. However, when you had to continually make the call between flying hours and maintenance downtime, something was going to suffer. Quite often that was maintenance downtime, which affected the long-term health of the fleet.

I don't for a minute feel we can blame it all on flying-hour focus, because our taskings around the world have also contributed to the lack of maintenance downtime. Your job as a supervisor or worker is to go into this new organizational structure with an open mind. You have an opportunity to write history. You can prove to the Chief of Staff, General Jumper, that he made the right decision in allowing us, as maintainers, to focus on what we were trained to do — maintain airplanes, missiles, bombs and support equipment.

This doesn't mean that you become stubborn and abandon your operator brethren, because we are still one team. We still must all go to war together, fight together, and yes, play together. Remember the operators are at the "pointy end" of the spear, and that point is only as good as those who have sharpened it.

You Asked For It

Have you really trained your replacement?

My challenge to you is to follow the technical data and safety procedures and effectively train your replacement. The true indication of a successful leader is one who can leave for a period of time and no one notices they are gone. The same holds true of worker bees that have properly trained their replacements. Your leaving should be just like sticking your hand into a bucket of water. When you pull it out, the water, might ripple for a short time but then it quickly settles back to a nice smooth surface.

Have you *really* trained your replacement? Have you tried to teach them what you've learned from your mistakes or are you going to let them fall into the same traps? Some think that is the only way they'll learn, but that is *baloney*! If they make the same mistake you made after you've trained them, *shame on them*. However, if they repeat your mistakes because you didn't train them, *shame on you*. They will have enough opportunities to learn from their own mistakes without being set up by you, their trainer. Also, if you think you're doing them a favor by showing them a shortcut that violates procedures, you might as well not train them at all. You've set them up for failure. You may have even set them up to kill themselves or their fellow workers.

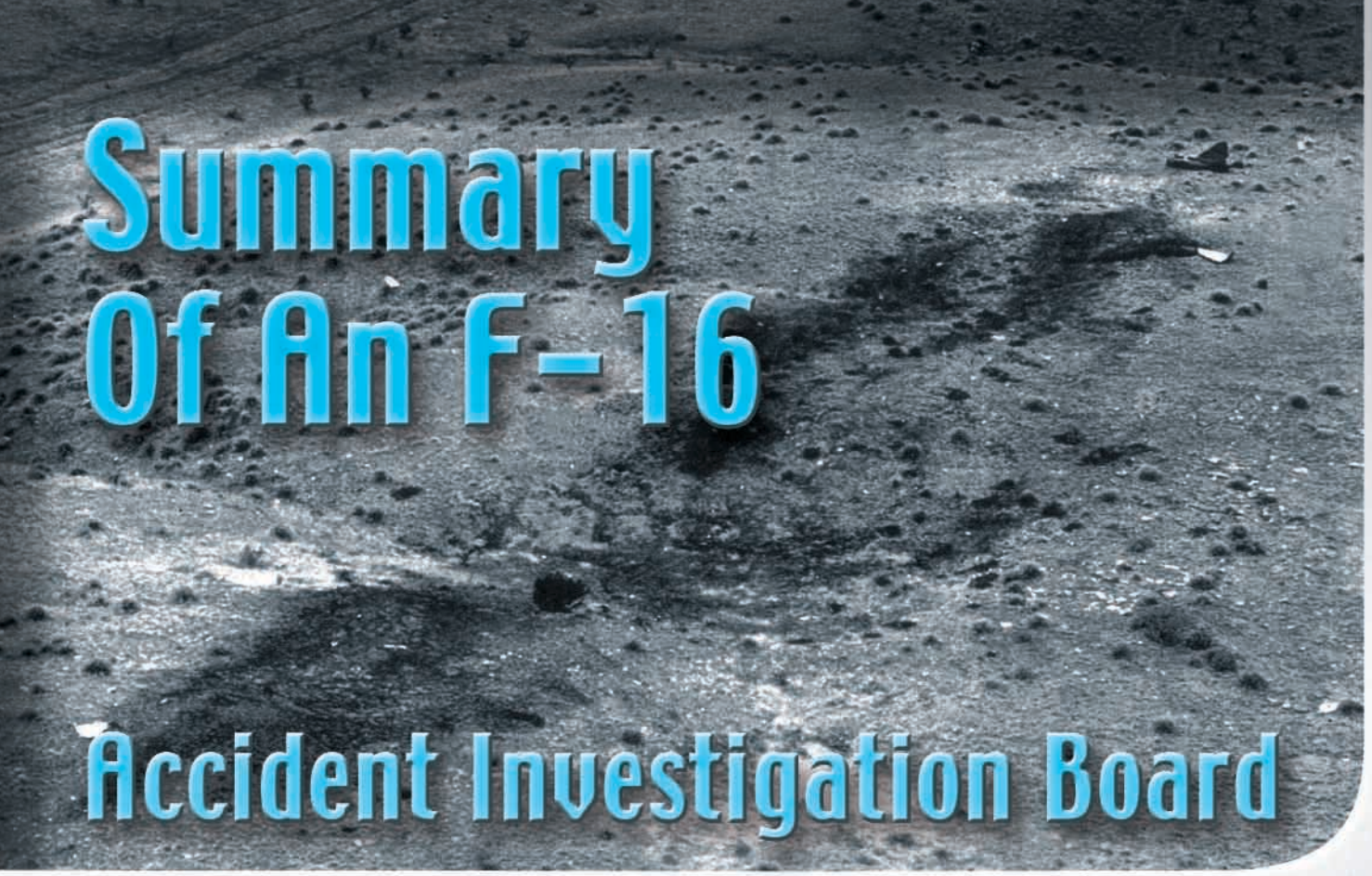
I hear you out there groaning, "It'll never happen to me." But I'll bet the people who tipped over stacks of missiles, dropped them off trailers, broke their glass radomes, or got burned when they dropped a BDU-33 without a safing block, all felt the same way. None of us feel it will ever happen to us, but, believe me, it can and does. I look at the mishap statistics every week at the chief of safety's staff meetings. This year has been absolutely disastrous.

We have to come together as an Air Force family and we need to take care of each other. We have got to drop the attitude that what someone does off duty is none of our business. If you know people who are doing dangerous things at work or off duty, it is your obligation as a supervisor, fellow worker or friend to talk to them. Let them know that if something happens to them it will also affect their loved ones, friends and the Air Force's mission. The Air Force has invested a lot in them, and they, as airmen, don't need to let the team down by risking their lives unnecessarily! They may be the "finger in the dike" that keeps it all together.

Now you are wondering, what does all this have to do with the new changes in maintenance? Well, it has everything to do with it. We, as maintainers, are coming back together as one community and it is time we act like we care about each other. It's time to sacrifice some of our individualism for the betterment of the whole. What better time than right now with the new changes? We need to make sure that maintainers know that violating procedures or safety will not be tolerated in the maintenance community. We should never put other's lives or the mission at risk because we want to take shortcuts.

It is time to put the "black hat" back on our quality assurance evaluators. It is time for us to become part of the solution and not the problem! It is time for us to be proud of being maintainers whether we are aircraft crew chiefs or weapons troops (and I mean all weapons troops — 2W0, 2W1, 2W2 or 2M0), or back shop support. We have the chance to show the rest of the Air Force that no one comes closer to perfection! *Let's take the lead and make this the best thing that has happened to Maintainers!*

Summary Of An F-16 Accident Investigation Board



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The following article is an extract from an F-16D Accident Investigation Board report. In the opinion of the Accident Investigation Board Investigating Officer this accident was *caused* by faulty maintenance. Training and experience are major issues facing today's Air Force. How good is your training program, and are your supervisors aware of what is actually going on in your shop or on your flightline? Unfortunately, if supervisors and technicians do not use and remain knowledgeable of technical data, and are making assumptions on maintenance practices and training, the following can be the consequence.

History of Flight

Mishap pilot (MP) was scheduled as number four in a four-ship formation for a combined low-level and basic surface attack sortie. The flight of four F-16s departed and proceeded to the entry point via the planned route. After approximately 14 minutes of flight, the MP noticed a thump, a noticeable loss of thrust and the presence of gray smoke in the cockpit. The MP directed a "knock it off," began a climb and performed the critical action procedures for an airstart. After an unsuccessful airstart attempt, the MP initiated an ejection. The ejection was successful and the MP suffered only minor soreness and abrasions. The aircraft impacted the ground.

Aircraft Maintenance Documentation

A thorough review of the active and most recently pulled (filed) AFTO 781 Series forms was conducted along with available computerized products. There were no discrepancies that would have prevented the aircraft from flying. Additionally, there were no overdue inspections, time changes, or Time Compliance Technical Orders (TCTO). Archived historical records including AFTO Form 95, *Significant Historical Records*, dating back to aircraft manufacture and AFTO 781 Series Forms were thoroughly reviewed and revealed the following:

(a) The Mishap Aircraft (MA) departed and arrived at depot for the depot modification program Falcon Up. On this date, the MA's engine was removed to facilitate ease of maintenance. The Mishap Engine (ME) was reinstalled in the MA after completion of the modification. The ME remained with the MA from this date until the mishap. The MA and ME flew a functional check flight following depot modification. There were no reported engine anomalies.

(b) An acceptance inspection was conducted on the aircraft, which included an engine acceptance inspection. No discrepancies were noted during these inspections, although engine operating and flight times were not validated for six days.

(c) The MA flew a total of five times from the time of installation of the ME before the mishap flight. No reported engine discrepancies were noted during these flights.

Engine Maintenance Documentation

A thorough review of computerized engine management data, TCTOs, time changes, and component histories was conducted. No overdue inspections, TCTOs or time change items were noted. A thorough review of the engine work packages and subassembly replacement data revealed the following:

(a) The ME was originally installed in an F-16C belonging to an assigned Fighter Squadron. The engine experienced an oil consumption problem and was removed and sent to engine test cell for further troubleshooting. Engine test cell confirmed the oil consumption problem. Upon completion of the test cell runs, the ME was sent to the Jet Engine Intermediate Maintenance (JEIM) shop for further maintenance. An Engine Information Worksheet package was initiated, along with four Subassembly Worksheet packages. During maintenance, personnel utilizing the engine as a training aid discovered an out-of-limits dent on an eighth stage compressor blade. The top of the compressor section was removed, and work began to repair the compressor blade. Following the repair of several compressor blades, the compressor top half and the upper actuator rings for the variable stator vanes were installed. An In-Process Inspection (IPI) sheet was completed for the variable stator vane actuating rings. The next day the variable stator vane bellcrank assembly was installed and the technicians noted that the work required a thorough inspection and IPI. The following day another technician noted in the daily summary log that the lower actuator rings required new bushings and that he had removed the lower actuator rings to replace the bushings.

(b) Technical Order 2J-F110-6-4 SWP 059 07, Page 12, Paragraph 8, for removal and installation of the stage 1 and 2 compressor actuator rings, clearly states that removal of the lower actuator rings is prohibited unless the lower outer fan duct is removed. This statement is made in two notes prior to the first step in the task. Step one following these notes also requires the removal of the lower fan duct assembly, per WP 063 00, if the lower actuator rings are removed during maintenance. Failure to remove the lower fan duct assembly means that maintenance on the lower compressor section is necessarily blind.

(c) There is no documentation to indicate the removal or installation of the lower duct assembly on the ME or its components, and witness testimony supports a finding that the duct assembly was not removed during the critical maintenance. The daily summary log of that day reflects that the variable stator vane rings and connecting bridges were attached, which was done blindly. Following this entry is an entry stating that the IPIs were completed.

(d) Completion of an IPI requires documentation of a worksheet. An IPI worksheet was completed for the first assembly of the actuator rings, but no IPI sheet was found to support the second assembly of the variable stator vane actuator rings. The technician making the work package entry could not recall if the IPI was accomplished or whether an IPI sheet was initiated or completed. Since the pages in the work package were not numbered, it is not entirely possible to ascertain whether the IPI sheet was completed and lost, or was never accomplished. However, the evidence clearly suggests that an IPI was not accomplished for the second assem-

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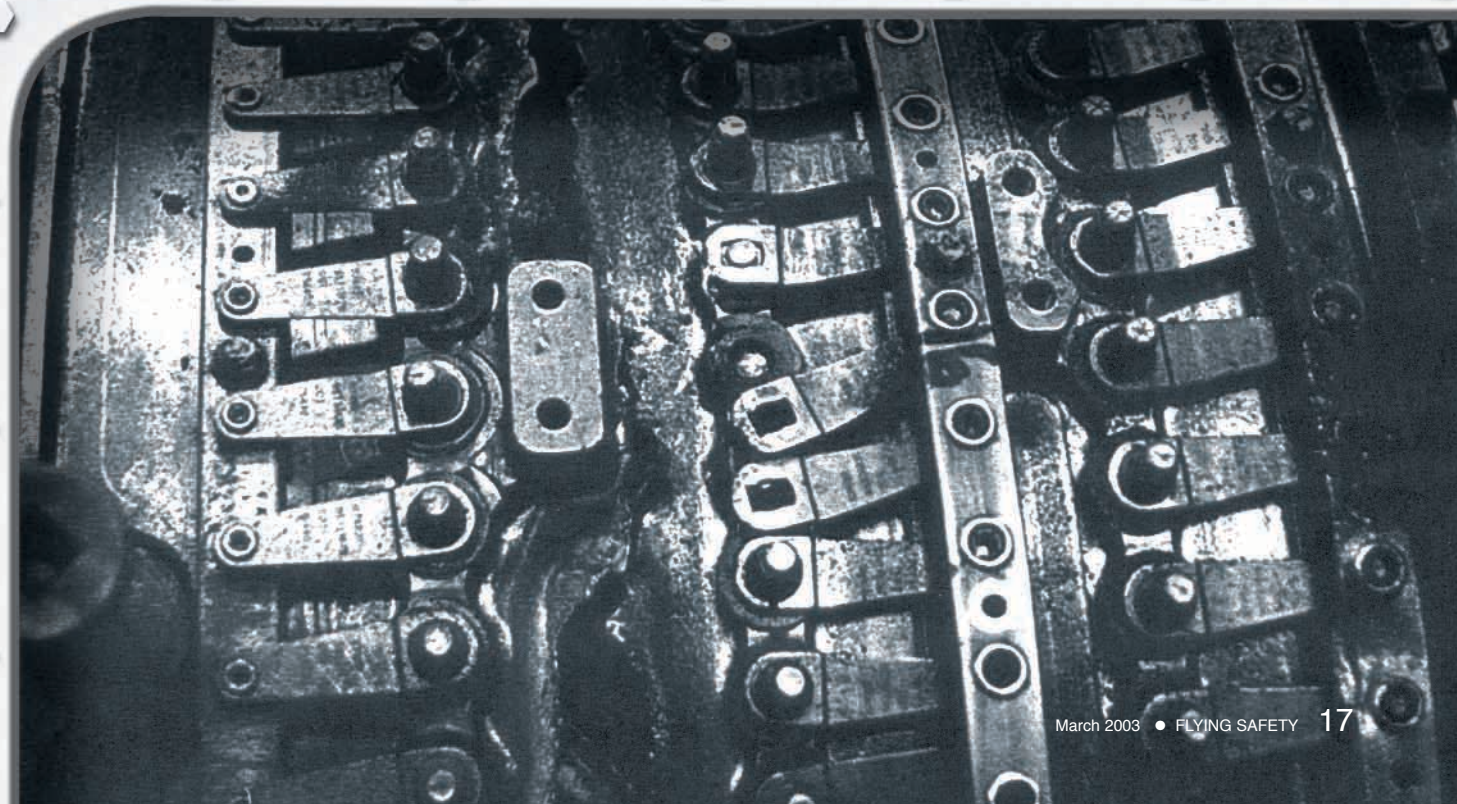

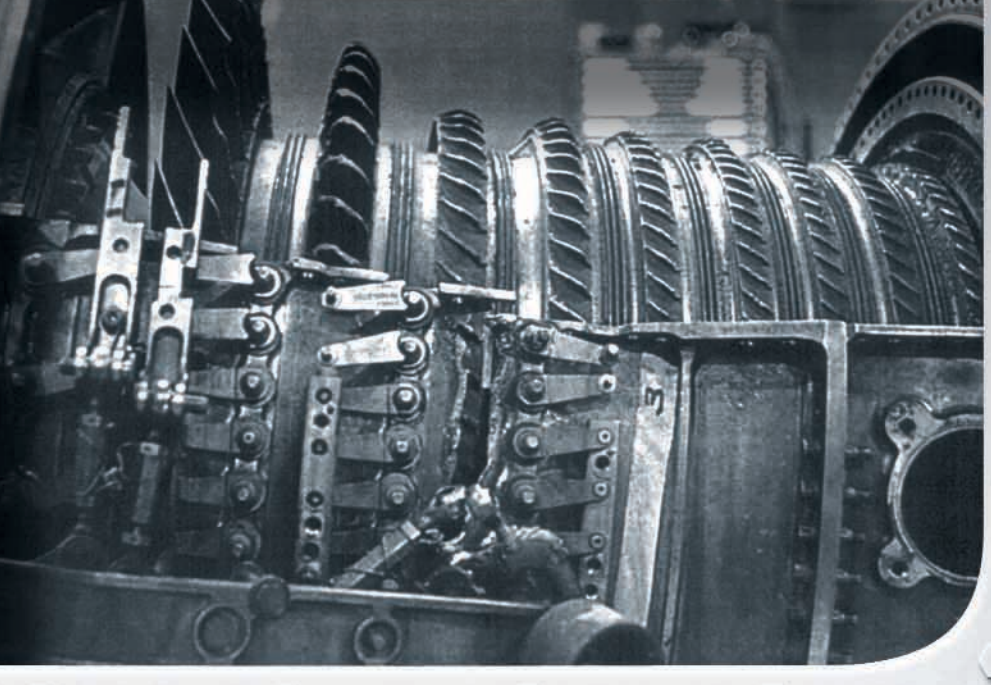

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bly of the variable stator vane actuator rings. The engine was sent to the test cell for operational checks, and the ME outer fan case would not be reopened until the mishap.

(e) The ME was then installed in an F-16D belonging to a different Fighter Squadron, and the aircraft departed home station and went to depot for Falcon Up modification. Upon arrival at depot the ME was removed for ease of maintenance, and an acceptance inspection was accomplished by the depot, which included a borescope and records review. Documentation during this period reveals that a bad Augmentor Fan Temperature Control (AFTC) unit was replaced. The nature of the malfunction requiring replacement of the AFTC revealed that the unit was actually cannibalized for maintenance and that the original AFTC installed on the ME had no reported discrepancies or anomalies. The ME was then installed in the MA and remained installed until the mishap.

Flightline Maintenance Personnel and Supervision

According to maintenance documentation on the MA, the aircraft was properly serviced and inspected prior to flight. Individual training records confirm that the individuals involved in servicing, inspecting and launching of the aircraft were all qualified and certified for the tasks they performed. The technician noted no discrepancies with the inlet inspection. Maintenance supervision viewed all aspects of the launch prior to the mishap flight as trouble free, and there were no indications that the aircraft had any problems. The investigation board could not find any evidence that flightline maintenance personnel or supervision contributed in any way to the aircraft mishap.

Engine Maintenance Personnel and Supervision

Four engine maintenance personnel and the NCOIC of JEIM were interviewed as a result of this investigation. The findings are based on interviews and other related evidence.

(a) The maintenance technician who removed the lower actuator rings on the ME currently works in the support section and at this time has no F-110 Job Qualification Standard (JQS) filed in his training records. When interviewed, the individual was unsure of his qualification to perform the task he documented in the daily summary log concerning the lower actuator rings. Additionally, the individual stated that he was not aware of the requirement to remove the lower fan duct assembly when removing the lower actuator rings from the compressor assembly. Further, testimony revealed that he was unsure of what his responsibilities were for the use of technical orders (T.O.) while performing maintenance. He stated that he did read the T.O. when training, but was not sure of his T.O. use while engaged in JEIM maintenance. When asked if he has seen maintenance performed blindly on the lower compressor section of other engines, he stated that he believed so. Additionally, he was unsure about who was responsible for initiating and requesting IPIs on engine maintenance tasks.

(b) The technician's immediate supervisor was on leave during the particular time period when the lower actuator rings were removed. When interviewed, he was knowledgeable of the requirement to remove the lower fan duct for the type of maintenance conducted and stated that he had not seen blind maintenance performed in the JEIM shop. The immediate supervisor felt qualified, but his JQS contained no documentation initiating, completing or certifying compressor training.

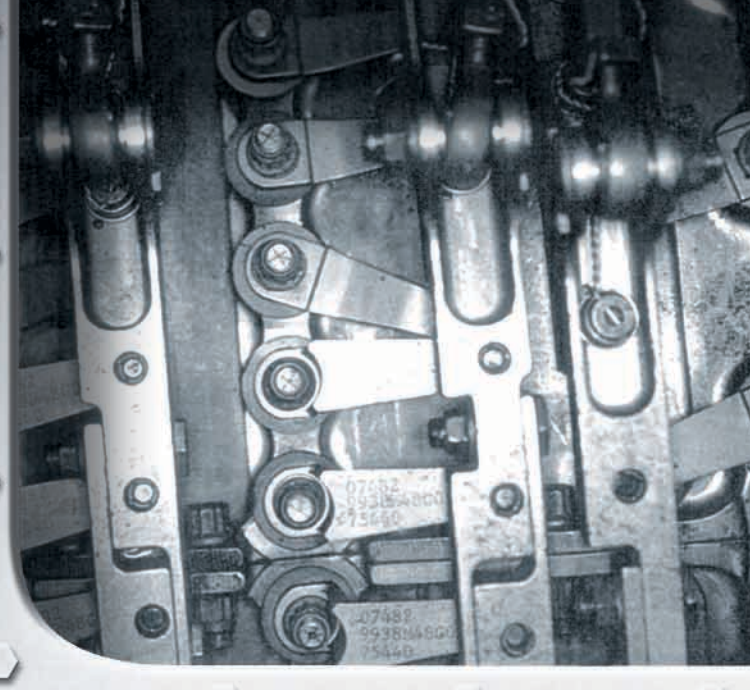
(c) The technician that may have finished the assembly of the variable stator vane components annotated that an IPI was accomplished for the maintenance. The technician had the appropriate F-110 JQS with compressor maintenance, and his JQS reflected a start date, stop date and initials, but no certification or trainer verification. This individual felt he was qualified and believed he was certified in his JQS. He was aware that the procedure on the lower compressor actuator rings was prohibited with the lower fan duct installed. He acknowledged that the logbook reflected this violation, but could not remember if he was personally aware

that this procedure was being conducted at that time, on that engine. He admitted that he had performed blind maintenance in the past and has witnessed blind maintenance on a few occasions within the JEIM shop. Further, he believed it was the production scheduler's responsibility to initiate the IPI sheets on maintenance tasks performed and was unsure of the procedure when unscheduled maintenance of an IPI item was required.

(d) The individual who was noted in the daily summary log as having performed the IPI on the variable stator vanes was not qualified or certified in his JQS, but he was specially certified to perform IPIs. This individual also believed he was properly certified and capable of performing compressor section maintenance. He was clearly aware of standard IPI procedures and responsibilities, and noted that the individual maintenance technician is responsible for identifying and obtaining documents for any unscheduled IPI items. This technician also stated that he only performs IPIs with the appropriate IPI document for the job in-hand. Given his usual practice, he could not account for the missing IPI document that the repair technician stated he performed in the daily summary log entry. He also stated that he does perform the required IPI with the lower fan duct installed using a borescope. However, he would not perform the actual maintenance blindly.

(e) The NCOlC of the propulsion section was also interviewed. The NCOlC believed that removal and installation of the lower actuator rings was not considered blind maintenance since it could be inspected with a borescope, and therefore, the lower duct did not require removal. After being read the notes and steps in the actuator ring technical order, he acknowledged that he was unaware of that requirement. When questioned on the JQS discrepancies, he noted that the page in question was new and acknowledged a problem with his training documentation. He thoroughly believed his personnel were qualified for the tasks performed. Specific mention by the NCOIC and the other witnesses was made to a lack of F-110 experience at the time of this incident. During the time when the lower actuator rings were removed and reinstalled, none of the individuals involved, except for the IPI technician, had more than six months experience on F-110 engines.

(f) Failure to properly use technical data and failure to accomplish a necessary IPI, coupled with the low level of F-110 experience in the JEIM shop during this period, indirectly contributed to the mishap. The unit made several attempts to gain more personnel with experience in the F-110 engine, and supervision recognized that this was a serious problem. All individuals interviewed from the JEIM shop appeared conscientious and concerned.



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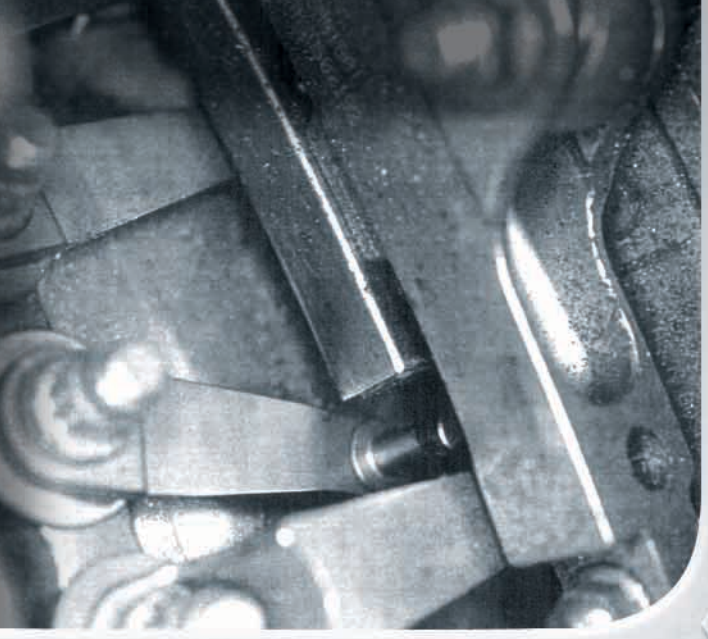
Air Frame and Aircraft Systems

A thorough examination of the wreckage, surviving computerized data and the testimony of the MP clearly indicate engine failure. All other primary aircraft systems and emergency systems functioned normally. Examination of the engine warning and fire warning lights indicate that the engine light was illuminated and that the fire light was not illuminated at time of impact. The evidence shows that the fire associated with engine failure remained within the engine case. There were no other failures or malfunctions outside of the engine that contributed to the mishap.

During the engine teardown, a stage 1 compressor variable stator vane arm pin was found disengaged from the lower stage 1 actuator ring at the 9 o'clock position. The vane arm had chafing marks, which corresponded to the place where it was contacting the outside end of the lower stage 1 actuator ring. The lower actuator ring end cap had a corresponding chafe mark where the arm pin was contacting the actuator ring. These marks could not have occurred as the result of impact, and the evidence conclusively indicates that the pin was disengaged and operated in this position for an extended period of time. The actuating arm pin was not properly installed when the last maintenance was accomplished on the particular engine component. Two stage 2 variable stator vane arm levers were found to be improperly engaged in the actuator ring at the 6:30 position. One of the levers had dented the square tubing of the actuator ring, and the other adjacent lever was positioned in the actuator ring rig hole. The disengagement of these pins could also indicate misassembly, or they could have become disengaged during impact. Therefore, this finding remains inconclusive.

Six second-stage blades had released from the



USAF Photo

second stage compressor just aft of the stage 1 compressor variable stator vanes. The retainer rings securing the blades were properly installed and appeared serviceable. Examination of one of the recovered blades shows a fracture in the foot of the blade, which allowed it to release from the compressor disk. The fracture of the blade was caused by fatigue failure of the metal in the blade foot. There was no indication of a foreign object entering the second stage compressor rotor area from a source forward of the stage 1 variable stator vanes. The area of the compressor aft of the stage 2 rotor was virtually destroyed. The remnants of the compressor components clogged the compressor outlet area just forward of the combustion section. A compressor fire occurred, burning through 360 degrees of the outer compressor case at the third stage rotor area. The physical evidence indicates that the mishap engine failed due to the high cycle fatigue of a stage 2 compressor blade, which was a direct result of one stage 1 variable stator vane not being properly engaged in the actuator ring following maintenance. In addition, this fatigue may have been compounded by the possible misalignment of two trailing edge stage 2 variable compressor vanes. The failure occurred with approximately 27.5 engine operating hours from the time of misalignment of the stage 1 variable stator vane. This failure of the stage 2 blade destroyed the remainder of the compressor and rendered the engine completely inoperable.

Opinion as to the Cause of the Accident:

Under 10 U.S.C. 2254(d), any opinion of the accident investigator as to the cause or causes of, or factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from an aircraft accident. Nor may such information be considered an admission of liability by the United States or by any person referred to in those conclusions or statements.

Based upon evidence, which I found to be clear and convincing, it is my opinion as investigation officer that the cause of the accident was catastrophic failure of the engine compressor due to the separation of six second-stage compressor blades. The blades released and destroyed the compressor core, rendering the engine totally inoperative. The compressor blades failed due to high cycle fatigue, which was caused by the misassembly of a variable stator vane on the first stage actuating ring. Post accident investigation revealed that the vane arm pin on the left side of the engine just below the cutline (nine o'clock position) had been misassembled. The misassembly caused the lever arm pin to become trapped at the end of the actuating ring in the gap beneath the bridge connector, creating a misaligned stator. This misalignment caused the downstream rotor blades to pass through disrupted airflow, a pressure pulse, and created a condition where excessive cyclic loading resulted in the failure of a second stage blade.

Inexperienced Jet Engine Intermediate Maintenance (JEIM) shop personnel accomplished maintenance on the lower compressor variable stator vane actuator rings without removing the lower fan duct assembly. This was a *direct* violation of the technical order. In addition, a required In-Process Inspection *was not* accomplished or documented for the work that was performed. It was during this period of maintenance that the variable stator vane was misassembled.

Substantial evidence is available to indicate that the low experience level of the JEIM personnel was an underlying factor in this accident. When the engine maintenance was performed on the mishap engine, the unit was in the process of transitioning to the F-16. During this period, the JEIM shop had only one individual, a Senior Airman, with substantial F-110-GE-l00 engine experience.

The MP was qualified and current in the aircraft. Mission planning, briefing and flight operations were not a factor in the mishap, and the evidence shows that the MP responded quickly to a critical emergency at a low altitude, making a proper and timely decision to eject.

XXXXXXXXXX, Colonel, USAF
AFI 51-503 Accident Investigation Board
Investigating Officer

Editor's Note: This article wasn't published to throw salt in any wounds or to discredit anyone involved. It was published to show that we as maintainers must be ever vigilant, and that our actions can have severe consequences. Every shortcut we take, every time we deviate from tech data, we can be stacking the odds against the pilot in the seat and needlessly waste our high-tech and high-priced aircraft. Let's learn from each other's mistakes!

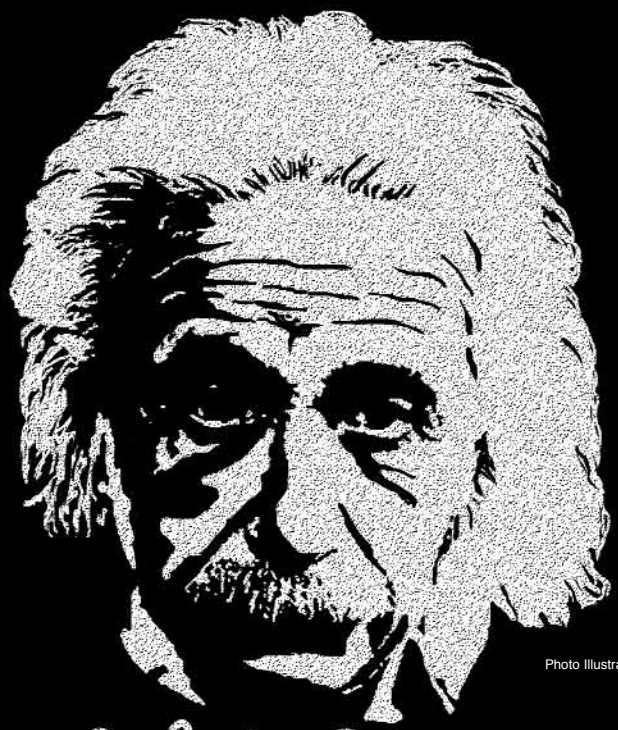


Photo Illustration by Dan Harman

Flying Safety & Einstein's Paradox

J.S.T. RAGMAN

One hundred years of flight safety briefings, yet the accidents continue. One hundred years of regulations, standard operating procedures, notes, cautions and warnings, which, while no doubt saving countless lives, cannot save all lives. One hundred years of "lessons learned," each new lesson illuminating a previously unexposed gap in the flight safety net.

As each new "lesson learned" has illuminated yet another gap in the flight safety net, the fragile and porous nature of that flight safety net has become readily and obviously apparent: There will always be the unforeseen element, the unknowable factor, which, under the correct alignment of circumstances, will reach out to tap the aviator upon his/her shoulder.

Enter Einstein: *"As the circle of light increases, so too, does the circumference of darkness."* With each successive flight safety accident, with each successive "lesson learned," with each successive illumination of a gap in the flight safety net, our "circle of light" increases—and that is a good thing: We learn something, we identify yet another unforeseen element, we know more. Yet, as the "circle of light" increases, so too, does the circumference of darkness: We are reminded, yet again, that there is much we do not know. And that too is a good thing, for it is that which we do *not* know, that which resides *beyond the circle of light*, which can—and as evidenced by each successive accident, does—reach out to tap us upon the shoulder.

The "circle of light, circumference of darkness" model takes on ever-greater weight when one considers that so many accidents happen despite aircrews doing absolutely everything right; drawing upon every previous "lesson learned," touching all the bases, crossing all the T's, dotting all the I's. Put another way, the accidents continue despite flawless operation within the "circle of light" of aircrew knowledge.

The model takes on yet another order of magnitude when one considers that so many accidents happen despite the stellar qualifications (check airmen, flight examiners, instructors), experience (thousands of hours of flight time, hundreds of hours of combat time, scores of carrier landings), and reputation ("he/she was the best") of the accident aircrews: They had "mastered the circle of light", they knew it all, forward and backwards, inside and out. Yet, it is frequently that which resides *beyond* the "circle of light," that which resides within the "circumference of darkness" which prevails over aircrew mastery of the circle of light.

On a recent cross-country, an aircrew held a long-running discussion on the question of "What constitutes an exceptional aircrew member?" Perhaps Einstein would suggest that in addition to our quest as aircrew members to "master the circle of light" (know our job, practice good crew resource management, manage error), we might do well to recognize and appreciate the magnitude and significance of the "circumference of darkness," for it is within this ever-widening realm that the unforeseen resides, and it is from within this realm that many of our fellow aviators, past, present and future, encounter the unexpected.

"Man's flight through life is sustained by the power of his knowledge." The "circumference of darkness" is out there. Paradoxically, with each new "lesson learned," with each new increase in the "circle of light," the "circumference of darkness" likewise increases. Know it. Never forget it. Einstein was a smart guy. V

("J.S.T. Ragman" is the pen name of a C-130 pilot and unit commander in the Air Force Reserve. He is also a Boeing 777 pilot for a major airline.)

HAZARDOUS AIR TRAFFIC REPORT (HATR) HATR SUMMARY FOR CY02

MSGT JAMES K. ELLIOTT
HQ AFSC/SEFF

This article breaks down the CY02 reportable incidents (figure 1), and trends, HATRs by location and by MAJCOM (figures 2 and 3), HATR Safety Automated System (HATR SAS) update, and conclusion.

CY02 Reportable Incidents

There were 183 reported HATRs filed from 1 Jan 02 through 31 Dec 02. Near Midair Collisions (NMAC) represented approximately 54 percent of the reportable incidents, which is four percent less than last year. The second largest category was ground incidents, which increased from 14 to 21 percent of reported incidents. The majority of these incidents were between USAF vehicles and USAF military aircraft. There was a mixture of causes, mostly vehicle operators not adhering to/understanding ATC instructions around the runway environment. Unit flightline driving programs must continue to be aggressive with their training programs, especially with contractors not familiar with the base runway environment. There were no significant increases/decreases in the other categories to quantify any trends.

HATR Safety Automation System (SAS)

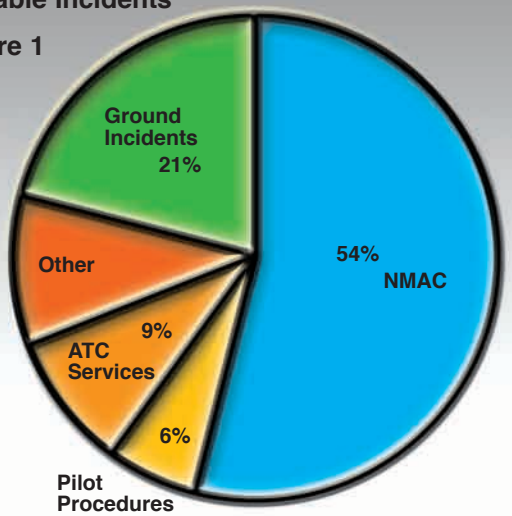
The HATR SAS web-based database will be rewritten to model our new Aviation (AvSAS) database. One of our new enhancements is to give unit safety offices retrieval capability instead of asking the Safety Center for information.

Conclusion

Efforts continue to simplify and encourage HATR submissions. Send your comments/suggestions to HQ AFSC/SEFF 9700 "G" Avenue, SE, NM 97117-5670; call DSN 263-2034, or e-mail Kevin.Elliott@kirtland.af.mil.

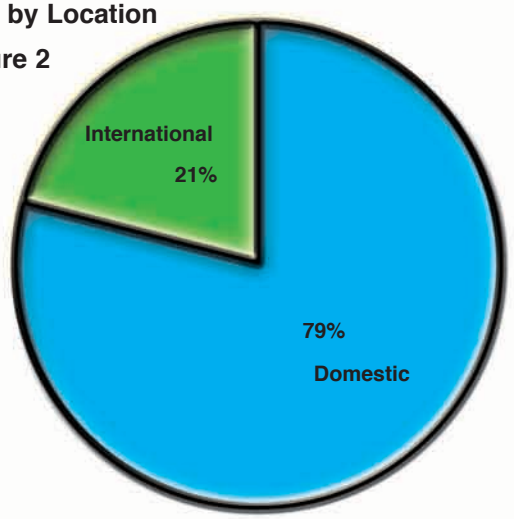
CY02 Reportable Incidents

Figure 1



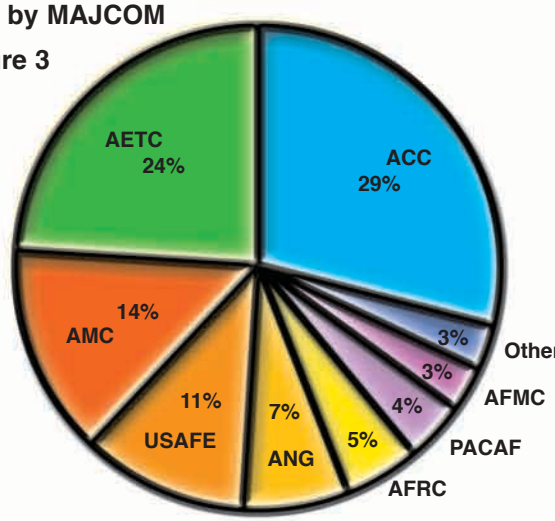
CY02 HATRs by Location

Figure 2



CY02 HATRs by MAJCOM

Figure 3



Human Factors 101

MSGT CHERYL GORDON-JOHNSON
NCOIC Aerospace Physiology
Human Performance Training Team
Eielson AFB AK

Illustration by Dan Harman

(*Editor's note: This article is the text of an oral briefing which MSgt Gordon-Johnson presents. Although the tone is humorous, the human factors information is solid, and you'll note the influence of Dr. Seuss.)*

Once upon a time, the world was safe…and all were free of blame. Then someone chomped a forbidden apple. Now, things aren't the same. People slip on fresh-mopped floors; bash their shins on open file drawers; hit their heads on low-hung doors...and precautions? Too often ignored. Hours grow longer, and the days, shorter; but folks just have to make do. Machinery gets older, and budgets smaller—no surprise we're black and blue.

More than four decades of studies show what those who work in Safety know to be behind our mishap rates. And sad to say, it's not too great. So guess what? It's us. We're the cause of all the fuss. Poor judgment, channelized attention, task saturation…not to mention while we're mired in all we do, that sometimes, we're just dog-tired. Aren't you? These human factors, as they're known, chip away at abilities to hone those skills and practices we know to be right, causing common sense to take flight.

Human factors cover more ground than just what's mentioned above. The gamut spreads far, so I'm just getting started. And you really should know 'em, 'less *you* get carted off in an ambulance, torn from those you love. So let's sit awhile, and maybe just talk. If this works out, you won't need to squawk 243.0[1]. Instead, be your own hero; and break the mishap chain long before you're ever in pain.

We're the cause of all the fuss.

Start with a knowledge of human factors types. That way, you're sure to cut through the hype.

First, look at environmental factors. Are you in an office, or outside on a tractor? Heat, cold, darkness, smoke and fumes from equipment, driving wind, rain and snow…even noise all conspire against your poise in handling stress, making a mess of your ability to cope. You only hope someone throws you a rope to get you through, since these factors hurt how well you do. Productivity suffers, endurance falls, fatigue creeps in, thought and reflexes slow. In this state, can you handle emergencies? The answer might well be no. And if that's not enough, things *really* get tough when these same factors affect equipment or gear. Parts may break, and with so much at stake, you can't work through it. You're thinking, "Screw it. I wanna disappear, and go get a beer." Meanwhile, your boss yells "Hey! Who left this here?"

We tell ourselves that we'll get far; already knowing we're not up to par.

Next are factors self-imposed, the ones we do although we know how bad they really are. We tell ourselves that we'll get far; already knowing we're not up to par trudging through our lifestyle tar. A lousy diet hits us hard, sapping strength, endurance and reason. And that increases mishap potential regardless of the season. Skipping meals is dumb indeed, going through the day, a record on the wrong speed. Decision-making and judgment suffer, endangering ourselves and many others. And if folks really knew how impaired we are, they'd avoid us too, if they had their d'ruthers. Fitness is a factor we also neglect. Reclining on the couch, we'd rather select channels on the remote—all the while ignoring the dusty gym tote. Dehydration's a factor hitting year-round, stabbing at endurance otherwise sound. We lose a third of our potential before we're ever thirsty[2]…before we even know it. And on that point, we seldom realize how badly we show it.

More self-imposed factors to consider here are diet pills, supplements, and medications, for when we're…just not ourselves. Self-medicating can mess us up royally. In doing so, we frequently spoil the natural balance of chemicals within, not to mention hormonal blends. Dangers arise when unwitting concoctions react with each other. If so, oh brother! Pray a slap on the back—maybe some ipecac—helps you on your way. And woe be to you, for the price is great, if you fly and self-medicate! It's not that we're being a pain in the butt, or trying to keep you in a caffeine rut. Plain and simple, no time to quibble, unauthorized drugs do bad things, whose effects far worsen under wings!

The next couple self-imposed factors have rather potent performance detractors. Smoking, for starters, makes it much harder for oxygen to reach the tissues. Carbon monoxide hogs red blood cells, which in turn sounds warning bells. The pulse speeds up and blood pressure raises, making the day you push up daisies a far bigger issue. Aside from cancer, to make matters worse, you can't sustain those energy spurts due to the body's oxygen-starved curse. One more hit against the mission deals with smokers' loss in night vision of 15-20 percent[3], making a very significant dent. Tobacco chewers don't fair much better. They too, like smokers, bow to cancer and addiction. And breaking free requires a conviction they may be unable to rouse.

Our final self-imposed factor ranks as America's drug of choice. Any clues? "Of course, it's booze!" we proclaim in one great voice. Its effects at the party aren't our concern here...the clumsiness, judgment errors, lampshade hats and lack of cares. What may be news instead to you, is the grip it holds on all you do two to three days later. Job performance isn't so hot. You're making mistakes you'd otherwise not, all because your body caters to the fix you put it in. Poor quality sleep, dehydration, low blood sugar, disorientation, splitting headaches, slow reactions…give it up—you're not gonna win. Things get risky on the job, so God forbid you drop the ball; and someone sadly ends up having to call your next of kin.

So far we've seen two human factors types. Sure, things look gloomy, and you may be thinking "Yipes!" But don't you worry. Help's on the way, and what I'm selling will get you through the fray. So where's the pitch? I'm getting to it. Just hang on—we're almost through it. All I need's a few more minutes of your precious time. First, I wanna grab a soda. How 'bout you? Lemon-lime?

Next, we have a category addressing the job itself. Mission-imposed factors

come from the top shelf—management, Mount Olympus, the big kahuna, the boss… These sudden demands take many forms, all of which conspire to make you more tired, since they're out of the norm—fiscal year closeouts, disaster response, equipment failures, pre-inspection measures…even extended holiday hours for your shopping pleasure! Fatigue's the big danger, not just from long hours. It also hits with changing work shifts, or crossing time zones on TDY trips. One more factor in the workplace is the relative increase in our pace, compensating for lost manning, shrinking budgets, in turn fanning the flames of mishaps caused in our haste.

Our final category lives in our minds, and hurts our perception of danger signs. Psychological factors target attention[4]. They bog down our thoughts; not to mention, two lead the way as causal to mishaps. So, let's look at how thinking gets zapped. First, there's Distraction, which takes two forms. External examples are buzzers and horns. Internal distraction covers more ground, occupying thoughts with a game downtown or fight with the spouse, where you went round-and-round. Maybe finances have you down, or having to take your hound to the pound. Do the kids' grades have them in trouble? Does pressure from peers keep 'em in a bubble? Maybe you're thinking of a second job, or fixing the house, or corn-on-the-cob. Maybe it's the term paper you haven't started, or how much that fall on the ice really smarted! In any case, the point is clear—your thoughts are elsewhere, instead of right here.

We'll look at Negative Transfer next. Defining it from common text, it's when something's learned so well, it's performed on a subconscious level. Is that bad? The task is mastered, and so you revel! But with new equipment, or a different setting, those old habits can have you betting against your life—the results of which could be so sad.

Our last two factors—Channelized Attention and Task Saturation—lead the way in mishap rates and taking victims to the Pearly Gates. They're number one and two, respectively, so we'll look at both subjectively. Channelizing has us focused on a single cue; and so intently, we don't give other cues their due. We don't notice, for example, the space we have is far from ample as we lurch for a spot in the parking lot, the last to be found anywhere around, and scrape the doors' paint right down to bare metal. Then the insurance claim, we'll have to settle. Task Saturation lies at the other extreme, attending to too many cues at once. We then fail to prioritize, leading to bone-headed stunts.

So there you have 'em, all four for you…the human factors types—environmental, self-imposed, mission-imposed, and those in our minds. What can be done to make us better? What keeps us safe so we don't take a header? If you're buying what I'm selling, then I have a deal for you…not so much a new invention, just a salesmanship approach to mishap prevention!

Human Performance Training, HPT, could very well be the key to improving job performance and reducing mishap rates…all for a nominal fee. The price is simply that we shadow you for a while—what's your name, Bob? Then we develop human factors countermeasures tailored to your job! So run, don't walk, to your nearest Human Performance Rep. Take advantage of what they offer. That's the first step. Wouldn't it be nice being better at what you do? Get the boss off your back? Stop a mishap in its tracks? It might surprise you, 'cause it's not so hard...and oh, by the way, here's my card!

Just a salesmanship approach to mishap prevention!

[1]243.0 MH, the emergency radio frequency for US military aircraft.

[2]*Influence of Hydration Levels*, JAMA, 1984

[3]AFI 11-403, Standard Curriculum, Apr 00, *Night Vision Tactics.*

[4]*Human Factors in Flight*, Hawkins, 1987.

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

Communication is the key to ensuring you have the proper Air Traffic Control (ATC) clearance you asked for, and actually understood the clearance you thought was yours. Here are some examples where what was heard wasn't what was said.

Alert Scramble—Part One

Two F-16s sitting alert got to experience a practice scramble, but things didn't go quite right. After receiving the call they cranked up, and one aircraft had an unfortunate maintenance problem, so the first aircraft taxied single-ship after receiving clearance from the tower to taxi and take off. Aircraft number two called the Supervisor of Flying and asked if the clearance for the first aircraft was still good for him. The SOF, thinking the pilot was talking about the flight plan, told the pilot his clearance was good for five minutes. However, the pilot of the second aircraft was talking about the taxi and takeoff clearance. I do believe the communication process had broken down. The second aircraft was repaired and proceeded to taxi out to the runway, the pilot thinking he had clearance to take off.

The tower, seeing the aircraft heading for the runway, called the aircraft on both UHF and VHF with no success. As the aircraft taxied on the runway, without clearance, the tower called on guard for the aircraft to hold short and come up their frequency. The pilot heard this, stopped and contacted tower. Tower then got the clearance issues resolved and the aircraft departed. Simple case of all parties involved not ensuring they were talking about the same thing. When it comes to the critical aspect of proper taxi and takeoff clearances, it is essential for everyone to understand what is being said.

Alert Scramble—Part Two

Another pair of F-16s, at a different location, were to participate in a practice scramble. The crews were informed they would be part of a preplanned mission, and would be practice-scrambled into their missions. The aircraft did not file a flight plan since that would be part of the normal scramble response, and handled by base operations or Radar Approach Control (RAPCON). The first link in the safety chain.

Command post received the scramble order and activated the alert net. Everyone received the alert order, but command post forgot to contact base operations as per their checklist. Second link. The command post, pilots and base operations were not given any heading or altitude info over the alert net, just a Combat Air Patrol (CAP) name. Third link. Base operations couldn't file a flight plan, as they didn't have enough information to choose one of the alert scramble preplanned flight plans. Fourth link.

The aircrews cranked up and called tower ready to "taxi two." The tower cleared them to taxi and the aircraft reported they were approaching the runway, ready for takeoff. Tower still did not have a takeoff clearance or flight plan for the aircraft and told the crews to "stand by." The aircraft reported

taking the runway on the roll, and the local controller then cleared the aircraft to active scramble. Was this clearance to take off? The aircrew took the clearance to active scramble as their takeoff and flight clearance, and replied "copy all." Upon climbout, the pilots contacted the center, who had not received any clearance or flight plan for them. Now we have a problem. After several opportunities in a very short time, two aircraft were allowed to take off without clearance. The controllers at the center were unprepared for the alert takeoff and had to move some civilian aircraft out of the way of the military flight. The aircraft then completed the mission without further complication.

The unit had an arrangement with ATC that they would "pre-coordinate" all practice scramble exercises with them. Unfortunately this did not happen. Had the unit accomplished this important step, the center would have been prepared to handle the extra aircraft. Another issue was communication between pilots and controllers—controllers telling pilots they are cleared for scramble, which pilots took for takeoff clearance. Who is responsible for ensuring the aircraft has proper takeoff clearance? I think you know the answer to that question. As always, nothing is done by a single person in the Air Force. It takes team effort to communicate effectively, especially in the critical area of ATC.

Alert Scramble—Part Three

It's "Pick On F-16 Month," as here is another case of a pair of F-16s taking off from a "practice" scramble without clearance. This time the call went out and the runway used by the alert aircraft was not the active runway. The active runway had a C-130 on it lined up and cleared for takeoff. The controllers de-conflicted the C-130's flight path, called the alert birds with their clearance to taxi and advised them to contact tower when ready for departure. The controller heard "push victor four," which he assumed was the tower frequency. The two aircraft then proceeded to taxi past the hold line and take off without clearance from the tower. Everyone was informed of what happened, and that they would work this when the aircraft returned. Upon return, the pilot stated that they were task-saturated with radio frequencies during the launch, and didn't realize until they were powering up that they had not received their takeoff clearance.

Is it ever too late to call and ask for permission? Is task-saturation during a "practice" scramble a reason to not follow the rules? We must train like we fight, but there is a limit to the risk we should accept. If you are overloaded, it is time to slow down. Aircrews and aircraft are too valuable to lose to dumb mistakes and miscommunication.

Were You Talking To Me?

Here is a case where the pilot didn't listen well enough. The T-37 was given clearance to taxi to the runway, which he did and held short awaiting clearance. The next thing the controller noticed was the T-37 taking the active and he then sent another aircraft, a T-38 on 3/4-mile final, around. The controller then transmitted "aircraft taking the runway, say call sign?" The pilot responded that he understood he was cleared for takeoff. He was not, and he was then directed to depart the runway at the next available taxiway.

What happened here to cause the mistake? The pilot heard the tower give the aircraft on final clearance to land and thought it was his clearance to take off. He had noticed the aircraft on final and thought he needed to expedite his takeoff. What are the rules for responding to tower clearance? Isn't the pilot to repeat the words "cleared for takeoff" to ensure there is no confusion? Maybe we need to get back into the books and look up radio discipline.

Taxi, Takeoff—Same Thing!

An HH-60 requested permission to taxi onto the runway for takeoff. The tower responded with "Taxi to Runway." The aircrew then switched to the tower frequency and proceeded onto the runway and reported "on the active ready for takeoff." Tower then instructed the aircrew that taxi "to" the runway does not give permission to taxi "onto" the runway. They do sound somewhat alike, don't they? Tower then cleared the aircraft for takeoff.

Now this was the third identical incident from this unit in the last ten days, so I guess there was a little history behind the incident. Maybe some habit patterns had grown that need to be changed. The unit and ATC got together and discussed the proper use of Federal Aviation Administration clearance terminology. In looking at the problem they did find out that the tower instructions are heard on the ground frequency and ground instructions can be heard on the tower frequency, which could cause some confusion. It still does not give anyone the justification to take off without proper clearance. Make sure what you hear is what was said.

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

"Tech Data? We don't need no stinking Tech Data." Here are some examples where the evidence showed Tech Data wasn't followed. Things like damaged aircraft or injured people happen when procedures aren't followed. Follow the books not only because you are required to, but more importantly because the tech data is there to protect you from injury and from damaging equipment.

How Close Do You Put The Stand?

A KC-135 crew was performing an ops check on the refueling boom after changing the boom hoist control valve. Checkout procedures require a padded stand be set underneath the boom to protect it in case the boom is inadvertently lowered. In this case, the folks performing the task missed a key step and did not install the boom hoist lever rig pin, which allows the boom to freewheel. I bet you can guess what happened during this checkout. Yes, the boom fell onto the B-1 stand, which was positioned several feet from the boom. Damage was done to the boom ice shield, boom nozzle and the B-1 stand. Bet it fell more than a few inches. Now, T.O. 1C-135(K)R-2-6JG-10 is unclear on how close to position the stand. It just states, "Locate padded stand under boom" and includes a picture that shows the stand positioned just under the boom. Here is a question that I have faced many times, as I'm sure you have. The words are unclear, but there is a picture. Is the picture tech data guidance or reference? Did a person violate tech data because they did not 'follow' a picture? I have always thought of it as guidance to reinforce the words provided, and ensure the task is done correctly. A simple task with tech data guidance ended in damage to an aircraft. More work for people with too much work on their hands already. What do you think?

How Not To Drop A Bomb Or TGM-65

It was an easy Close Air Support training mission for an F-16, but the simulated drop became the real thing. Oh yeah, he didn't just drop a bomb, he dropped a TGM-65A and LAU-117A launcher! Now that made a big dent in the desert below. The pilot declared "knock-it-off" and returned home for the day. Once back at home station, maintenance found the MAU-12 sensing switch stuck in the up/depressed position. In master arm hot, zero quantity GB12, and the sensing switch depressed, a firing voltage is sent to the MAU-12 rack, which fires the MAU-12 rack impulse carts when the weapons release button is depressed. This mechanically released the LAU-117A with TGM-65 attached.

T.O. 1F-16C-33-1-2CL-10 states, "Exercise caution when raising launcher to avoid damage to bomb rack sensing switch." When load crews do their thing they are normally very sensitive and gentle people, but sometimes the gorilla may come out. In this case it wasn't clear when the damage happened. The big question goes, "Why didn't someone notice the switch was stuck in the up/depressed position?" If the load crew did the damage, they should have said something, or the supervisor doing a follow-up could have stopped this accident. The current ops

procedure on how the aircrew would set up the armament switches contributed to this incident, but that is another story. We all know when you mess with explosives you double-check everything. In this case, a $188,000 missile and launcher made a big hole in the desert below. Be careful, and if you see or do something that could lead to a problem, be the hero and speak up!

How Strong Was That Wind?

A C-130 parked at an off-station location, experienced some winds that gusted to above 45 knots. That will get a Herc rocking. The crew examined their aircraft and found some damage to the rudder and vertical stab. They called the ever-ready Logistics Readiness Center, who dispatched a maintenance repair team (MRT). The MRT arrived at the aircraft and only inspected the horizontal and vertical stabs and associated control surfaces. The MRT was never tasked to perform a high-wind inspection IAW T.O. 1C-130A-6, and they did not perform the inspection. Don't you think a high wind inspection would have made sense? The MRT performed their assessment in which the damage required depot assistance. Depot came and fixed the damage they were tasked to repair, and then helped the crew chief with an engine run and full flight control check. Everything checked out okay, so an FCF flight crew was sent in. After the normal preflight and FCF checks, the plane headed for the skies. Everything was normal until shortly after takeoff. Having problems, they diverted to another base. Enroute, the onboard maintenance technician removed the damper assembly from the aileron boost pack. The crew completed a controllability check and they once again had full control. They were then able to land safely.

Now that they were safely back on the ground they found the aileron boost pack viscous damper support bracket had failed. The failed bracket had caused the viscous damper to block input into the control valve, which induced loss of aileron control. Not a good thing to have happen when you're in the air, or on the ground. Metallurgical evaluation revealed distinct evidence of fatigue cracking which grew into an overload failure.

The question I put to you is, should the MRT have accomplished a high-wind inspection of all flight control systems after they found wind damage to one flight control system? Tech data, 1C-130A-6, only requires a high-wind inspection after exposure to winds in excess of 75 knots, or when the flight controls have moved violently against their stops with hydraulic systems static. In addition, T.O. 1C-130H-2-27JG-00-1 states: "Whenever control surfaces are caught by high winds and moved violently against their stops, or to the limit of travel under any condition, inspect the flight controls before flight…" This maintenance crew did not violate tech data, but could they have done more to ensure aircraft serviceability and safety? If one flight control system received damage, we need to look at everything. All the flight controls faced the same forces of Mother Nature, so the damage potential is the same. We need to learn from the past. If your aircraft experiences Mother Nature's windy side, perform an in-depth check of all flight controls, not just the one with readily visible damage.

POP! Goes The Canopy

An F-16 two-seater was in the hangar for some gear work and got to stay a little longer than planned. The landing gear team was assembled even though supervision did not document if the crew was qualified or trained for the task at hand. The crew then went out to do their assigned duties. The task required three technicians, one in each cockpit and one man on the ground who had the easy job of reading the job guide. The gear checkout was started the day prior, but had been stopped due to a hydraulic leak. The leak was repaired and they were back on the job. They completed a brake bleed and leak check, and the basic landing gear operational check with no problems. Now the fun begins. As the crew started to perform the alternate gear extension system operational checkout, things went from good to bad very quickly. The check required the technician in the front cockpit to position the gear handle to the up position. The next thing the ground man knew, the canopy was being jettisoned. It bounced off the ceiling and back onto the aircraft, destroying the canopy and damaging the spine, tail, left wing and missile rail launcher before it came to rest on the hangar floor. The crew then safely shut down the aircraft and egressed the hangar.

Now how could three technicians, reading the tech data, get confused about what was what and instead of raising the landing gear, jettison the canopy? Were they really qualified for the task? Did they complete the before maintenance aircraft safety procedures? Where was the canopy jettison safety pin? Many questions with few answers that I can give in this forum. You can see your wing safety office for a copy of the actual mishap message. The point I want to make with this example is three people with tech data in hand, and still we did $380,000 in damage to a valuable aircraft. Not to mention the potential for personal injury. Mishaps like this one are the ones *we can prevent*. Read and follow the book. If you aren't qualified for the task, don't do it. Unqualified crews performing maintenance tasks they are unsure of will almost always cost you more in the long run.

FY03 Flight Mishaps (Oct 02-Feb 03)

10 Class A Mishaps
3 Fatalities
8 Aircraft Destroyed

FY02 Flight Mishaps (Oct 01-Feb 02)

14 Class A Mishap
5 Fatalities
8 Aircraft Destroyed

18 Oct	♣	A TG-10D glider crashed during a student sortie.
24 Oct		An F-15 experienced an engine failure during takeoff.
25 Oct	♣✶	An RQ-1 Predator crashed during a training mission.
25 Oct	♣♣	Two F-16s collided in midair during a training mission. One pilot did not survive.
13 Nov	♣	An F-16 crashed during a training mission. The pilot did not survive.
04 Dec	♣♣	Two A-10s collided in midair during a training mission. One pilot did not survive.
18 Dec		Two F-16s collided in midair during a training mission.
20 Dec	♣	Two T-37s collided in midair during a training sortie.
02 Jan	♣✶	An RQ-1 Predator crashed during a training mission.
26 Jan	♣	A U-2 crashed during a training mission.
06 Feb		A manned QF-4 departed the runway during takeoff.
11 Feb	♣✶	A QF-4 drone crashed during a landing approach.
18 Feb		Two A-10s collided in midair during a 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.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF 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 and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html
- **Current as of 24 Feb 03.**

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How Not To Tear Down A Crane

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18 MOS
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There I was, deployed to Korea on a Thursday night, and the Ville's calling. We were performing a safety investigation for an HH-60 helicopter that had experienced a hard landing just two weeks prior and had just finished hanging the rotor blades and both engines … all in a day's work. Trying to wrap this mission up so we can go back to home station. It's been two weeks and the work is getting monotonous. Can't do this or that 'til Flight Safety says so. We finally get the go-ahead to put the bird back together, so we're humpin' it all day long.

It's beer thirty and we've been jobbing. Now, if we can just get this 1500-lb. maintenance crane out the door for AGE we'll be on the bar stools by 1900. Only one minor problem—the hangar doors won't budge. As I'm sure any of you who have been to Korea know, this is the standard, not the exception. We have two options: Go across the way and get the tug to push the doors open (big no no), or break down the 1500-lb. crane and roll it out the door.

As I'm sure you've already guessed, we chose option 2. Let's see, it's only been 10 years since the last time I did this. No problem; it's only a little piece of AGE, right? First mistake! Out of the four-member team, none of us had touched this type of crane in more than six years. Second "uh-oh!" I've always said, "This 1500-lb. crane is dangerous. Let's just get an all-terrain crane." I had never had a personal experience with the 1500-pounder's danger; I'm just quoting all the old school crew chiefs that are long gone now. My experience level was about to go from 3-level apprentice to 7-level craftsman in a split second.

Keep in mind that this is a team of the best crew chiefs available. To top it off, I'm a Quality Assurance inspector. Well, we proceeded to hook the hoist cable to the mast eyelet at the bottom of the mast. Next, we pulled the mast safety pin. Now the supervisor gets a quirky feeling that maybe the cable is supposed to be reeled to the top of the mast before we pull the mast cable safety pin. Everybody heard, but no one was really listening. Boy, if only someone had been more assertive and raised the B.S. flag. Pride played a big part, as no one wanted to admit we weren't sure of ourselves …"being experts and such."

As the mast cable safety pin comes out, here comes the boom and mast falling to the ground. Only one problem: Two of us had our hands on the mast. Individual number two comes out of the ordeal with only a sore elbow. As for me, I wasn't so lucky. My humerus was snapped in two like a dry twig. The mast had come down like a runaway freight train. Before I even knew what happened, I was picking myself up off the ground, pulling my wrecked arm from between the mast and the A-frame leg. This was 800 lbs. of steel dropping from 20+ feet onto my arm. If my head had been 6 inches to the right, I wouldn't be writing this story. The safety report would have read: Dead SSgt survived by beautiful wife and three great blonde-haired, blue-eyed boys.

Here's your sign! What lessons did we relearn that day?

- If it doesn't seem right, chances are that it isn't.
- Don't let the simplicity of a task or piece of equipment act as a pair of blinders.
- Swallow your pride and admit if you're not sure of something, even if you are the so-called "expert."
- Don't get in that huge rush right when it's time to go home.
- If it's been a while, ask someone who knows.
- And last, but not least, be safety-minded and don't ever let your guard down.

Image Courtesy of Leslie D. Benito, AFNEWS