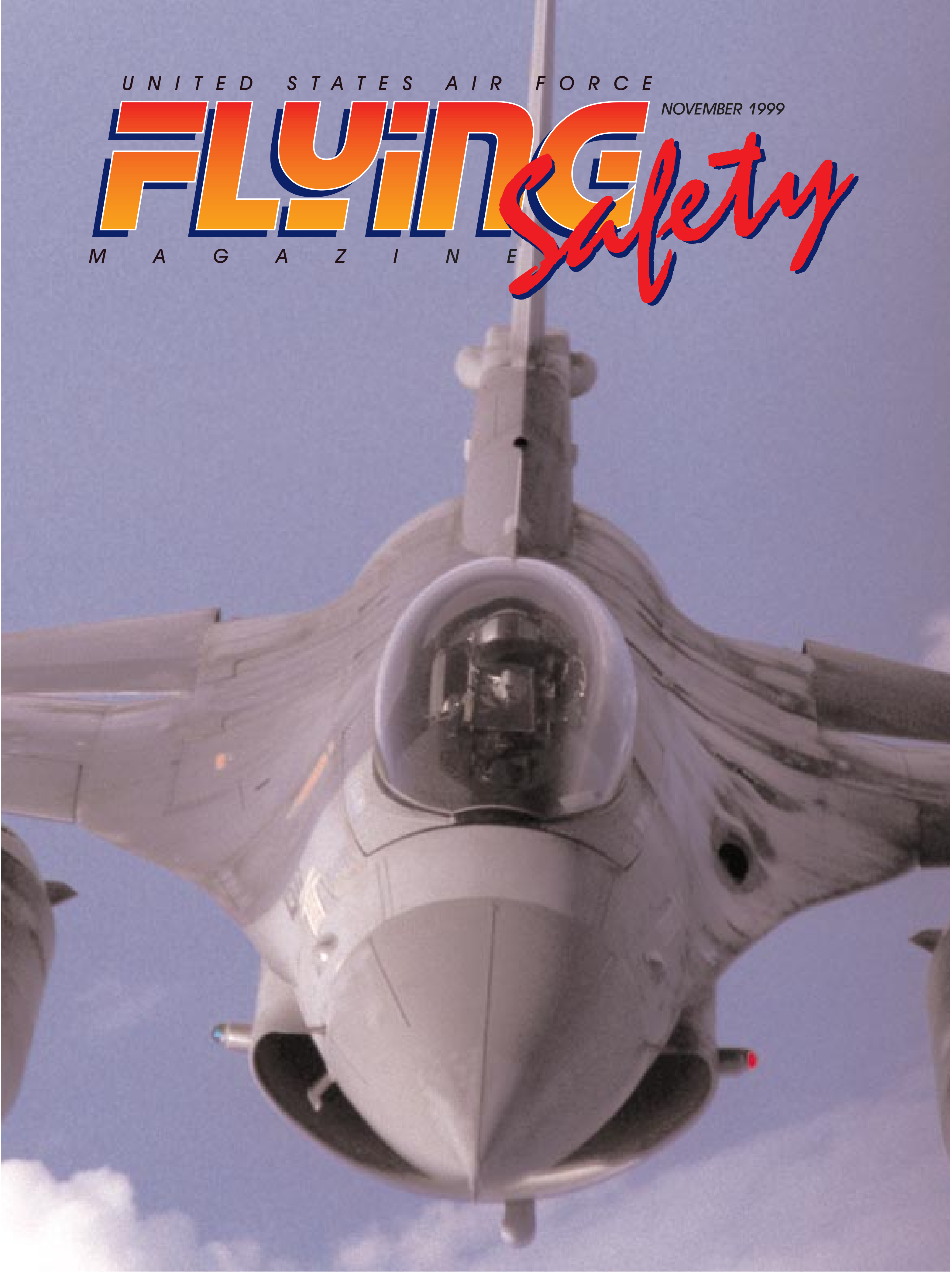
UNITED STATES AIR FORCE

FLYING Safety

MAGAZINE

NOVEMBER 1999



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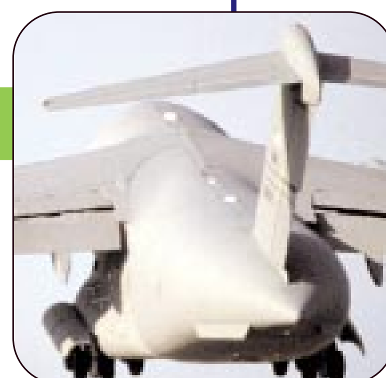

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FSM notams

Spin City

Courtesy *ASRS Callback*, Mar 99

A pilot practicing aerobatics over a private pasture learned why air show performers don't attempt some maneuvers:

I was using a base of 1,500 feet AGL while I performed advanced aerobatic maneuvers. I had worked all night the night before and was somewhat tired. I had misjudged a couple of maneuvers…and realizing this, added 200 feet to my base…I entered a hovering maneuver at 1,700 feet AGL. I pulled the nose up to a 60-degree-or-so angle with full power and used the rudder to keep it straight…A popular air show performer performs this maneuver and then rudders the aircraft in a small turning circle to the right. I have done this maneuver many times. This time, I decided to do a left-hand turn.

There is a reason the popular air show performer turns right. The aircraft suddenly broke into a left-hand flat spin. I pulled the power, put in full right rudder and released the stick…The rudder had no effectiveness. I pushed the stick all the way forward which only resulted in a cross-over spin to inverted. By this time, I was getting very low. It finally came out of the spin at about a 45-degree inverted nose-down angle. Due to my lack of altitude, I continued a delicate, buffeting 45-degree push to level inverted. I had only 100 to 200 feet before I became a statistic.

I figure that I lost 1,500 feet in only four rotations. Some botched maneuvers require more than the 1,500 feet minimum mandated by the FAA. That altitude is the bottom, and I need at least double that for any new maneuvers. I am sure my lack of sleep affected my judgment, and I feel that I am lucky to have survived…

We're also glad that our reporter survived his ordeal and was willing to share this experience with others.

The Color of Caution

Courtesy *ASRS Callback*, Jan 99

Perhaps the most commonly misread piece of paper is the aircraft checklist. This report of a checklist incident was submitted by an air carrier captain.

We were taxiing out for takeoff. The Second Officer read the taxi checklist and the First Officer responded. One item is flaps [looking for a green light]. This was responded to correctly. Prior to takeoff, the same challenge was answered again. An FAA inspector on our jumpseat stopped the checklist at this time and told us the light was not green, but amber. We returned to the gate. The flight was delayed for 24 hours for a flap problem.

All three crewmembers missed this call. The amber light is associated with landing, not takeoff. This problem could have caused a very interesting takeoff.

This incident could have been avoided by more careful consideration of each individual checklist item, rather than rote responses to the familiar pre-takeoff agenda. ✈

When One Second Does Count: T-38 Ejection Seat Performance

All photos courtesy the author

PERRY NELSON
311 HSW/YACL
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The countdown concludes, "five, four, three, two, one," and rockets light up the sky near St. George, Utah. It is 13 May 1999, and this countdown is for a T-38 ejection seat test conducted at the Hurricane Mesa Test Track (HMTT), a sled-testing facility managed and operated by Universal Propulsion Company (UPCO), part of B.F. Goodrich. It's the fifth T-38 ejection seat test conducted since January 1999, and the tenth since 1997, to gather acceleration and load data to quantify the risk of ejecting extreme-size crewmembers in the T-38 seat.

Extreme-size crewmembers are those outside the original design limits of the T-38 seat, which in the 1950s, according to the Anthropometry of Flying Personnel, was 132 to 201 pounds. The T-38 seat was upgraded in the 1970s to increase its performance and reliability. It was later requalified for crewmembers who weigh from 140 to 211 pounds, the newer size limits.

AFI 48-123, *Medical Examination and Standards*, which governs allowable crewmember size, was recently changed so people who weigh from 103 to 245 pounds may be allowed to operate ejection seat equipped aircraft. This new "range" is considerably different from the 140-211 pounds that had been the guideline previously. 140-211 pounds equated to 5th-95th percentile males; 103-245 pounds equates to 5th percentile females (5 percent of women are smaller), and 245 pounds represents 98th percentile males (98 percent of men are smaller). For ejection safety, size and weight do matter.

Some Congressional members have lobbied to expand the anthropometric range of crewmembers flying fighter and bomber aircraft to those who weigh as little 103 pounds. A lightweight occupant provides many challenges to ejection seat designers, especially coupled with the probability this same seat must be capable of ejecting a 245-pound person also. These "challenges" are even greater when the T-38 is the aircraft. This is due to the mechanical operation of the seat and the age of the seat subsystems.

All prospective fighter and bomber crewmembers must transition through the T-38 en route to their destination aircraft. This 1950s-era ejection seat is one of the slowest, least forgiving seats in operation today; however, used within its design limits, it still provides a safe means to eject. The dilemma is: Do we maintain the seat's current performance, and therefore limit crew size, or do we pursue seat replacement or upgrade? The answer depends on how the USAF plans to work with the expanded crewmember anthropometric range.

Approximately 80 percent of female crewmembers weigh between 115 and 135 pounds, and 4 percent of male crewmembers weigh greater than 211 pounds. Granting waivers and allowing people outside the design limit for weight and overall size places them at a higher and unnecessary risk. This is especially true when approaching the extreme ends, which is generally considered less than 115 pounds or greater than 230 pounds.

The current T-38 seat was designed, built, tested, and placed in service by the Northrop Corporation, designers and builders of the T-38 and F-5 aircraft. The T-38 has been—and will continue to be—the mainstay of the USAF pilot training program. It has been a great and capable aircraft. And, due in large part to the visionary leaders at SA-ALC/LF (Proven Aircraft Directorate) and HQ AETC, the T-38 will continue to be a great trainer due to upgrades in the avionics systems, a propulsion modernization program, and wing replacement programs. Each of these major modification programs will ensure the T-38 is capable and maintainable until its planned departure from the USAF inventory in the year 2025, possibly the year 2040.

While the avionics, engines, and wings are being modernized into the 2000 era, the seat remains 1950s vintage. The 1950s seat technology, coupled with a tremendous expansion of crew anthropometric ranges, spells danger for ejecting crewmembers.

While no one ever plans to eject, the simple truth is ejections do occur. With the tremendous improvements in escape systems technology, ejecting has become less hazardous today than ever before. The ejection success rate is also the highest it has ever been for USAF aircraft. For our current USAF fighter, bomber, and attack aircraft—excluding the B-52 (another 1950s vintage seat)—the overall success rate is almost 92 percent. Compared to a success rate of 87 percent in 1980, we have come a long way. Our major injury rate has also improved, with the Advanced Concept Ejection Seat II (ACES II) seats having fewer major injuries than any previous seat.

The increase in successful ejections is due to three very important factors—all of which must occur to increase crew safety. First, crewmembers must "pull the handle" with sufficient time remaining for the escape system to work properly. The greatest system in the world is worthless if the crews fail to attempt ejection or eject too late.

The second factor is the maintainers. These are folks who strive every day to ensure crew safety is first and foremost. We, the USAF, are blessed to have tremendous folks in our egress, survival equipment, and life support shops. These are the people who equip the "crew dogs" for flight and ensure their safety, whether the seat and survival equipment are brand new or, literally, 50 years old.

The final link in the equation for success rests with escape system designers and technical specialists. It's our job to equip the crew with the best possible equipment—and constantly strive to improve this equipment. It was the goal of improving ejection safety in the T-38 that stirred my interest in seat performance.

Currently, the overall success rate for the T-38 is 83.6 percent, not even close to the 91.8 percent of the ACES II we have in modern USAF fighter, bomber, and attack aircraft. But even the ACES II is undergoing a major upgrade program. The ACES II Cooperative Modification Program (CMP) is a joint effort between the USAF and the Japanese Air Self Defense Force to increase the capability of ACES II seats. Crew accommodations (especially for small-statured crewmembers), stability improvements, and limb restraints additions are the three target areas of the CMP. The latter two improvements will benefit all-size crewmembers and are crucial to further reducing major injuries from high-speed ejections. The total cost of the preproduction phase of this effort is close to $40 million. The possible retrofit cost for seat modification parts and kits could be an additional $70 million—and this is for a seat with a 91.8 percent success rate and one of the lowest major injury rates ever. Now what about the T-38 "Talon"?

As mentioned previously, there are ongoing upgrades with three major aircraft systems (avionics, wings, and propulsion systems). Nothing definite has been planned for the seats—as of right now. The first step in launching a seat upgrade program (similar to ACES II) or a seat replacement program, is to quantify the risk of ejecting crewmembers. This is where the sled tests at Hurricane Mesa come into play.

Engineering-type folks and computer-simulation experts can predict how the seat will perform under specific conditions, but the true test remains ejection-seat testing. We must have sled tests to validate the computer simulations and verify the seat's performance. After all, we're talking about the last means of survival for our aircrews.

Engineering analysis and computer simulations show the 103-pound crewmember will experience a much faster and higher acceleration index along the spine than a person who weighs 140 pounds. Similarly, the lighter ejecting mass (seat and crewmember) will yaw at a much higher rate than one who weighs 140 pounds. The combination of spinal compression (catapult acceleration), yaw, and deceleration of the seat/crewmember

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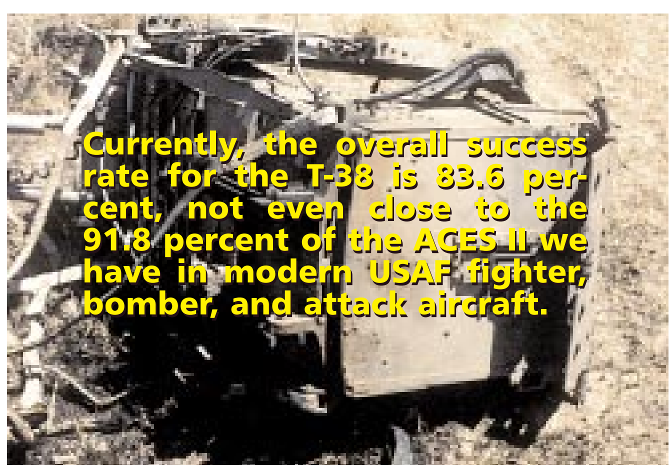


Major Injury Definition

- Five Days Hospitalization
- Five Minutes Unconsciousness
- Bone Fracture
- Moderate/Severe Laceration
- Internal Organ Injury
- Third Degree Burns

mass (from the drogue chute and wind blast) combine to provide an equation to measure risk.

These three forces combine together to form what is termed the Multi-Axial Dynamic Response Criteria (MDRC). MDRC is fairly new and came about due to advances in manikins. No longer are they just rubber covering metal joints. Now they are highly instrumented along every plausible body section. We can measure spinal compression, deceleration forces, yaw rates, neck loads, chest loads—you want it measured, the experts who work with the manikins will make it happen. Today's manikins move like a human and record data better than any person or computer. The manikins even come in a variety of sizes—103-pound LOIS ("Lightest Occupant In Service") up to ADAM ("Advanced Designed Anthropometric Manikin"), and the "JPATs-Large" (Joint Primary Aircraft Trainer) that weighs up to 245 pounds.

In 1997, a total of five seats were fired using LOIS at different airspeeds. The goal was to ascertain the risk to crewmembers and compare actual sled-test data with engineering/computer simulations. In 1999, an additional five tests have been conducted using LOIS, including the 13 May 1999 test. The results clearly indicate the T-38 seat is not safe for someone as light as 103 pounds.

A synopsis of the test runs indicates a small-statured person does have a higher MDRC than what is considered safe. The upper limit of a safe MDRC is 1.0. A 1.0 MDRC represents a 5 percent chance of major injury to the ejecting crewmember, which is the highest acceptable limit. The goal of today's escape system specialist is to reduce the MDRC for all ejection seats to less than, or equal to 1.0. During the high-speed test runs, the peak MDRC reached 1.4 with the LOIS manikin. A total of three test runs at 500+ KEAS (knots estimated air speed) validated the computer simulations and proved the MDRC of 1.4 was an accurate figure.

An MDRC of 1.4 means the crewmember will have approximately an 80 percent chance of major injury. A 140-pound crewmember ejecting under similar conditions will have approximately a 1.2 MDRC. The progression of risk is not linear when calculating MDRC. The risk of injuring increases exponentially as the MDRC value increases. An MDRC of 1.0 equates to 5 percent risk, 1.2 equates to approximately 50 percent risk, while an MDRC of 1.4 results in a near 80 percent chance or risk of a major, possibly career-ending injury.

If a small-stature T-38 crewmember was forced to eject at airspeeds greater than 500 KEAS, the risk assessment could be similar to playing roulette with a six-shot pistol loaded with three bullets. The hazard is severe, and the probability of a mishap is medium to high. Newer seats, such as those produced by Martin-Baker, and the ACES II upgraded with the enhanced drogue, can lower the MDRC to 1.0 or below. ACES preliminary tests indicate, with the enhanced drogue, an MDRC of 1.0 is attainable for the ACES II. So the technology is there to bring the lighter/smaller-sized crewmembers into an acceptable risk. Even the K-36 3.5A, an American version of the Russian K-36 seat, will reduce the MDRC to acceptable limits. But can these same seats that reduce risk for light-weight crewmembers be used for the 245-pound Air Force Academy "zoomie" star tailback?

Computer simulations and engineering analysis led escape system experts to believe the T-38 seat would perform better with the heavy-weight crewmembers than it did with LOIS. The two tests conducted to date prove that theory was wrong. The peak MDRC for the 245-pound manikin ejecting at 500+ KEAS was 1.6. Again, not acceptable by today's standards for crew safety.

The catapult acceleration was lower (which is good) with the 245-pound manikin; however, the larger manikin has a considerable amount of "leg" extending below the seat. The combination of thigh, calves, and feet acted like a sail and caused the seat to pitch forward approximately 50 degrees. Also, the larger manikin's left foot contacted, though slightly, the canopy bow, thereby causing the boot to act as a rudder and yaw the seat left about 60 degrees. This did not occur with LOIS.

Even though the T-38 has a drogue chute attached to the seat in four places to counter pitch and yaw, the drogue is very slow to deploy and stabilize the seat. By the time the T-38 drogue did fully inflate, the seat had

pitched forward and experienced considerable yaw. The resulting effect of the drogue "snapped" the seat vertical and corrected the yaw. However the violent "snap-back," as it is called, created abnormally high neck loads on the large manikin. Therefore, the MDRC was extreme and not acceptable.

The MDRC of the 211-pound manikin, which is the upper weight limit that the T-38 was designed and qualified for, was calculated to be approximately 1.3 during tests from the 1970s upgrade program. This 1.3 is considerably less than the 1999 measured value of 1.6 but still above the 1.0 limit. Though very critical in measuring injury potential, it's important to point out MDRC is just one element of risk with the T-38 seat.

The T-38 seat is classified as a second-generation ejection seat. First-generation seats are those which propelled the pilot out of the aircraft. It was then up to the crewmember to separate from the seat and deploy their parachute. Third-generation seats are those similar to the ACES II and the Naval Aircrew Common Ejection Seat (NACES). These third-generation seats have variable operating modes based on altitude and airspeed. They also have pitch stabilization rockets, plus parachutes that are ballistically deployed off the seat. The result is a fully inflated parachute in as little as 2 seconds for airspeeds less than 250 KEAS.

Second-generation seats, such as the T-38, F-5, and B-52, utilize back-automatic parachutes that rely on airflow to deploy and inflate the parachute. This is a slow process and takes as long as 2 to 3 seconds to fully inflate, and this time is after seat/crewmember separation—which requires an additional 1 to 1.5 seconds. Total time for a full parachute: approximately 4 seconds after the seat is fired.

Consider the mission of the T-38, which is to train student pilots. Where do most emergencies occur? And where is crewmember risk the greatest? The answer for both questions is traffic pattern work. Takeoffs and landings pose the greatest risk to the crewmembers. Low altitude and adverse attitude can quickly turn a routine approach into a dangerous, life-threatening scenario. When this occurs, 4 seconds is an eternity. It is traffic pattern work, or other low-altitude sorties, where an improved ejection seat will save T-38 crewmembers' lives.

T-38 ejection statistics reveal there have been 184 ejection attempts since 1971, with 34 being unsuccessful. Of the Class A mishaps, approximately 44 were in the traffic pattern or close to the destination runway. Of these 44 mishaps, 24 initiated ejection, and only 8 were successful. The overwhelming reason for the fatalities is ejecting too late—"out of the envelope" as it's called. Of the unsuccessful ejections, statistics indicate as many as an additional nine may have survived had a third-generation seat been available. Of the 34 fatalities overall for T-38 aircraft, it's quite possible a third-generation seat may have saved 17 lives. Of course, it's difficult to verify how many lives a third-generation seat would have saved, but these figures are realistic when altitude, attitude, and airspeed are considered.

Besides having a more restrictive ejection envelope than modern ejection seats, the T-38 system has several other factors that limit its capability and increase the risk of injury. The drogue parachute, seat/crewmember separation system, back-automatic parachute, very narrow center of gravity limits, and pitch stabilization are several areas that need to be addressed. Advances in technology make improvements possible in each of these areas.

The drogue parachute requires an average of 1.5 seconds to inflate and stabilize the seat at 150 KEAS. Above 150 KEAS, inflation occurs at approximately 1.0 second. This is much too slow; however, it was the best that early 1970s technology had to offer. With the drogue requiring over a second to inflate, the seat, in most all of the previous 2 years of testing, began to yaw and pitch in an uncontrolled manner. The resulting "snap-back" of the seat/crewmember mass is largely responsible for the high MDRC rates. Studies based on the Enhanced Drogue Program, which is part of the ACES II upgrade, indicate complete inflation and seat stabilization can be achieved in approximately 0.4 seconds. Regardless of which seat is considered, a saving of 0.7 seconds in the free-flight portion of the ejection sequence will significantly reduce yaw and pitch and lower overall MDRC values.

Seat/crewmember separation is a second area to improve. The current T-38 seat uses a rotary actuator that retracts a strap positioned in the seat's bucket. As this strap is drawn taut, it pushes the crewmember out of the seat. As seat/crewmember separation occurs, the parachute is armed for deployment. This type of system works well in separating the crewmember from the seat; however, it doesn't control body position. Hence, the crewmember can tumble, roll, or flail—or all of these at the same time. The point is, seat separation is not "controlled," and the random tumbling and flailing can cause serious injury during ejection.

The effects are even greater on smaller statured crewmembers because there is less muscle tissue on a 110-pound person than on someone who weighs 200 pounds. To provide the best protection, there needs to be better body position and control during the seat separation phase of ejection.

continued on next page

The back-automatic (BA) parachute has been in existence since people first began jumping out of balloons and airplanes. For the most part, the BA series chutes have performed very well. There are two areas where BA chutes can cause problems with ejection. First, BA-style parachutes are slow to inflate. Depending on airspeed and crewmember body position upon pack opening, the time from pack opening to full parachute can range from 2 to 3 seconds, possibly more. Compare 2 to 3 seconds to 0.8 to 1.5 seconds for ballistically deployed parachutes, and the advantage is clearly seen. Ballistically deployed parachutes open faster and more consistently than aerodynamically deployed BA-style chutes.

The second area where BA-styled parachutes can cause problems is during parachute pack opening. Several instances have occurred where the parachute has entangled the crewmember/manikin or the parachute has become entangled in itself. This is a serious problem, though rare, and is due to the tumbling crewmember plus the manner in which the spring-loaded parachute deploys. The combination of a tumbling crewmember and random parachute opening can be deadly.

The center of gravity (CG) of the ejecting mass and pitch stabilization are two other important areas that are related to each other. The CKU-7 rocket catapult on the T-38 seat generates sufficient force to cleanly eject someone as light as 103 pounds, or as heavy as 245 pounds. The problem is not the catapult; it is controlling the trajectory of the seat/crewmember that's difficult.

For optimum ejection trajectory, the CG of the ejected mass must not be greater than 0.8 inches tangentially above or below the catapult thrust line. If CG is too far forward (below optimum), the seat will pitch forward. If CG is too far aft (above optimum), the seat could pitch aft. A forward-pitching seat reduces upward trajectory, which is critical for BA-style parachutes to achieve full opening. Conversely, an aft-pitching seat may go higher, or it could tumble aft. Testing is required to accurately determine the outcome. In the T-38, unlike many newer seats, there is no method to control pitch. The seat's performance with a person weighing between 140 and 211 pounds was proven to be acceptable for pitch and overall performance.

The testing in 1997 was aimed at the LOIS; in 1999, both LOIS and JPATS-Large were evaluated. The effects of CG are still under evaluation. Two additional sled shots in 1999 will help quantify how critical CG is on the T-38 seat. We know the effects of seat CG at 500 KEAS is minimal because at high airspeeds, wind blast and wind drag (e.g., lower torso acting like a sail on JPATS-Large) have a greater effect on seat performance. These additional tests will help ascertain the effects on pitch stabilization at lower airspeeds.

The T-38 will remain in service at least until the year 2025. It will do so with major upgrades that enable this jet trainer to do its mission better than ever before. But the fact remains we need a better ejection seat to protect the crewmembers who fly this wonder aircraft. Just as the aircraft is undergoing a major upgrade, so must the ejection seat whose sole purpose is to protect our sons and daughters who currently fly and will continue to operate this aircraft into the next century.

NASA has already selected a new seat for their T-38 aircraft. If we continue to use the current seat, those crewmembers below 140 pounds and above 211 pounds—especially those at the extreme edge of 103 and 245 pounds—will be at risk. No ejection is risk-free, but our job is to make sure the risk is as low as possible.

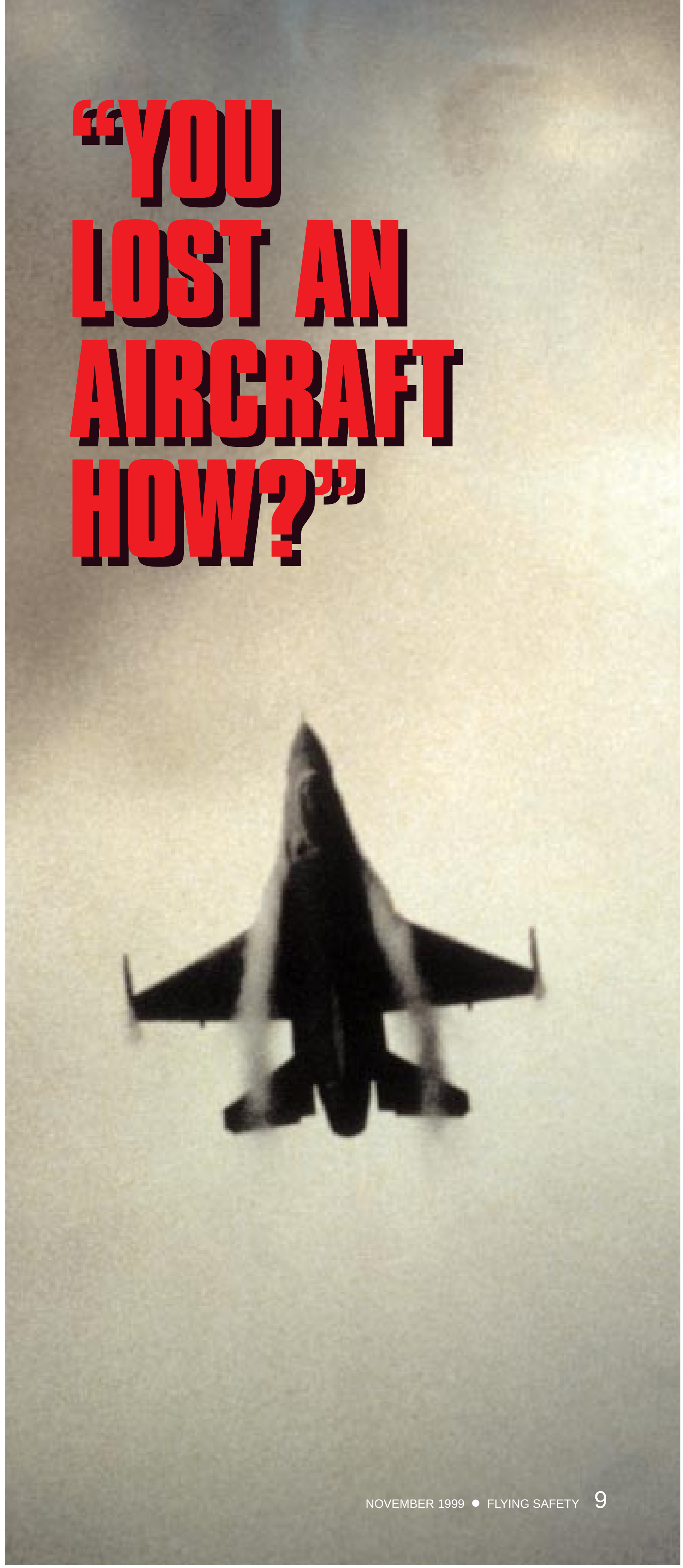
For high-speed ejections, it's always best to trade airspeed for altitude—if time permits. The injury risk at 250 knots is significantly less than at 450 KEAS. The higher the airspeed, the greater risk for major injury in any aircraft.

Especially for traffic pattern work, 1 second is an eternity. And saving one second during the ejection sequence can be a life-or-death decision, especially with the T-38 seat.

Fly smart. Eject safe. ✈

"YOU LOST AN AIRCRAFT HOW?"

MAJ KURT J. SALADANA (CAF)
HQ AFSC/SEFF



It was just a normal training mission. The unit was in the middle of intercept training, and everyone on the morning slate was doing 1 v 1, high aspect, 30-mile setups. Boring! At least on the last run both Vipers were all-up fighters at 3-9 passage. "Pockets" was the interceptor for the last pass, and although he'd have angles, I wasn't going to be a grape. I came out of blower at the merge, pulled to max corner keeping Pockets at the top of the canopy, then relit the AB. That's when all hell broke loose! I felt the plane shake, saw the annunciator panel light up like a Christmas tree, and was suddenly pinned to the canopy. Betty was saying something, but she was stepped on by Pockets: "Kongo, the tail just blew off your aircraft! Eject! Eject! Eject!—ABANDON YOUR AIRCRAFT! YOU LOST YOUR TAIL!" The plane felt like it was tumbling, and I fought to get my back straight as I reached for the handle.

The next thing I knew, I was looking up at a beautiful white canopy. I remember thinking it looked iridescent against the blue background of the sky. All the training in the hanging harness kicked in, and I went through the after-ejection procedures without even thinking about them. Looking down and to the south, I saw my plane, trailing smoke, hit the ground and was impressed by the black mushroom that rose over the explosion. I looked slightly above the horizon and saw Pockets about a half mile away doing lazy circles around me. I imagined all of the things he was doing: calling the MAYDAY, passing on the lat-long, telling the world I had a good chute, and most likely talking to the next set of Vipers scheduled to enter the area after we finished. They'd pick up SARCAP from him and would likely stay overhead until a rescue chopper showed up.

I wasn't too worried about the landing. The real estate under the range was mostly sand with a little bit of scrub here and there, but no cactus or rocks to speak of. Heading towards a reasonably flat, barren stretch, I checked to see if the wind was affecting me and reviewed landing technique. It sure seemed to be taking a long time to reach the ground. As I concentrated on the earth, I heard an explosion off to my left and looked over in time to see Pockets ejecting from his plane about a quarter mile away and still

continued on next page

above the horizon. The Viper rolled right and got bigger. I don't know how close it came, but I remember closing my eyes and pulling up on the risers as far as I could.

When I realized I was still alive, I opened my eyes just in time to see Pockets' plane hit the ground smack in the middle of my LZ. I grabbed the right riser, pulled for all I was worth, and ended up hitting the ground hard with the fireball at my back and my legs spinning like a cartoon character that just went off a cliff. I had the chute off in mid-run and didn't stop until I could no longer feel the heat on the back of my neck.

When I realized I was still alive, I opened my eyes just in time to see Pockets plane hit the ground smack in the middle of my LZ. I grabbed the right riser, pulled for all I was worth, and ended up hitting the ground hard with the fireball at my back and my legs spinning like a cartoon character that just went off a cliff.

The way my luck was running, I wondered what could go wrong next and was answered by Pockets' shout, "Look out!" In retrospect, I doubt if he would have landed on me, but it would have been close. After we confirmed neither of us was seriously hurt, I asked him why he was a fellow pedestrian. It seems he had a flight control problem. For no reason, his plane departed controlled flight and, realizing he was below the min recovery altitude, he ejected.

The ensuing investigations revealed my plane had an uncontained engine failure that ruptured some fuel lines, which ignited and, in turn, blew off my tail. I was told I was lucky I didn't break my back or my neck. What happened to Pockets' plane? Well, he fixated on me, got low and slow, didn't hear the warnings until it was too late, and departed his aircraft. He's a good pilot and made a mistake, so he's still flying. But you can imagine how he feels. Oh, and he has a new call sign.

The previous account never happened. That's not completely true—the first part happened in various iterations to different aircraft many times over the years, and as they say in the movies, only the names have been changed to protect the innocent. However, there is nothing in the Safety Center database about losing a plane during SARCAP. This has been more good luck than good management.

It seems incredible that any pilot could come close to losing his own plane while performing SARCAP, yet they come close appallingly often. Don't believe it? Safety Investigation Boards (SIBs) for Class A mishaps transcribe recorded communications for the formal report. This is done to see if Search and Rescue worked as planned/advertised and to see if it can be improved. Because modern fighters have HUD tapes, as SIBs transcribe transmissions, they get to watch the SARCAP's flight parameters. More often than not, the initial SARCAP is a member of the mishap formation. This isn't the best choice because, even though pilots are always supposed to be professional and detached, in real life there is going to be some sort of impact from the mishap. This is obvious from reviewed HUD tapes.

In recent mishaps, we've seen fighter and attack aircraft get below 500 AGL and/or slower than 130 knots without noticing radar altimeter or stall warnings. We've also seen the pilot of an aircraft badly damaged in a midair start to set up as SARCAP even though there were other aircraft in the immediate area. The pilot involved didn't even consider performing a controllability check. These aren't inexperienced people we're talking about here. For the most part, they are senior pilots with over 2,000 hours on type.

A recent SIB president who wanted to give special recognition to two pilots who flew SARCAP following a Class A mishap highlights just how poorly SARCAP is being flown. The Board president insisted the SARCAP's outstanding performance be included as a mishap finding. Eventually he was convinced to describe their actions in the narrative of the formal report and highlight their performance on a separate slide when he briefed the commander. When asked just what the SARCAP did that was so outstanding, the Board president answered, "They didn't screw it up." In other words, they did their job the way they were supposed to.

Salary is the reward for doing your job correctly. Medals and commendations are supposed to be for doing more than is required. If we're giving pilots medals for risking their lives flying in peacetime SARCAP, we're doing something wrong. Flying SARCAP shouldn't be any more dangerous than flying an IFR holding pattern.

The need to fly SARCAP isn't going to go away. While it isn't normal for aircraft to crash, it happens. How do we make flying SARCAP safer? There are several things we can do. Review wing policy and regulations regarding SARCAP. Discuss it on safety days and, if possible, practice it. If you use technique books, make up a how-to page for SARCAP. Nobody is advocating building a syllabus mission around SARCAP, but it could certainly be piggybacked on another exercise.

From experience, it appears common sense is lacking when we're suddenly faced with flying SARCAP. While we can't teach or enforce common sense, the following are worth consideration:

1. Whether they're damaged or not, formation members who survive a mishap are involved. The pilot's routine is broken, and that means his/her habit pattern is disrupted. Anyone involved in safety knows this is when mishaps often occur. Once relief is available, the other aircraft involved should RTB via the most normal routing and approach possible, i.e., without trying to update a currency.

2. The new SARCAP should be assigned as required. The only reason to have high and low CAPs is if radio relay is required. If it isn't, the extra aircraft is simply a comm jammer and more work for ATC.

3. If the wing has a policy to determine who will be the CAP if more than one aircraft is available, use it. For example, is the high fuel aircraft the best choice or is the most experienced individual? There have been cases where policy had a lead-qualified pilot flying CAP, but another more senior pilot took it over without actually stating he was now the SARCAP. Very few things are more confusing than two leads trying to lead the same exercise at the same time.

4. Give the On-Scene-Commander (OSC) authority to whoever is best qualified, then follow their direction. If it's a single ship SARCAP, then he/she is the OSC. If the situation dictates high-low SARCAP, the high CAP usually takes command. It isn't unusual to be working with airborne weapons control. If there's an E-3 on scene, they are likely the best able to coordinate all airborne aspects of the search and rescue effort.

5. There is no reason to go low or slow when flying SARCAP. Looking for a chute is good, but trying to get close enough and slow enough to see what's happening on the ground serves little purpose. Ask the PJs if anything a SARCAP passes on is going to change their reaction time or their procedures. Don't go lower than good airmanship or regs permit. If you've got the option, set altitude hold on the autopilot and reset your radalt to reflect the selected altitude. Likewise, if you've got it, set mach hold or airspeed hold.

There's no doubt that someone reading this is going to say, "It's just another safety puke mouthing off. In combat, if I lose my lead or my wingy, I'm going to follow them down and give them top cover." Nobody's saying this is wrong, but some thought better be given to the idea before action is taken. You aren't going to do anybody but the enemy any favors by getting into small arms range and then flying below maneuverability speed. And you probably aren't going to make ground troops do more than flinch if you try strafing at an untried angle and 200 or more knots slow.

We lose enough people and aircraft every year for reasons we can't prevent. Let's not add to the mishap rates by losing control of a perfectly good aircraft doing something as simple as peacetime SARCAP. ✈

Salary is the reward for doing your job correctly. Medals and commendations are supposed to be for doing more than is required. If we re giving pilots medals for risking their lives flying in peacetime SARCAP, we re doing something wrong. Flying SARCAP shouldn t be any more dangerous than flying an IFR holding pattern.

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USAF Photo by SrA Jeffrey Allen

Commercial flying is like ice-skating. Military flying is like hockey—ice-skating and so much more.

J. T. RAGMAN

Perspective can be a remarkably illuminating concept. My 10-year military flight experience, followed by a 9-year hiatus in the airline business, and my recent return to military flying, bring to mind one thought in particular—everything is indeed **relative**. Terms and concepts such as "risk" and "safe" and "margin for error" have meaning only in relative terms.

During my military flight experience, I was a serious adherent to the "Safety is an Attitude" mindset. However, my mindset lacked perspective. I had known only one form of aviation—military aviation. With 9 years of the airline world under my belt, my return to military flying comes with a whole new perspective. It is indeed illuminating.

What we do each and every time we fly places each of us at far greater risk than most commercial flying. And commercial flying, as the occasional headline will attest, is by no means a risk-free operation.

First Perspective

Consider what we do for a living, Engine-out work, windmill taxi starts, no-flap operations, rejected takeoff operations; low-levels and airdrops flown day and night, on NVGs, in formation, in the mountains, in the weather, lights-out and comm-out; maximum effort takeoffs and assault landings on dirt strips with reduced stall margins and critical acceleration, deceleration, and directional control issues. As an added consideration, we do all of the above with in-flight instruction, unqualified, noncurrent, and nonproficient crewmembers in one or more crew positions.

Consider even the most basic instrument operations: full procedure turns, nonprecision approaches, and in particular, NDB approaches. An NTSB fact: Depending upon the definition of nonprecision approach, 60 to 86 percent of all controlled-flight-into-terrain accidents by commercial aircraft between 1988 and 1997 occurred during nonprecision approaches. I can count on fingers and toes the number of nonprecision approaches I have flown in 9 years of airline flying, yet we do them with great frequency in military aviation.

All of the above operations involve reduced margins for error, reduced recovery times, and greater risk. With very few exceptions, airlines do *none* of the above on anything remotely resembling a routine basis. Indeed, I would be hard pressed to find *anything* in the above discussion that I have ever done in a commercial aircraft. The only items listed above that I have ever done in a simulator have been the engine-out work, rejected takeoffs, and varied simulated inflight emergencies. They've been accomplished in a simulator for a very good reason—risk and margin for error. In military aviation, we do them routinely in flight.

All of the above operations involve routine, constant and competing demands upon our ability to focus on "Job One"—flying the aircraft. All of the above operations involve numerous tasks essential to the mission, but peripheral to the task of flying the aircraft. In the airline business, flying the aircraft is the *only* mission.

In the military, we fly the aircraft while accomplishing the mission, conducting inflight instruction in formation, in the mountains, in the weather—and we do so while monitoring the Radar Warning Receiver (RWR) gear, the Missile Warning System (MWS) gear, *while* outfitted in the aircrew chemical warfare ensemble. Risk. Margin for error. Perspective.

One young and very insightful passenger described the difference between commercial flying and military flying far better than I. She used a sports analogy: Commercial flying is like ice-skating; military flying is like hockey—ice-skating and so much more.

Second Perspective

What we do, and what the airlines don't do, takes on added significance when we consider what the airlines have, and what we don't have.

System Redundancy. In the airline business, lose all electrics—tap the hydraulic-driven generator. Lose all hydraulics—deploy the ram air turbine. Lose normal brakes—select alternate or reserve, emergency or accumulator.

In congested environments, the airlines have had TCAS for many years. In the mountains, they are fielding the enhanced GPWS. If approaching a stall, the airliner's stick shaker will provide an alert, and the leading edge slats will automatically deploy to provide the added edge through the stall.

Concerned with wind shear? The airlines have predictive wind shear alert systems and reactive wind shear flight director commands. Distracted on taxi-out? The takeoff configuration warning system has saved more than one airline crew. Operating in a challenging environment? The airlines provide their crews with engine-out between Bogota and Quito, engine-out departures for Las Vegas or Tegucigalpa, and decompression escape routes through the Andes.

The list of added safety features goes on and on, far beyond the few examples mentioned here—far too numerous to list. Not necessarily so with our military aviation operations.

Third Perspective

In the military, we are all part-timers. Airline types are full-timers. The "part-time" label applies most clearly to the Guard and Reserve; however, my recollection of active duty suggests many an active-duty aviator is indeed a "part-time" aviator. We all have our additional duties and our ancillary training requirements. We, in the military, might fly 2 to 5 hours per week while working a 40- to 50-hour work-week. Our airline peer will fly 15 to 20 hours per week and go home afterwards. How do you spell "margin for error"? "Full-time" or "part-time"?

The "part-time" perspective takes on added significance when I reflect upon all that we're required to know—the basics of aviation, plus airdrops, airlands, formation, tactics, threats, defensive systems, and on and on and on. So much to know—and so great a reason to know it. Again, look at the things we do each and every time we fly, our exposure to risk and our reduced margins for error. Our lives depend upon knowing all there is to know.

There are, however, "up-sides" to the mil-

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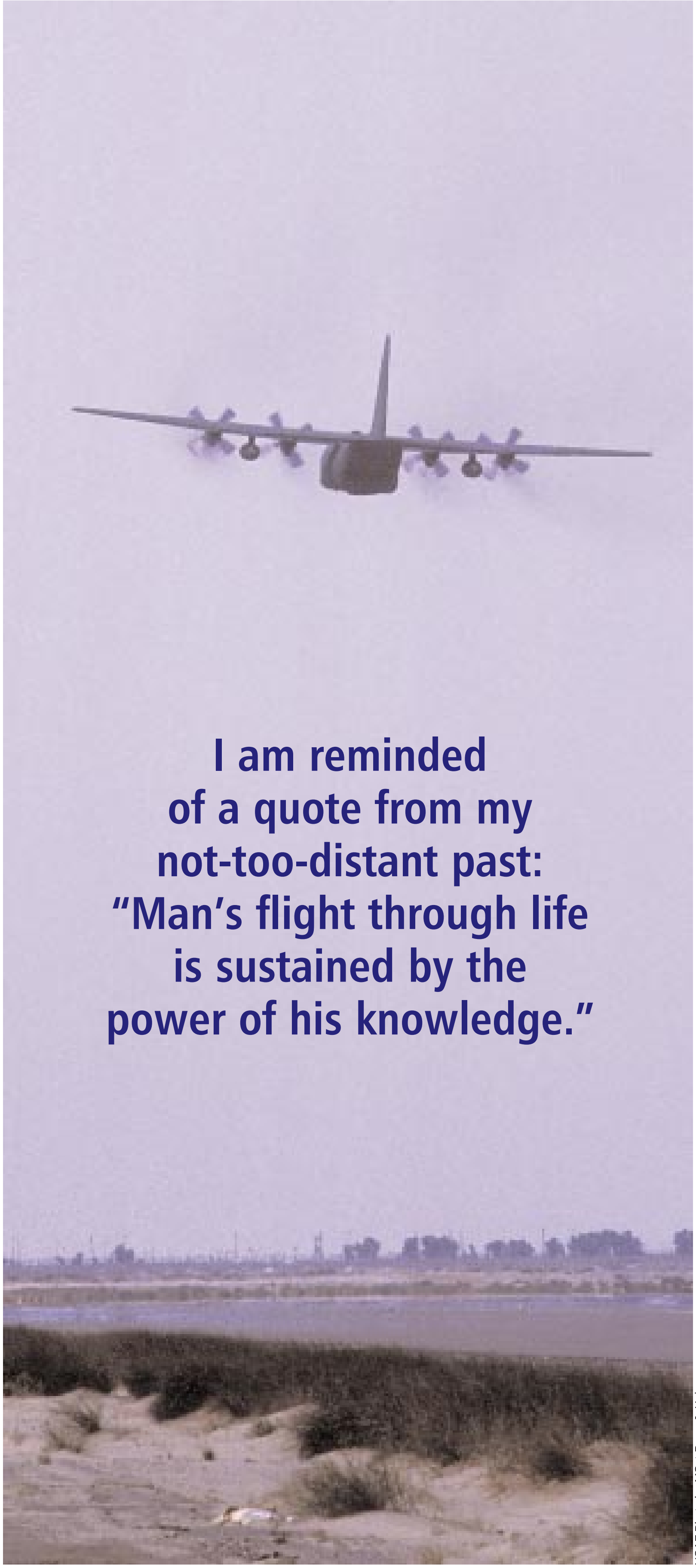
What we do each and every time we fly places each of us at far greater risk than most commercial flying. And commercial flying, as the occasional headline will attest, is by no means a risk-free operation.


I am reminded of a quote from my not-too-distant past: "Man's flight through life is sustained by the power of his knowledge."

USAF Photo by MSgt Perry J. Heimer

itary versus commercial perspective.

■ First, and foremost, we have a *crew.* A crew chief, a loadmaster, an engineer, a navigator, and two pilots—each an authority in his/her particular field, each a glance or interphone call away, each ready to provide the needed answer right now. A commercial crew has two or three pilots. The answer to any load question, any systems or performance question, any navigational question, *may* be available on the other end of a lengthy, scratchy, intermittent HF phone patch.

■ Second, we have a chain of command which, from the top on down, emphasizes through word and deed the preeminent role of safety in our flight operations. The chain-of-command emphasis enables each and every crewmember to make the right call. Accomplishing the mission safely is our motive.

■ Third, while the 40- to 50-hour workweek can be a burden on the one hand, it can be a safety blessing on the other hand. For 8 to 10 hours each day, the knowledge, expertise, and answers to our questions are only as far away as the nearest instructor—down the hall or across the room. Once that airline instructor blocks in at the gate, he or she is on his or her way home. No answers until your next sim-check.

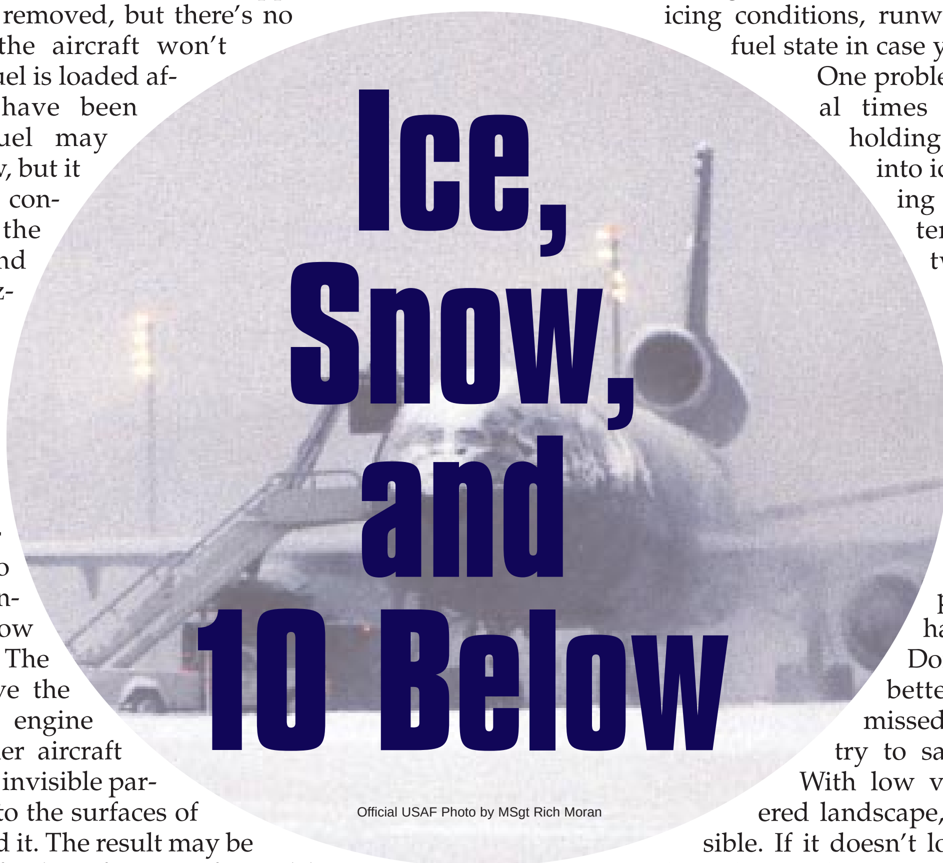
Final Thoughts

Am I alarmed as a consequence of this new-found perspective through which I now view military aviation? Not at all. On the contrary, the emotion is one of gratitude for the added perspective. I am reminded of a quote from my not-too-distant past: "Man's flight through life is sustained by the power of his knowledge." The military-to-commercial, back-to-military experience has provided me with a perspective I had previously lacked. That perspective is a form of knowledge. That knowledge makes me a safer crewmember. It can make you a safer crewmember as well. That knowledge can help sustain both of us in flight. ✈

("J. T. Ragman" is a pen name. The author is a C-130 pilot in the Air Force Reserve. He's also a Boeing 757 pilot for a major airline. While his words apply most directly to the C-130 community, his thoughts, and the lessons therein, apply equally to all fighter, tanker, transport, rescue, reconnaissance, and bomber aircraft—Air Force, Army, Navy, Marines, and Coast Guard.)

Aerospace Safety, Nov 80

Ice, Snow, and 10 Below



Official USAF Photo by MSgt Rich Moran

During final approach, ice accumulated on the wings and left engine of a CT-39. The pilot increased speed to compensate for the aerodynamic effects, but the right wing stalled when the aircraft was about 10 feet above the runway. The wing tip struck the ground and was damaged.

Ice on the wings is just one of the annoyances of winter, but an important one. No crew, of course, would take off with a load of ice. But it has happened. Frost or snow may be removed, but there's no guarantee that the aircraft won't pick up more if fuel is loaded after the wings have been cleaned. The fuel may melt ice and snow, but it also may cause condensation on the wing surface and subsequent freezing.

Blowing snow can create ice. Heat from aircraft ahead, or a differential in temperature from a lighted or protected ramp to a cold, windy runway may turn snow or water into ice. The aircraft may leave the ramp clean, but engine blast from another aircraft may blow almost invisible particles of snow onto the surfaces of the aircraft behind it. The result may be flight control difficulties from ice formed by freezing of snow or water. Another problem is that snow or ice on wings may adversely affect their aerodynamic properties, lengthening takeoff, or even making it impossible for the aircraft to get off in the runway length available.

Slush picked up during taxiing can freeze and cause gear, flap, or engine inlet icing. Another danger results from frequent applications of high thrust to "break away." The blast may throw ice and snow that can cause damage and injuries, so check six before you boost the power.

Taxi as if you have a load of eggs. Here's a scenario for one reason why. You start to taxi, up comes the power, and you begin to move. It's kinda dark, and snow and slush make the taxi lines hard to see. You overshoot a turn and try to correct. Even though you're moving slowly, the bird slides sideways. If you're not lucky, you may go off the pavement, hit a light standard, a fire cart, some AGE, or another airplane. Just keep that possibility in mind. Go very slow; if you can't see the lines, you may have to stop and get a tow. Sloping taxiways are particularly dangerous when slick.

For a clean airplane, takeoff normally doesn't produce trouble; however, standing water, slush, and snow can cause inlet icing problems for some aircraft. Heat may be necessary. Consult your Dash One.

During cruise, a major consideration is clear air turbulence. The jet stream has moved south and frequently is very intense. You should concentrate on conditions ahead, including destination and alternate weather, icing conditions, runway condition, and fuel state in case you have to hold.

One problem reported several times last winter was holding or descent early into icing conditions. Icing can be serious at temperatures between 0° and -8°C in cumuliform clouds and freezing precipitation. Remember the rule: Heat *before* ice, not vice versa.

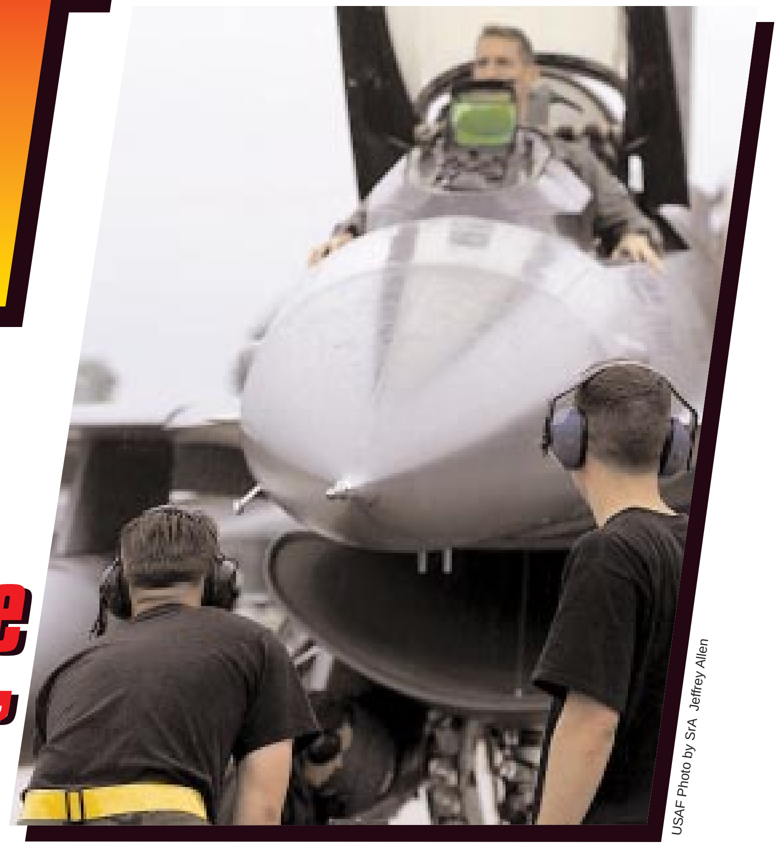
In winter, expect more low visibility approaches. You may have to go around. Don't hesitate. It's far better to make a missed approach than to try to salvage a bad one. With low viz and snow-covered landscape, illusions are possible. If it doesn't look right, it might not be right. Landings on snow-covered overruns can result in some nasty surprises.

Landings can be a real adventure in conditions like these: slick runway, snow-covered overruns, berms placed beside the runway by snow plows, strong crosswinds, and low visibility approaches. This is the time for your best instrument flying—on speed, on glideslope. A nice, firm touchdown—a grease job may start the bird hydroplaning. Remember the rubber and oil deposits on the far end will be slick, so get your speed down in the best part of the runway.

What this all adds up to is an alert crew that plans ahead and is prepared for contingencies. This crew has an aircraft commander who knows his, the crew's, and the aircraft's capabilities—and never exceeds them.

This article is certainly not all inclusive; its purpose is to get your attention. Remember how it was last winter. If you're a new guy on the winter block, learn from the old heads. They can save you a dented bird and maybe your life. ✈

MRT Means 'Hit the Flightline Running!'



USAF Photo by SrA Jeffrey Allen

BOB VAN ELSBERG
Managing Editor
Road & Rec

"Ratta-tatta-tat!"—a German fighter spirals down in flames. The sky is filled with World War I biplanes twisting and turning in a great swirling dogfight. Then the scene changes. Back at a British air base, a couple of aircraft fitters labor over a worn-out fighter.

"I'd like to make a bonfire out of the whole blinkin'' lot of 'em—that's all they're good for," one fitter says to the other as he begins removing a propeller.

The second fitter answers, "No, not even that! They've been shot up so much they ain't worth the blinkin' petrol to set 'em afire."

About that time, the maintenance sergeant strolls up to the airplane, overhearing the conversation.

"Hold on, my lad! That's the King's property you're talking about!" he growls.

"I know, sergeant, but look!"

"I've looked. So has everyone else. What about it?"

"Well, what about it?" asks the exasperated fitter, standing next to the battered engine.

"No mucking about—mend it and shut your mouth!"

Keeping airplanes in the air has changed a lot since the movie "Dawn Patrol" portrayed life at a World War I British air base in France. Gone are the fabric-covered and wire-braced biplane fighter, the clatter of their rotary engines replaced by the roar of modern jets. Gone also is the "no mucking about—mend it and shut your mouth" approach to those who must keep them flying. But that doesn't mean today's young crew chiefs don't have a challenging job—they do. However, now they've got something the old-timers didn't have to help get them ready. It's called "Mission Ready Technician" (MRT) training.

Capt Daniel Runyon commands the 362nd Training Squadron's fighter training flight at Sheppard AFB, Texas. There, he oversees MRT training for F-15, F-16 and A-10 crew chiefs. He'll tell you the MRT program is an idea whose time had come, driven by the rapid-fire ops tempo of today's Air Force.

"We realized the Air Force's operational commands were deploying so much that they didn't have the time to train newly arrived crew chiefs the way they wanted to.” That training, he explained, also had put “a huge burden on the commands” when new crew chiefs arrived fresh from their training at Sheppard. “We realized there was a better way to do business. We could do a lot of the student training and certification the commands were doing.”

That, however, meant changing the way the Air Force trained its crew chiefs. Gone was the strictly academic approach, replaced by one that added hands-on knowledge and flightline experience.

Runyon explained, “What we’ve done is taken the days the operational units used in the past to train a new crew chief—days that were, in essence, lost to the unit—and used them here at Sheppard and at our (deployed) MRT training locations.” The result, he explained, is a new crew chief who is less of a training burden for the operational unit and can contribute more on arriving. And the feedback they’ve been getting from the operational units has been positive. “They are much happier with what they are getting than what they previously got.”

What they’re getting, he explained, is much more than they used to get from a recently graduated student crew chief.

“Overall, the students are brought to a certified 3-level,” Runyon said. “They are taught how to do tasks on airframes such as inspections and wheel and tire removal. These are basic crew chief tasks that I, as an aircraft maintenance officer, want a new 3-level to be able to do.”

One person who can speak directly to that is 17-year veteran C-130 crew chief TSgt Kevin LaVergne. A C-130 MRT instructor since the program’s inception, he began his career as a product of the “old style” crew chief training. He vividly remembers the shortcomings of that system.

“The way we used to do on-the-job training on the flightline was very sporadic,” he said. “You might get a couple of hours of training *this* day, an hour the next, then maybe no training at all for the next three days because of operational commitments.”

However, MRT has changed all that.

“Now, we’ve taken all of that time and condensed it into a solid, jam-packed 65 to 71 days of training so that it flows better,” LaVergne explained. “The students have better continuity—they remember things better. They can pick up and remember what you talked about yesterday, today. You just didn’t get that in the field. It used to take us almost a year to get a 3-level up and running because the training was so sporadic.”

There are currently MRT crew chief programs for the F-15, F-16, A-10, C-141, C-130 and H-53 helicopter. Varying in length and with flightline training done at different bases, the basic concepts are the same, Runyon said. He explained the crew chiefs'' training starts with a 23-day fundamentals course.

“They’re taught ‘lefty-loosey’ and ‘righty-tighty’,” he said. “They’re taught ‘this is a safety wire, and here’s how not to get it stuck in your finger.’ They’re introduced to technical orders and safety procedures. We basically teach them to speak ‘crew chief’ so that everyone is brought to the same level.”

After completing the fundamentals course, students enter the MRT course for the airframe they’ll be working on. Here’s where the hands-on training begins—where book learning and classroom lecture blend

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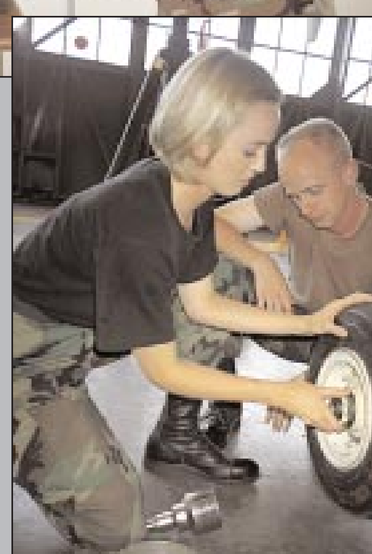
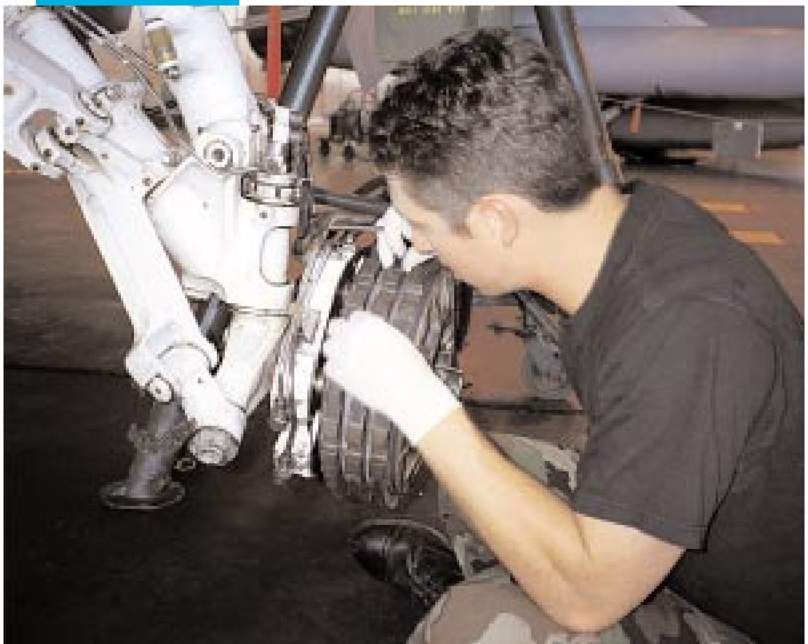


(Top) TSgt Ricardo Cisneros uses a large-screen monitor to show his students computer simulations of how various aircraft components work.

(Right) Airman Jessica Scheib practices removing and re-installing an F-16 nosewheel assembly as part of her MRT training.

Official USAF Photos by Robert VanElsberg



Official USAF Photo by Robert VanElsberg

Airman Rick Palmer performs a brake inspection on an F-16 during his MRT instruction. Prior to the MRT program, new crew chiefs had to wait until they arrived at their first assignment to get practical experience maintaining their aircraft.

with wrench-turning to produce experience.

"We take them out to the flightline and teach them tasks such as wheel and tire removal and installation, fuel and liquid oxygen (LOX) servicing, towing procedures and ground-handling tasks," LaVergne said. "Basically, it's everything apprentice technicians will need to know during the first six months they're on the flightline."

What might a typical day be like for a fledgling C-130 crew chief in MRT training? LaVergne offered the following description.

"Probably the day they like best is the day we talk about engines and props," he said. "It starts out as a four-hour lecture in the morning where we talk about all of the different systems and subsystems of the engines and props. We break it all down for the students so that they can see all of the components. Then we'll take them over to our engine shop. There, they'll see an engine hung on a plane, taken off an airplane and pieced out in different pieces. Then we'll explain what each piece does so they'll get a good visual understanding of what we're teaching them. We'll teach them the basic tasks they would do on those engines or props—things such as propeller oil servicing and checking the starter fluids. Throughout the process they're also learning to use the technical data that goes with that engine."

Safety is also stressed, he added, explaining the students are taught Air Force Occupational Safety and Health standards and how to work around the C-130's engines without being injured or killed.

However, it's not just the "heavies"—the C-130s and C-141s—that have benefited from MRT training. Air Combat Command opted to ensure all its fighter crew chiefs get MRT training, backing up that decision by providing 13-year veteran F-16 crew chief TSgt Ricardo Cisneros to teach the new F-16 crew chiefs. Like LaVergne, Cisneros starts his students off in the classroom, taking full advantage of computer simulations to show his students the components they will work on and how they function.

"I can click the mouse on a picture and show the flight controls moving or the speed brakes opening up," he explained. "Instead of me showing them a picture and going up (to the front of the classroom) and waving my hands, I can show them actual footage of someone marshalling an aircraft."

There's more. The first time Cisneros saw an F-16 was on the flightline at his first operational unit. Now he can take his students into a hangar housing several F-16s for practical, hands-on experience. Block Four, which focuses on the F-16's landing gear, includes some of the classes' most challenging days, according to Cisneros.

"We'll go to the hangar floor and watch a landing gear operational check—which the students seem to enjoy," he said. After a show-and-tell session, the students try their hand at removing and installing tires and brakes, and also bleeding the F-16's brake system. "Once we feel they're ready, we'll watch them do the job. For instance, during the landing gear operational check we'll listen in on the headset. As long as they're not making any safety violations, we'll *just* listen in. When we feel they're ready to do it on their own, we'll certify them. It's a 'go' or 'no-go.'"

Did he say certify? Yes. Certification is one reason MRT-trained crew chiefs are much different from their predecessors, according to Cisneros. He explained that during their 71 days of follow-on training at Sheppard he teaches them 158 different tasks and *certifies* them on 63. Later on, during their 20 days of "hot" training launching aircraft at Luke AFB AZ, they're certified on 19 more tasks. This, Cisneros explained, is a big improvement over the way he was trained more than a decade ago.

"I remember when I came through," he said. "I went through the fundamentals course and then out to the flightline. People expected me to know a lot more than I knew... It took me a whole year before I was at the level the students are at when they leave Luke."

And it's not just teaching the students more, it's also establishing a level of consistency in what each student learns and can do. That consistency was often absent in the old days, according to LaVergne.

"One thing I remember very clearly after training here in 1982 and going to the field was that every new person on the flightline had a different trainer," he said. "They all taught differently and they all taught different things—so you had a group of apprentice technicians who weren't all trained to the same level. If a new crew chief went outside of his familiar work environment, he might not know what to do," LaVergne said. "One of the great benefits of what we do now is that all of the instructors teach from the same lesson plan. The field is getting a 'like-trained' student. No matter where that student goes, they've all got the same level of training. So you don't have to bring one guy up 10 yards more than another guy."

The program is not static; it can change to allow improvements in the curriculum. In fact, Runyon explained, there is a mechanism in place designed to keep the training from stagnating.

"We get what we call 'Graduate Assessment Surveys' back from supervisors of our graduates," he said. "They rate us on three questions and tell us if they like what they're getting from us. For instance, does the graduate conform to military standards? Is he able to do what he is certified on? They also tell us whether or not they think the certification tasks their MAJCOMs have requested are what they really need."

The MAJCOMs are major players in the MRT program, Runyon said, explaining they decide what the training will include and which tasks will be certified.

"We have what are called Utilization and Training Workshops (UT&Ws) approximately once every three years," he said. The MAJCOM functional managers come in and we talk about the course, then vote on whether or not we want to add anything or take anything out of the course."

The instructors—all experienced crew chiefs—have the freedom to mold the course as they teach it, according to Runyon. He explained, "The MAJCOMs tell us *what* to train, and we figure out the best way to provide that training...the instructors *are* the course writers."

As effective as MRT has proven for those who've gone through the program, it's unlikely MRT will be available for all crew chiefs. Runyon explained there is a cost trade-off—a break-even point that makes it uneconomical to institute MRT for all of the Air Force's aircraft. Some aircraft, such as the C-9 Nightingale, are not present in large enough numbers to justify the cost to the MAJCOMs. Still, Runyon believes the program has a lasting future, one that will evolve as older aircraft, such as the C-141, are retired, and new aircraft, such as the F-22, come on line. And whatever the changes, he believes MRT is a valuable tool to help an ever-shrinking and often-deployed Air Force meet its missions worldwide.

"I think we're providing the Air Force with more capability—with somebody who's now more quickly deployable and who's more usable when he reports to the flightline," he said. "Yes, he needs supervision—someone to watch him—because each flightline is a different environment. But he is a much better 'package' than ever before, thanks to MRT." ✈

GEAR UP...I smell gas!”

USAF Photo by SrA Greg L. Davis

CAPT MARK A. HOPSON
RAF Mildenhall

“Gear—Up,” said the copilot.

“I smell gas!” said the nav.

The flight was an RC-135V sortie scheduled round robin out of RAF Mildenhall, U.K. It was supposed to last 13.5 hours in support of Operation Joint Guardian. The flightcrew consisted of myself, an instructor pilot acting as the pilot in command, two dual-seat qualified aircraft commanders (one acting as the copilot, one in the auxiliary crew seat), an instructor nav, and a mission navigator. In addition, there were 20 crewmembers on board to perform the reconnaissance mission. The scheduled takeoff was 0315L with a planned landing time of 1645L.

Immediately after the gear was raised, the instructor nav (IN) smelled fuel. The smell was confirmed by the mission nav shortly thereafter. At that time, the fuel vapors were not detected anywhere else in the aircraft. We were cleared by Lakenheath Departure to climb to FL 230 and direct MC6. The pilot in the right seat was doing the takeoff and continued the initial climbout while I did the after takeoff-climb checklist and talked on the radios.

As this checklist was accomplished, the navigators looked for a fuel leak in the air refueling manifold. The manifold runs from the receiver receptacle in the center of the aircraft above the nav station, aft and down the right side of the aircraft behind the nav station. Due to the location of this plumbing, the portion that runs behind the nav station is not visible. The IN checked the visible portion of the manifold and was unable to find a leak.

The after takeoff-climb checklist was complete passing through about 10,000 feet on climbout and about 25 miles from the field. Just like we brief in mission planning, I delegated duties to perform while the problem was investigated. The copilot continued flying the plane and took over the radios. The mission navigator took over the navigation duties and backed up the co. The extra pilot got out the Dash One and looked up the procedures for fuel fumes on the flight deck. The instructor nav continued looking for the leak. I got out of the seat to help the IN determine the severity of the leak. The in-flight maintenance technician came forward to help and noticed that the fumes were also noticeable behind the flight deck bulkhead. Collectively, we determined that the smell was JP-8 and that fumes were coming from behind the nav station—that dark tangled mess of power cords and cooling fans. With that, the flightcrew came to a consensus that this was definitely a problem. We turned on the navigator’s fan and opened the sextant port to help dissipate the smell.

The instructor nav asked if any work had been done on the AR manifold before the flight. No one on the crew knew, so he called 95 RS Ops on Command Post frequency to tell them of our situation and have them ask maintenance if they knew of a possible fuel vapor source. However, 95 RS Ops relayed that maintenance had no explanation for the fumes.

By this time, we were at MC6 and had reached our final altitude of FL 290. The fumes hadn’t dissipated over the 20 minutes we had been airborne. The IN, the flightcrew’s most experienced flier, had never experienced such strong fuel fumes in the cockpit and was clearly concerned. The rest of the flightcrew keyed off of his concern, agreeing that the situation was serious enough to warrant a return to Mildenhall to get the spare jet. We planned to dump gas over water in the fuel dumping “wash area” and land.

I got back in the seat and relayed our wishes to, by this time, Dutch Mil. The IN radioed 95 RS Ops and Mildenhall Command Post to tell them of our intentions. The extra pilot read from the Dash One the procedures to follow for smoke and fume elimination and for a fuel leak. We increased the cabin altitude to 10,000 feet and the rate of change to Max to ventilate the aircraft.

To limit the number of possible ignition sources, we turned off nonessential electrical equipment including Electric Stab Trim, HF radios, two UHF/VHF radios, TACANs, Doppler Nav Systems, Lower Strobe, Lower IFF antenna, and Copilot's Instrument Power from Normal to Emergency. The flightcrew went on oxygen and advised the rest of the crewmembers to do the same.

Going on oxygen caused communication problems on the flight deck. The RC-135 has a hot mic system that allows the pilots and navs to talk to each other without using interphone. So, when we went on oxygen, each of us could hear our own breathing plus the breathing of the other four crewmembers on the flight deck. This was a communications hindrance that we were forced to overcome.

On the way to the fuel dump area, we declared an emergency. We passed the appropriate information to London Mil and the copilot actually got to set 7700 in the Mode 3 (I was jealous). We still planned to fly to the wash area and dump gas over water and then direct Mildenhall. That plan changed several minutes outside of the dump area when the situation got more serious.

The navs discovered puddled fuel on the nav table. We began dumping immediately. We needed to dump about 55,000 pounds of fuel to get down to a landing gross weight of 210,000. So we continued to the fuel dumping point and out over water. I wagged that if we dumped about 30,000 pounds over water, we could then turn direct Mildenhall while still dumping. I hoped to finish the dump before leaving 10,000 feet to give us plenty of time to set up for the approach and landing.

We dumped the first 30,000 pounds and turned direct Mildenhall. The pilots had the TACANs off, so we relied on the mission nav to get us there. During the descent, we discussed what we would do after landing. This discussion was difficult considering the multiple distractions on the flight deck: five crewmembers breathing over hot mic, Command Post and 95 RS Ops calling on the radio, fans running. Oh yeah, and the smell of gas. Despite these difficulties, we came to a decision. We obviously wanted to get off the jet quickly, but we also wanted to taxi clear so we would have a runway to take off on with the spare aircraft. So we decided to land, open the pilot and copilot windows on rollout to vent the aircraft, taxi clear, and egress the aircraft.

As we continued descending into Mildenhall, we continued dumping gas. We told London Mil what we were doing, and they were very helpful. The dump went smoothly until the aircraft's ability to dump gas from the body tanks exceeded its ability to drain gas to the body tanks. This is something I should have considered. As a result, we didn't finish the dump as quickly as planned, and I wasn't able to take control of the aircraft until final approach. Fortunately, the copilot flew a really nice en route descent and set up the jet for an autopilot coupled approach.

The approach and landing was easy. When I took control of the aircraft, we had just intercepted glide path for the ILS, we were configured for landing, and the autopilot had the jet trimmed. I used the manual trim wheel some during the approach because the electric trim was cut out. We meant to minimize our radio and interphone transmissions to avoid a possible spark, but habit patterns were difficult to quell. The copilot and I each zippered a call from tower, pressing the press-to-talk switch an extra four times. But we did land uneventfully to an airfield crowded with the fire response vehicles. We opened the pilot's windows, slowing through about 90 knots, and this very quickly ventilated the aircraft.

We taxied clear and ran the Ground Evacuation Checklist. The copilot got to pull the fire switches (I was again jealous). Unbelievably, the ladder would not extend down the crew entry hatch despite both navigators' best attempts. So all 25 of us went down the rope and ran away with no broken ankles.

We had to wait about 30 minutes before the fire chief would clear us on the jet to get our gear. But we got our stuff, bag-dragged to the spare, took off about an hour and a half after landing, and flew an 11.2-hour sortie.

Maintenance found that there was indeed a leak in the air refueling manifold. Needless to say, I'm pretty happy we didn't blow up. We actually did some things well, and CRM was the key. The copilot had the not-so-glorious job of simply flying the plane. The mission nav was solely responsible for navigation. They were focused on the job at hand, avoided the numerous distractions, and performed their assigned duties flawlessly. We also took advantage of the extra crewmembers on board. The IN was our primary investigator, we relied on his experience flying RC-135s, and we took it to heart when he expressed his concern about the situation. The extra pilot took over Dash One duties and spoon fed us the procedures to follow.

During mission planning, we always brief how we will delegate duties during emergencies. Having briefed this what seems like hundreds of times, it was easy in the jet to take control of the situation and tell each crewmember what to do. One pilot was always actively flying the plane. One navigator was always backing up the pilot flying and doing the navigation. The extra crewmembers were utilized to help take care of the problem. The mission was a success—we didn't fly the plane into the ground, we took care of the emergency to the best of our ability, and we landed safely to fly another, well, the same day. ✈

LOWER BACK PAIN AND THE USAF FLIGHTCREW

MAJ BILL WALKOWIAK
HQ AFSC/SEFF

My back had bothered me for over 10 years, since I was about 25 years old. It was just a minor but deep pain. It felt like I should be able to crack it or stretch it out. I was very active, lifting weights, running marathons, and racing bicycles. It was like a toothache that would never go away. Fearing some negative diagnosis and a potential grounding (horror stories and urban legends abound), I never told the flight surgeon about the problem. In retrospect, it was getting worse. I was constantly in some form of discomfort, but I got used to it.

Figure 1

Then after one very long flight, I was especially stiff. The next morning, I awoke in agony. Pain shot down my leg (sciatica) and into my toes. It was so intense I couldn't sit down. So I had to go to the flight surgeon. And yes, I was grounded. It's been a long but not too painful story. I've learned a lot, and the biggest thing is that most people with back pain, or a herniated disk like I have, get waivers to continue flying. Despite the horrible pain, most lower back problems resolve in a month or two.

There isn't a lot of emphasis on back health in the flying community. Lower back pain is the No. 1 cause of disability for those under 45 in the United States. Low back problems are the No. 2 reason for visits to primary care physicians. Various estimates of the total societal cost of back pain in the U.S. range from $20-50 billion annually.[1]

Because you don't suffer from lower back pain yet doesn't mean you won't. Eventually, most people will experience back pain. There are preventive measures you can take to prolong your back health and reduce the chances of a disk herniation.

Many times a backache is simply a case of strained muscles. This can occur after the first softball game of the year or the first raking of leaves in the fall. Persistent back pain can be an indicator of a bulging or herniated disk.

There are very rare cases of more severe back problems; for instance, tumors that require immediate hospitalization and/or surgery. There are rare infections that can cause pressure on the spinal nerves. All of these rare causes may be preceded by a loss of bladder or bowel control depending on the extent of the nerve damage. So if you ever get that symptom, go to the hospital right away. The most likely cause for severe back pain and sciatica is a bulging or herniated disk.

Back injury is cumulative, much like hearing loss. Excess weight, poor posture, and ineffective or nonexistent exercise programs all contribute to a long-term deterioration of the intervertebral disks and eventually to back pain or severe disk herniation resulting in shooting pain down the buttocks and leg (sciatica).

So, let's look at the physiology of the disks and herniation, the waiver policy for fliers, and some methods and resources for prevention of cumulative and debilitating back pain.

Anatomy of Spinal Disks and Herniation

If you have never experienced a damaged spinal disk, I can assure you, it's a significant life event. The pain is excruciating, and every movement makes it worse. Like most pain, it's a valuable warning signal. If heeded, it's possible to fully recover and minimize future damage. If ignored, seriously physical and neurological damage can result.

When you hear someone speak of a slipped disk, you may picture a wobbly stack of disks with one sticking out of place.

This isn't exactly how it works. Intervertebral disks are actually flexible pads tightly fixed between the vertebrae. Each is a flat, circular capsule roughly an inch in diameter and about 1/4-inch thick. The outer membrane is called the annulus fibrosis. It's strong and resilient, made of crisscrossing fibrous layers like a Kevlar road tire. The inner nucleus is called the nucleus pulposus. It's a gelatinous substance which can be likened to a balloon that changes shape when compressed, but returns to its original shape when pressure is reduced.

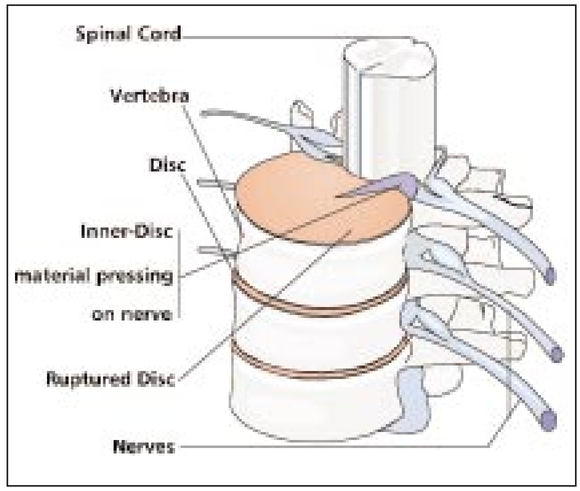
Disks are always under some pressure due to gravity acting on the body, and the para-vertebral muscles continuously contract to maintain posture. When balanced in the correct posture, the disks are under the least amount of mechanical stress[2]. The disks are embedded between the vertebrae and held in place by the ligaments connecting the spinal bones and by the surrounding sheaths of muscle. There's little if any room for them to slip. The vertebrae turn and move along facet joints. These facet joints stick out like arched wings on each side of the vertebrae and keep them from bending and twisting enough to damage the spinal cord, the bundle of nerves running through the center of each bone.

A study was done in the early 1960s to map the intra-disk pressure in various body positions[3]. A seated person is under the most pressure, especially when leaning forward. It was further determined that poor (slouching) posture (in flexion, or bending forward) further increases the disk pressure.

The disk is sometimes described as a shock absorber for the spine, which makes it sound more flexible than it really is. While the disks separate the vertebrae and keep them from rubbing together, they are far from pneumatic or springlike. When you are a child, they are fluid-filled sacs, but they begin to solidify as part of the aging process. In early adulthood, the blood supply to the disks has stopped, the soft inner material begins to harden, and the disk is less elastic. In middle-aged adults, the disks are tough and unyielding, with a consistency of hard rubber[4].

Under stress, it's possible for the inner material to swell and herniate, pushing through the tough outer membrane of the disk. The entire disk becomes distorted. Either this bulge or actual inner disk material pushes on surrounding nerves, causing pain. By far, the most common area for this to happen is the lumbar region, L-4, L-5, or L-5, S-1 (mine). See figure 1. When it occurs here, the pain comes mostly from pressure on the nerves that combine to form the sciatic nerve, running down the buttocks and the outside of your leg to your toes.

Not all herniated disks press on nerves; therefore, it's possible for a person to have deformed disks without any discomfort. A recent study examined the disks of men who had never had back pain. Of the men between 20 and 39 years old, 35 percent had abnormal disk scans. In the men over 60 years old, 57 percent had disks that were diagnosed as abnormal[5].



Sometimes it's a matter of luck whether or not your disk abnormalities will press on the nerves and result in pain. There are exercises which can strengthen the girdle of muscles which help support the spine. And your mother was right—"sit up straight" really is important. Poor posture dramatically increases pressures on your spinal disks.

Typically, a herniated disk is preceded by an episode of low back pain or a long history of intermittent episodes of low back pain. However, when the nucleus actually herniates out through the annulus and compresses the spinal nerve, then the pain typically changes from back pain to sciatica[6].

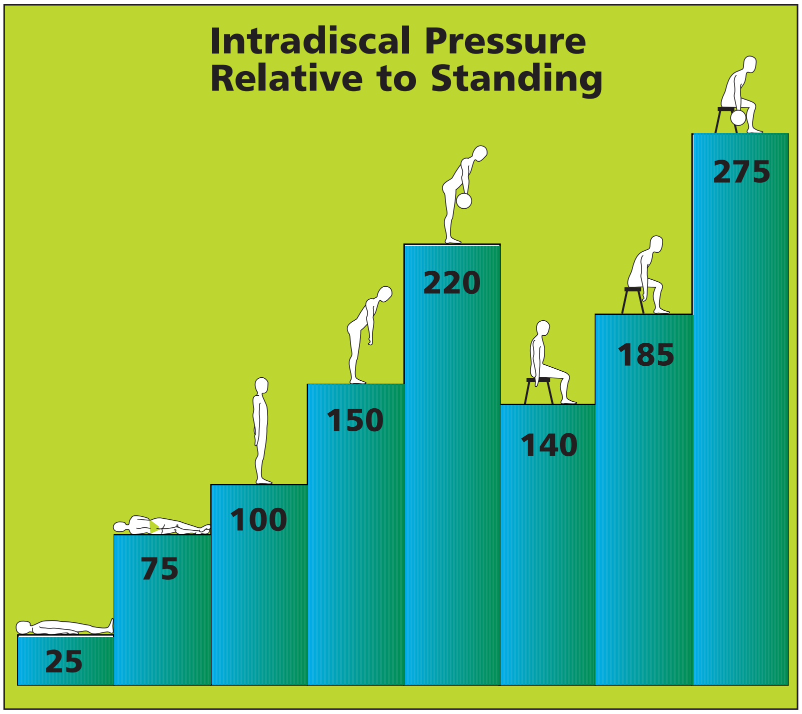
Many times a backache is simply a case of strained muscles. This can occur after the first softball game of the year or the first raking of leaves in the fall. Persistent back pain can be an indicator of a bulging or herniated disk.

Aeromedical Waiver Considerations

Whether you are a fighter pilot, navigator, or loadmaster, your career and some of your pay depend on your health, and therefore, your medical flight clearance. Most of us avoid the flight surgeon for fear of being grounded. A visit to the flight surgeon is a voluntary exposure to an authority able to take away our ability to fly. Of course, from the medical perspective, they have a responsibility to ensure a crewmember is fit to fly. Nevertheless, if you have consistent back pain, you are increasing your distractions from flight duties, making a mishap more likely. There's help available.

One aspect of military health care is the fact that you often see a different physician every time. If that happens to you, it's im-

continued on next page



Postion of Body

portant to be very knowledgeable about your condition and previous diagnosis to prevent continual reevaluations. Educate yourself before you take any course of action. You arm yourself with knowledge before buying a car or house, before picking a college. Why not before making major decisions affecting your health? See the reference list at the end of this article for resources and websites with more information.

Of course, I was a typical crewmember avoiding the flight surgeon about my back for years. I went to a chiropractor a few times with no apparent help. I had massage a few times. It felt great, but it didn't help my back. In fact, the deep tissue massage I had once really hurt, and I was more uncomfortable for a couple of days afterwards. But the day I woke up after my herniation and I couldn't even sit down for the pain, I needed medical help. Had I been more proactive or sought intervention earlier, I might have prevented that big episode. With proper medical and physical therapy advice, as well as a huge motivation to get healthy, I've been pain-free for over a year.

So what are the rules? What is grounding and waiverable? AFI 48-123, *Medical Examination and Standards*, outlines what will ground you and how to get a waiver. The highlights for back pain/herniated disks are:

- Herniation of nucleus pulposus, when symptoms and associated objective findings are of such a degree as to require repeated hospitalization or frequent absences from duty.
- Recurrent disabling low back pain due to any cause.
- History of frank, herniated nucleus pulposus, or history of surgery or chemonuclyosis for that condition.

For a waiver to continue flying duty, your local flight surgeon will prepare the paperwork. Usually, after about 3 months without symptoms, you can get a waiver physical exam. The general guidelines say that the condition:

- May not pose a risk of sudden incapacitation.
- Poses minimal potential for subtle performance decrement, particularly with regard to the higher senses.
- Be resolved or be stable and be expected to remain so under the stresses of the aviation environment.
- If the possibility of progression or recurrence exists, the first symptoms or signs must be easily detectable and not pose a risk to the individual or the safety of others.
- Cannot require exotic tests, regular invasive procedures, or frequent absences to monitor for stability or progression.
- Must be compatible with the performance of sustained flying operations in austere environments.

It's not necessary to get a specialist consultation for the waiver, but I was told that it would help. I got an x-ray (an obsolete and unnecessary procedure for this condition) and a simple reflex walk-on-your-heels test from an orthopedic surgeon. The waiver I got was unrestricted and will be reviewed in 3 years. However, most waivers will probably be for nonejection seat aircraft (i.e., IIA). If you are interested in your odds of obtaining a waiver, consider the following: The USAF aircrew waiver files show 343 members with a diagnosed herniated disk. Over 95 percent received waivers. The less specific condition of "back pain" lists 128 rated crewmembers with the condition, all but 30 receiving waivers. And finally, 111 of 118 with surgically fused vertebral disks received waivers.

Preventing Back Pain and Herniated Disks

First, to prevent lower back pain and a possible herniated disk, you need to be smart about your activities and lifestyle. A poor posture, which puts a lot of stress on the disks, leads to a cumulative degeneration beyond the normal changes due to aging. Sit up straight; use lumbar support before your back starts to hurt. If you fly long missions in heavy aircraft, get up often and stretch. I mean, if possible get up every 30 to 45 minutes on a long flight. If your aircraft has poor lumbar support, use a back roll. This can be a rolled up jacket, or I've even used a handful of approach plate books in the past. Do not add material like back rolls to ejection seats (or stroking seats on helicopters) without proper approval so as not to interfere with seat operation.

If you have a beer belly, get rid of it. A fat belly creates enormous stress on the lower back. You probably didn't have that gut 10 years ago, so get smart and lose it. Regular aerobic exercise is proven to reduce back pain. The more exercise one gets, the less reported back pain exists[7].

Begin and maintain a strength-training program. Probably the most misunderstood area of health that I've seen is resistance (weight) training. We, Air Force flightcrew, lead relatively sedentary lives at work. Weight training, when done correctly, adds strength and reduces fatigue. It strengthens bone and prevents bone loss and muscle deterioration due to aging. Many people increase their risk for injury by lifting weights that are too heavy and with poor form. Most Air Force base gyms have no guidance easily available for proper technique. I recommend each member seek a certified personal trainer, as I did, at least to get started. The benefits are enormous, and you decrease the risks for injury significantly. Most people will analyze the purchase of a home or automobile "ad nauseum," but never consider investing a couple hundred bucks to ensure their fitness and health.

Finally, the traditional back school advice of "lifting with your legs," "keep the weight close to your body," "avoid bending and twisting," etc., is still true today. Unfortunately, real life means that you'll occasionally stumble and twist. You'll have to reach into the trunk of your car to take out the lawn mower or a bag of fertilizer. Preventing back injury is a matter of preventing those cumulative stresses which break down the intra-disk material. Preventing back problems begins with keeping your body weight down, doing weight-bearing (especially back extension) exercise, and aerobics.

Now, what if you have already suffered and are continuing to suffer back pain? If it's mild, the above steps will help and eventually reduce the pain. If you are doing an activity that increases your back pain, like a back extension exercise on the Nautilus at the gym, stop it immediately! You don't need to further irritate your injury. I see people working their backs extra hard to try to get rid of the back pain. It doesn't work that way, folks. If it hurts, your body is telling you something. STOP!

If you want good info on diagnosing your pain, there's an excellent website: http://www.cyberspine.com/index. html. This is the Canadian Back Institute's guide to diagnosing and treating back pain. Less user friendly, but very informative, is the U.S. government-run site: http://text.nlm.nih.gov.

Remember: If you have any associated problem with bladder or sphincter control, seek medical help immediately. A good back and overall strength and aerobic training program does wonders. I've been on such a program for almost 2 years and have never felt better. I'm literally pain-free and a lot healthier than I used to be. So take care of your back, and you can avoid the whole problem. Fly safe! ✈

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Class A Mishaps FY99

FY99 Flight Mishaps (Oct 98 - Sept 99)
29 Class A Mishaps
9 Fatalities
24 Aircraft Destroyed

FY98 Flight Mishaps (Oct 97 - Sept 98)
24 Class A Mishaps
18 Fatalities
20 Aircraft Destroyed

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

18 Mar		**An F-16C suffered major damage on landing.**
26 Mar	**♣**	**An F-16C on a day training sortie suffered loss of thrust, crashed, and was destroyed.**
29 Mar	**♣✶**	**An RQ-4A Global Hawk UAV crashed and was destroyed.**
30 Mar		**A U-2S experienced loss of hydraulic pressure and suffered major damage on landing.**
7 Apr	**♣✶**	**A KC-135R sustained major fuselage damage. (Ground Mishap)**
10 Apr		**An AMRAAM and No. 1 launcher were liberated from an F-16CJ during flight.**
18 Apr	**♣✶**	**An RQ-1K UAV crashed and was destroyed.**
26 Apr	**♣**	**An F-16DG experienced a landing gear malfunction while attempting to land. The pilot executed a successful go-around and proceeded to the controlled bailout area, where both pilots ejected. The aircraft was destroyed on impact with the ground.**
19 May		**An F-117A sustained a fuselage fire on takeoff roll. Takeoff was successfully aborted.**
2 Jun	**♣**	**An MH-53J conducting an exfil mission crashed in the LZ. One crewmember was killed.**
15 Jun	**♣♣**	**An F-15C and an F-15D crashed while on a local training mission.**
18 Jun	**♣**	**An F-16DG crashed while on a local training mission.**
1 Jul	**♣**	**An F-16C, part of a four-ship SAT sortie, struck the ground during the low-level portion of the mission. The pilot was fatally injured.**
12 Jul	**♣**	**An F-16C crashed while on a local training mission.**
11 Aug	**♣**	**Two F-16Cs collided during the landing phase. The pilot of one F-16 successfully ejected, while the other F-16 recovered safely.**
19 Aug	**♣**	**Two F-15As collided during a BFM sortie. One pilot safely ejected. The other F-15A made it back to base.**

- ❑ *A "Class A Mishap" is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million dollars.*
- ❑ *These Class A mishap descriptions have been sanitized to protect privilege.*
- ❑ *"♣" denotes a destroyed aircraft.*
- ❑ *"✶" denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.*
- ❑ *Unless otherwise stated, all crewmembers successfully ejected/ egressed from their aircraft.*
- ❑ *Flight, ground, and weapons safety statistics are updated daily and may be viewed at the following web address by ".gov" and ".mil" users: http://www-afsc.saia.af.mil/AFSC/RDBMS/Flight/stats/index.html.*
- ❑ *Current as of 20 Sept 99.* ✈

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Hercules Wasn't So Mighty After All...

The C-130 Hercules was undergoing a #2 Minor Isochronal (ISO) inspection. One of the ISO-carded items is to R&R the hydraulic boost pack filters, which requires fully depleting hydraulic pressure. Once finished, standard practice at this unit to verify integrity of the hydraulic systems is to use a hydraulic mule for power-on pressure checks, op checks, and bleeds. These tasks were routinely completed before pushing an aircraft out of the ISO hangar.

Due to limited hangar space, ISO aircraft were restricted to a maximum 30-day stay in the hangar, and on those occasions when hydraulic system checks couldn't be completed in the ISO hangar, they were done on the ramp during post-ISO engine runs. Typically, most maintenance actions were completed within this 30-day window, and there had been very few problems returning aircraft to MC status.

This Herc was an exception. Because of scheduling conflicts, hydraulic system checks couldn't be done before it left the hangar, nor could they be done on the flightline, since all four engines were "high timers" and removed for depot overhaul. With no replacement engines immediately available, the aircraft was projected for extended down-time, placed low on the priority list, and system checks put on hold. As a result, it sat parked outside for more than $3^{1}/_{2}$ months with "zero" booster and utility hydraulic systems pressure.

Under normal circumstances with properly serviced hydraulic systems, "snubbers" installed at each end of the booster cylinders provide snubbing (damping) action to the rudder, preventing uncommanded control surface movements (see where this is leading?). It never registered with anyone that this Herc's hydraulic systems weren't properly serviced and snubber damping wasn't available, even though several C-130 Job Guides have "Cautions" warning of wind damage to flight control surfaces if booster and utility hydraulic systems aren't properly serviced. T.O. 1C-130H-2-27JG-00-1 includes the statement "…If the booster and utility hydraulic systems are properly serviced, normal wind gusts will not damage the flight controls."

At some time during the $3^{1}/_{2}$ months that the aircraft was sitting idly on the ramp as an unfinished ISO bird and a CANN bird, wind gusts ranging from 25 to 46 knots resulted in grounding damage to some primary flight control surfaces. Accordingly, the Herc spent some *additional* time on the ramp. Remember: Regular "care and feeding" of all aircraft—including those that are idle—is a must.

U-2 Aircraft Pins Airman In First Round!

One of the best ways to avoid a back injury is to use proper lifting techniques. Another very important consideration is knowing how much weight you're lifting. Which brings us to the following mishap where, apparently, no one took that variable into account... Two maintainers were assisting two other maintainers in lifting a U-2's right wing in order to remove the wing stand. Three maintainers positioned themselves underneath the wing near the wingtip and lifted up with their backs, allowing the fourth maintainer to remove the wing stand. Once the stand was removed, the trio under the wing realized that it was too heavy for them to support and two of them quickly moved out from under, leaving their coworker to hold the wing *solo*. Did we mention that the left wing contained only 20 gallons of fuel, while the right wing contained 650 gallons? The weight of the right wing and its fuel forced the solo maintainer into a "squat" position with his shoulders firmly in contact with his knees, and he remained pinned that way until his coworkers and others could lift the wing and rescue him. Fortunately, his injury was confined to a strained back and he was only on quarters for one day. We strongly suspect trust in his coworkers suffered some strain, too. And although we can't confirm this either, we do suspect that included among his thoughts while he was pinned, was the line "With friends like these, who needs enemies?!?!"

ce Matters

Ten-Ton Pallet Pins Airman In Second Round!

An aerial porter was helping transfer two pallets, weighing 20,000 pounds each, from a 60K K-Loader to a rollerized flatbed trailer. The first pallet had been transferred to the flatbed without incident, and the aerial port troop stood with his right foot on the pallet's edge awaiting transfer of the second pallet. As the second pallet was pushed from the K-Loader onto the flatbed, its weight caused the trailer to drop slightly and his right foot slipped off the edge of the first pallet. The first pallet rolled over the top of his foot and the edge of the second pallet finished the job of trapping his foot entirely. With the help of his buddies, he was able to extricate his foot from the trapped boot and taken to the hospital, where he was diagnosed with a fractured foot. (Bet he could have told the doctor that without the aid of an X-Ray!) Just proves once again that accidents can happen when you least expect them, but because this troop was wearing proper footgear, he'll regain use of his foot. That's why they're called *safety shoes*. Are you wearing yours?

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

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

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

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

One shift had disassembled the No. 1 bearing area and put attaching hardware in parts bags. A second shift replaced the No. 1 bearing carbon seal and reassembled the seal support area. It was during this reassembly stage that a single piece of attaching hardware was discovered missing. The buildup team was faced with some choices: (a) Determining whether or not the attaching hardware had originally been on hand and placed in the parts bag; (b) Initiating lost tool/hardware procedures; or (c) Doing neither of the above. The team chose option "c" and simply got a replacement piece of attaching hardware from bench stock. Despite all of the FOD, IPI, supervisory, and I&E inspections, and the three previous Test Cell runs, something had been overlooked. And the rest is history.

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

A Hot Pattern

Okay, quick! What's No. 1 on your list of things you'd rather not have to do on the downwind leg of your traffic pattern? How about this answer from a C-130 crew.

After more than an hour of flight, the C-130 entered the VFR traffic pattern for some work on landings. Once established on downwind, the interphones began to buzz (literally), and smoke began to fill the cockpit. Sure enough, where there's smoke, there's fire, and it was coming from the essential AC bus panel.

The crew donned oxygen masks and then went to work. The engineer set the air-conditioning to "vent" and started to open the panel. The loadmaster used first one and then a second fire bottle to put out the fire. The engineer then shut off all generators, and the pilots flew an uneventful electrical power-out approach and a successful landing.

All in a day's work, right? Yes…when the crew has had a good briefing, works together as a team, the checklist procedures are followed, and flightcrew discipline is maintained.

Ten Percent Don't Get the Word

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

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

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

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A Good Plan Is Better Than Good Intentions

Time after time, pilots go over the emergency procedures which may be needed on the upcoming flight. Usually, they are never needed, but every once in a while, the briefing pays off.

Prior to a recent helicopter mission, the crew briefed as usual, to include the possibility of jettisoning the external fuel tanks in an emergency. Arriving over the pickup site, they calculated all the performance factors for hovering 25 feet above the rocky creek bottom.

They stabilized at 50 feet and then began to descend to 25 feet. When they attempted to level off, the helicopter lacked power, and the crew began a go-around toward the canyon wall. As briefed, the tanks were dropped, and the helicopter flew out of the canyon without any further problems.

Now, aircraft needing to drop the external stores to improve performance during an emergency situation are not limited to the rotor wings. However routine the mission briefing for emergency procedures may become, it still provides a good plan *before* you need a good idea.

Abort!! Abort!! Abort!!

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

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

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

When the jet began to skid due to the overly aggressive braking, the pilot failed to release brakes and eventually began to drift off the right edge of the runway. To stop the drift, the nosewheel steering was engaged (with the rudder pedal deflected full left), and the aircraft swerved sharply back onto the runway. The aircraft continued across the runway until stopping 6 feet off the left edge. Sometime, in a cloud of dust, the throttles were brought to idle and eventually cut off during the ground egress.

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

Calibrated Fingernails

How much Avgas does it take for your Cessna 152 to make a $2\frac{1}{2}$-hour local flight? You're planning to do some touch-and-go's at three separate airfields before returning home. Therefore, the first thing you do is remove the fuel caps and look inside.

In preparation for a recent flight, one pilot did just that. Unfortunately, the fuel was not up to the top, so the pilot inserted a finger into the tank as far as possible. The fuel just barely wet the fingernail (call it about 1.5 inches below the rim). In the pilot's opinion, the aircraft was fully fueled.

Well, you all know the story about opinions. Now for the facts. One and one-half inches measured on a calibrated dipstick indicates the tank is missing 3.5 gallons (times two tanks, remember). The manufacturer has calculated there is 1.5 gallons of unusable fuel on board. Two gallons of fuel were used for start, taxi, and takeoff. A "topped off" Cessna 152 should have 26 gallons. So once underway, the pilot actually had 15.5 gallons for the trip.

The trip was flight-planned for 2 hours (the fuel needed for 30 minutes of touch-and-go's was not included). Due to a modified, bigger engine, the actual fuel consumption of this aircraft over the last 100 hours was 6.1 gallons of fuel per hour. For the mathematically inclined, the pilot had barely more than 2.5 hours of fuel on board.

As things will happen, the pilot deviated off the planned course in an attempt to follow a nondirectional beacon (particularly well named in this case) and added another 20 minutes to the route.

Two hours and 30 minutes into the flight, the engine sputtered. Five minutes later, the engine quit. One minute later, the aircraft landed in a cornfield. Weeks later, the pilot is still wondering how much time was saved by not getting a calibrated dipstick or by not topping off the tanks. ✈

Official USAF Photo from *FSM* archives

No matter the era... Winter is inevitable. Are you prepared?

Official USAF Photo by MSgt Rich Moran