flying

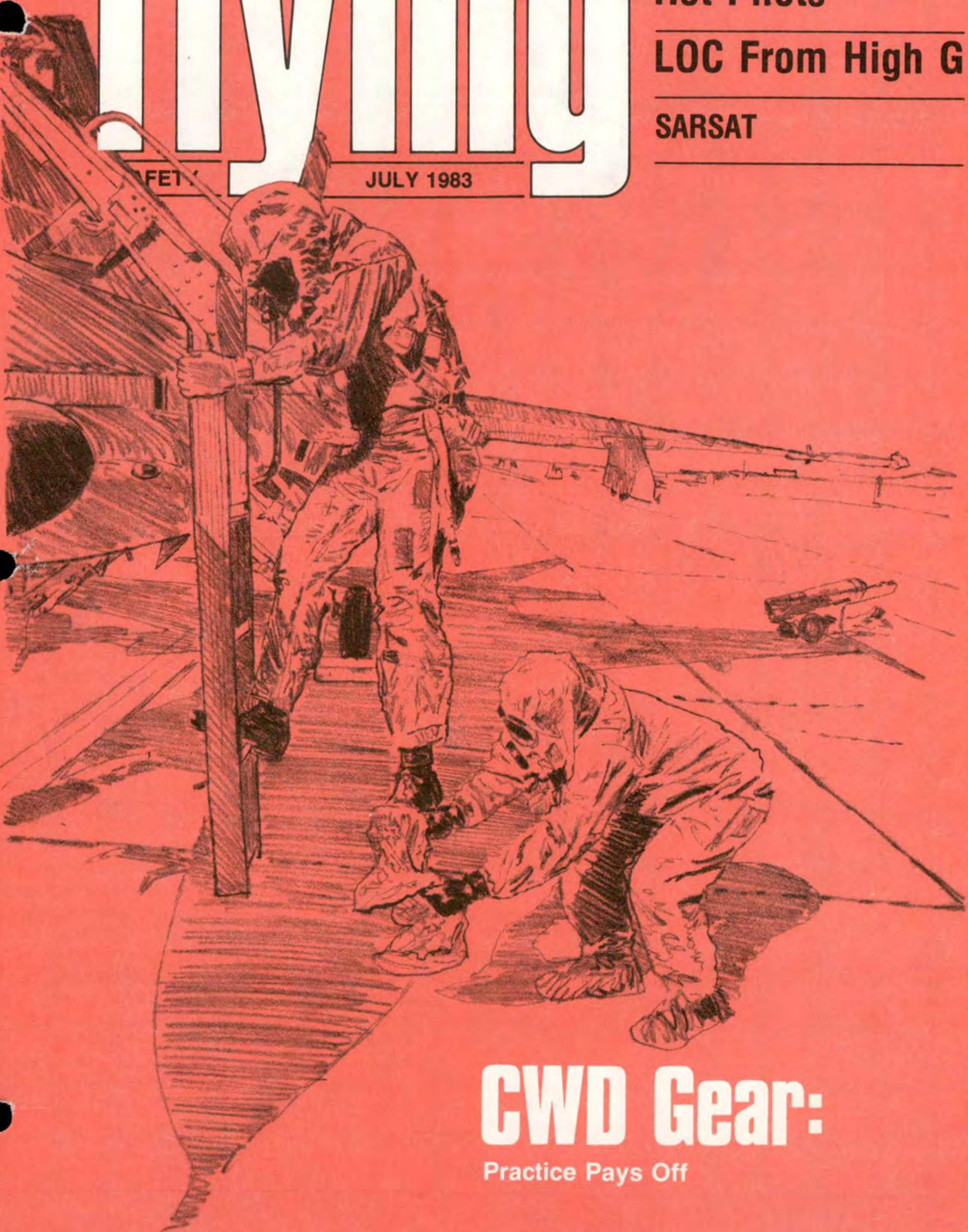
SAFETY

JULY 1983

Hot Pilots

LOC From High G

SARSAT



CWD Gear:

Practice Pays Off

“ ”

———————

On Takeoff

■ . . . just got my gear and flaps up and the aircraft yawed left. Full right rudder just barely got the ball centered. I was still climbing, engine instruments were OK and no jet wash. I determined it must be flight controls. I disengaged the SAS and the problem went away.

. . . chasing a CV student and just about at liftoff the stud's left main tire looked like it came apart. I was lucky. I got a radio call out quick enough to tell him not to raise the gear.

. . . just got my gear and flaps up and noticed a loss of thrust. I confirmed the left engine was winding down and informed lead. Then I saw the left fire handle illuminated. I accomplished the bold face, set up for a straight-in and got it back on the ground.

. . . I had just rotated when a hawk performed a Kamikaze attack in my windscreen. I couldn't see any damage but didn't know if he went into one of my engines or not. I decided to abort and had no further problems.

. . . just prior to raising the gear the aircraft abruptly rolled and yawed right. I was able to regain control using full opposite aileron and rudder and climb to a safe altitude.

. . . immediately after raising the gear and while holding slight aft stick pressure, the stick forces in the pitch axis suddenly went to zero and the stick ended up in my lap. I pushed the stick forward and determined I had normal control response but no stick forces.

Do these situations sound far fetched? Guess again. Every one of these happened to pilots at one base and could have happened to you.

How often do you think about what you would do for the "———— during takeoff" emergencies? Next time (and every time) you are in the arming area, it may be worth your time to mentally prepare yourself for coping with a problem during takeoff. It just may save your life! ■

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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HOT PILOTS

LT COL WILEY E. GREENE
162d Tactical Fighter Group (ANG)
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■ Now that the temperature is climbing, it's a good time to reflect on summer heat. When it's warm outside the aircraft performs differently and even the pilot feels different. In simple terms, it's more difficult to see with perspiration in your eyes. Your thinking is also impeded — wondering why? Read on.

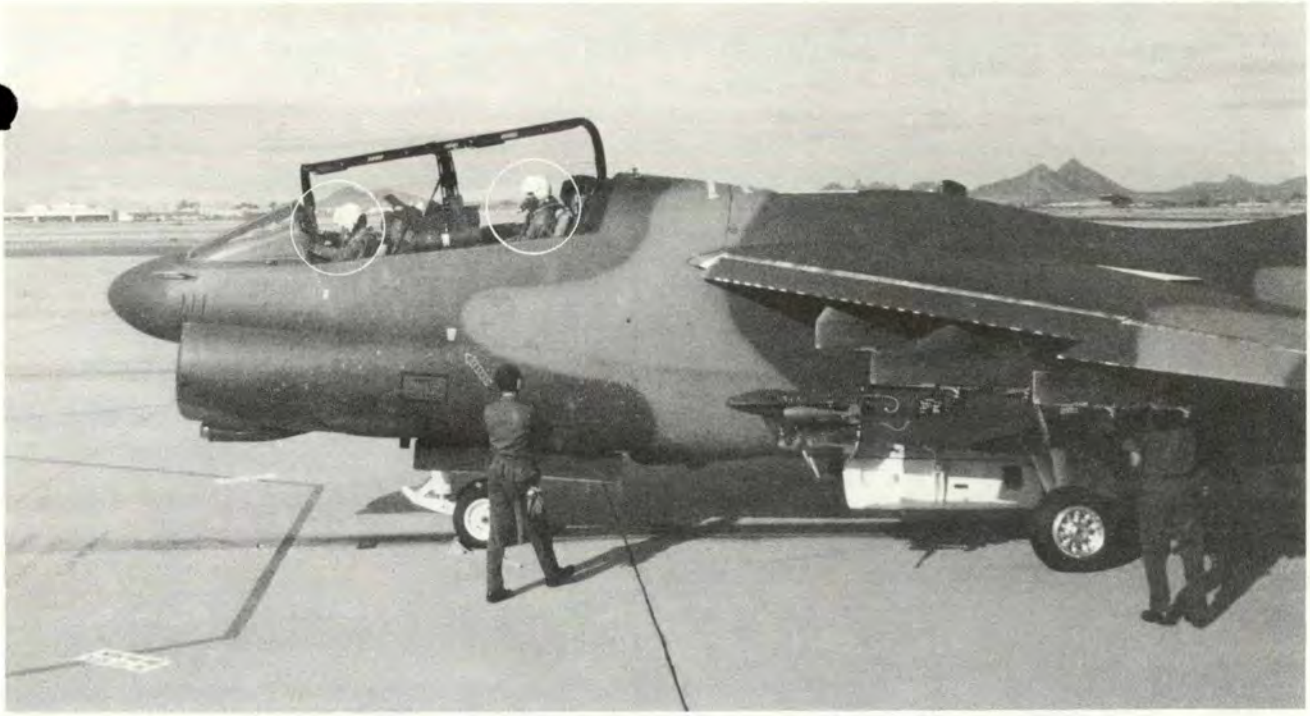
In 1983 the statisticians will chalk up about three A-7 Class A mishaps and two will probably be labeled pilot error. It doesn't take a crystal ball to predict accidents, just the application of history. But as we study past failures in an attempt to improve future human behavior we find the historical data lacking. Although we want to know what causes accidents, human response to internal and external stimuli (that cause accidents) exceeds the investigators' ability to record it.

Let's say a pilot allows the plane to hit the ground while he's still in it. The investigators can determine airplane and pilot malfunctions such as the engine quitting or the heart stopping, but whether or not the pilot detected the failure becomes conjecture — unless the pilot conveys the information by a radio call or autopsy. But we can apply *some* knowledge of human weakness and A-7 characteristics to predict areas of concern. Let's look at an important one — stress.

We all know that a quarrel with the wife or an unpleasant phone call will adversely affect our performance and increase the level of stress for awhile. We also know that the more we know about what we're doing, the less stress we feel while we're doing it (students take heart). If we take a task with which we are familiar (low stress) and add physical discomfort, the stress level will increase. Anyone who has occupied a seat in the A-7 has discovered discomfort at an important level. I don't think anyone is likely to become a statistic because of a sore posterior, but let's consider a more hazardous form of discomfort — heat.

Heat stroke is a disorder marked by high body temperature (without perspiration) that can be followed by collapse. You don't experience this condition willingly because most of us recognize whether we're perspiring or not and either drink a lot of water or decide not to fly. But if you are somewhat dehydrated before you walk out to the airplane, have forgotten to fill your water bottle, spend 30 minutes in the cockpit before take off (which is not unusual), and then fly a low level ingress to a tactical range, you have set the stage for either heat stroke or heat exhaustion.

Heat exhaustion is a condition marked by profuse sweating and may also have weakness, nausea, and dizziness associated with it. Within the A-7 community I would wager that every one of us has experienced heat exhaustion at one time or another. If you say you haven't, you may want to reconsider. Did you fly a low level of at least 15 minutes in a flight of two or more to a tactical range during the summer? Yes? Did you drink any water before you went out to the airplane? No? Did you get a full inertial alignment in the chocks? Yes? Did you perspire much during the flight? (If you felt a cool breeze when you opened the canopy and it was 95°F or hotter outside, then you were perspiring quite a bit.) Did you drink any water while you were in the airplane? No? Guess what? Yeah, you're looking at heat exhaustion. Perhaps you flew a



second sortie on that day and it didn't go as you thought it should considering the world's greatest fighter pilot was at the stick. Want to know a probable cause?

Of course, not every flight will result in a level of heat exhaustion, but some do, and they're the ones setting you up for a close call, or worse.

The A-7K is a great oven and heat exhaustion simulator (as are several other first-line aircraft). With the canopy open the ventilation offered by the wind is successfully blocked and, although the body does its best to keep its cool, it's hampered by the pilot's torso harness, G suit, brain bucket, and parachute.

You start to perspire, but without air flow to provide evaporative cooling the body just continues to lose a lot of water, plus some salt. As body fluid is lost, you become dehydrated. The sole mechanism for body cooling is evaporation of perspiration. With evaporation impeded, body temperature may begin to rise. The higher the body temperature the more oxygen required by the brain. Yet dehydration compromises blood circulation at a time when the brain needs it most.

Add this to the irritation, fatigue, distraction and discomfort of a hot-box and you have a pilot who can't think as fast or as clearly or concentrate, judge, decide, or act as effectively as he usually would. Also, the blood available tends to pool in the legs, decreasing G-tolerance.

It's very important to increase fluid intake (water, juices, iced tea), and drink more than thirst dictates. Your best gauge to body dehydration is the color of your urine, provided you are still producing some. If your urine darkens, drink more water. Water, diluted juices, and iced tea are better than carbonated beverages or electrolyte solutions.

continued

HOT PILOTS

continued

Any aircraft sitting on the ramp on hot, sunny days will soak up heat and several factors can increase the cockpit temperature above the outside ambient. One such factor is the "greenhouse" effect of a large canopy that lets the heat waves in and traps them; the temp inside a parked A-7D on a hot day may exceed 140°F. Another factor is the heat sink effect of heavy cockpit armor — as with the titanium bathtub on the A-10. Still another is the contribution of avionics equipment. If feasible, leave canopies open and cover the parts of the cockpit exposed to direct sunlight.

You can acclimate yourself to hot weather but it takes hard work. During World War II, the British found that their troops could acclimate to the Mideast while still in England by working out in a hot, humid gym. Their goal was to reach a level of work sufficient to produce perspiration and maintain that level for 90 minutes. They found it took about 10-14 days to reach such levels and that they were perspiring sooner and the perspiration contained less salt; i.e., they were "tuning up" their perspiration mechanism. Without re-exposure at least every second or third day, however, their acclimation declined. If you aren't acclimated to a hot environment (like Red Flag in July), avoid extreme efforts the first few days you are exposed to it.

The Fighter Index of Thermal Stress (FITS) gives commanders a valuable safety tool. For example, with increasing ambient heat and humidity (which increases useless perspiration but impedes helpful evaporation), a commander should consider: limiting ground time; requiring some minimum time between flight (to let fatigued, dehydrated crewmembers rest and recoup); or cancel flights. ■

FIGHTER INDEX OF THERMAL STRESS (FITS) °F FOR LIGHTWEIGHT-FLIGHT SUIT

Instructions: Enter chart with local air temperature (°F) and relative humidity (%). At intersection read FITS value and determine Zone.

Air Temp (°F)	Zone	Relative Humidity (%) 10	20	30	40	50	60	70	80
70		67	70	72	74	76	78	81	83
75		71	74	77	79	82	84	86	[illegible]
80		75	79	81	84	87	89	92	94
85	Normal	79	83	86	89	92	95	97	99
90		83	87	91	94	97	100	103	105
95		87	92	96	99	102	105	108	111
100		91	96	100	104	108	111	114	117*
105	Caution[2]	95	100	105	109	113	116*	120*	122*
110		99	105	110	114	118*	122*	125*	128*
115	Danger[3]	103	109	115	119*	124*	127*	130*	134*
120		107	114	119*	124*	129*	133*	136*	140*

Comments:

1 Chart is valid for clear sky to light overcast (shadows visible)

2 **Caution Zone:**

a. Be aware of heat stress.
b. Limit ground time (preflight, cockpit standby) to 90 min.
c. Recovery time minimum 2 hours between flights.

3 **Danger Zone:**

a. Limit ground time to 45 min. or less if possible.
b. Avoid more than one flight a day if possible.
c. Low-level mission with temperatures in this zone are not advised.
d. Recovery time as above.

4 *When index is greater than 115, consider cancelling all nonessential flights.

NOTE: FITS was designed to provide supervisors a guide to predict when fighter type cockpit environmental conditions during low level missions may jeopardize aircrew performance.

(FITS developed at USAFSAM by Stribley and Nunnely, 1978.)

LOC FROM HIGH G

To see or not to see . . . Perchance to sleep

COLONEL GEORGE A. LaHOOD
Aerospace Medical Consultants Div
Office of The Surgeon General

If you are a fighter pilot who loves to win, hates to lose, and who wants to be limited only by the technology of current fighter weapon systems, then continue reading. We have a deal for you that you can't refuse.

The Problem

■ The potentially disabling effects of G forces, including loss of consciousness (LOC), in aviation is not new information. Aircrews have been trained in and have experienced G forces for decades. Until recent years, flyers have been limited only by the capabilities of the machine. Because of advances in technology and the tactical need to stay ahead of an adversary, today's fighter aircraft are capable of exceeding man's physiological responses. The problem lies not only in the high level of Gs but also the rapid onset and sustained level of G that today's fighter aircraft can produce. This capability exists in the F-16, F-15 and, to some extent, the F-4, F-5 and A-10.

Recent Experience

The following cases briefly summarize several of the documented occurrences of LOC over the past few years.

- F-105. Senior pilot made 10° glide bomb pass and pulled off 15-20° nose high. Aircraft rolled inverted and impacted water. LOC suspected.
- A-7. After 17th dive bomb pass, pilot made what appeared to be a normal wings level pull off. Aircraft impacted 4 miles beyond target with controls neutral and no call or ejection attempt. LOC suspected.
- F-15. Combat tactics mission attempting nose low, high speed conversion. Ejection out of envelope. LOC considered a strong possibility.
- F-15. DACT one F-15 v two F-14s. Stan Eval pilot attempted high speed, nose low conversion. Ejected out of envelope over water. LOC suspected.
- F-15. Two F-15s v two F-5s, No. 2 F-15 in a pincer attack

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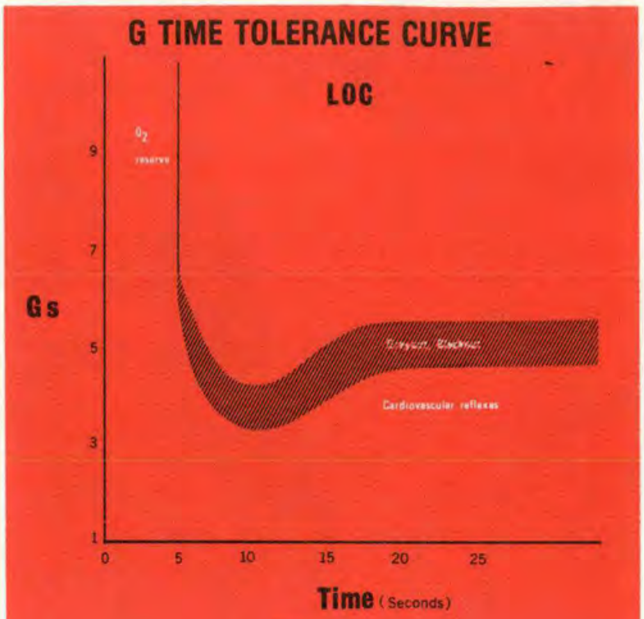

Figure 1

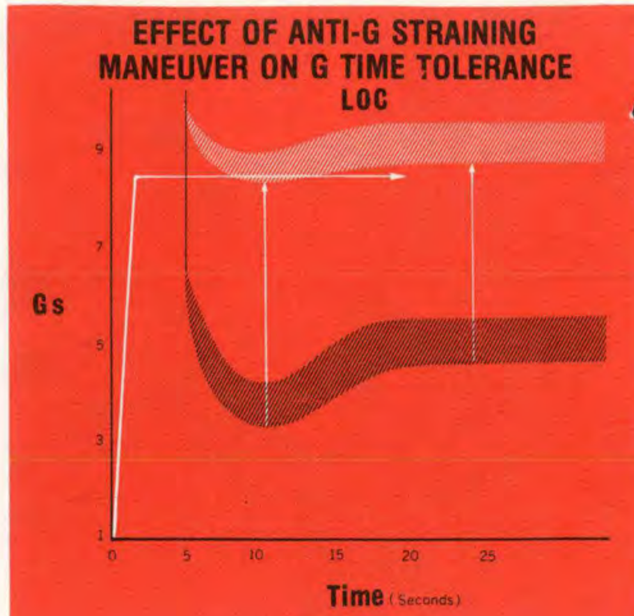

Figure 2

LOC FROM HIGH G

continued

entered a high G, nose low, right bank turn from 600-700 AGL and impacted. Tunnel vision likely. LOC possible.

- F-106. Exercise DACT mission. F-106 v F-15; LOC occurred around 20,000 MSL. Recovered aircraft below 10,000 MSL, but lost both wing tanks. Landed safely.
- F-5. Joint training mission; foreign F-4 flew too close to American F-5, which then broke hard to avoid collision. The F-5 pilot regained his senses below 10,000 MSL and ejected.
- A-10. Pilot initiated 70° banked turn from downwind to deliver ordnance. Aircraft flew smoothly into the water with no transmission from the pilot or attempt to eject. LOC considered a possibility.
- F-4. Number 2 of a 3-ship performing armed road reconnaissance training mission. Sudden increase in pitch and bank noted as aircraft rolled off above target. Back seater ejected out of envelope. LOC suspected.
- F-4. Lead of two ship BFM engagement over water entered a hard right turn during second engagement. Back seater ejected out of envelope. Front seater did not eject. LOC suspected.
- F-5. Aggressor pilot orbiting at 1,000 feet AGL, pushed, then pulled hard to avoid midair, "blacking" himself out. When his vision returned, his aircraft was 30° nose down rapidly approaching the ground. Rather than eject, he elected to salvage what he could. He managed to nearly zero-out his sink rate and during the subsequent break-up, was ejected, incurring a broken leg.
- F-16. BFM engagement. Student defending entered left hard turn, momentarily reaching 7.0 G. Aircraft descended from 23,700 MSL to 6,700 MSL. IP recovered the aircraft using 9.3 G. HUD VTR revealed student's LOC lasted 17 seconds, and his post LOC confusion an additional 8-10 seconds. Anti-G suit hose was disconnected.
- F-16. BFM engagement. IP with fighter weapons school attempted 135° sliceback with apparent goal to extend the fight into the vertical. Commanded 5-7 Gs one to two seconds prior to ground impact. LOC strongly suspected.
- F-16. Low level bomb delivery over tactical ranges. Flight lead

Figure 3

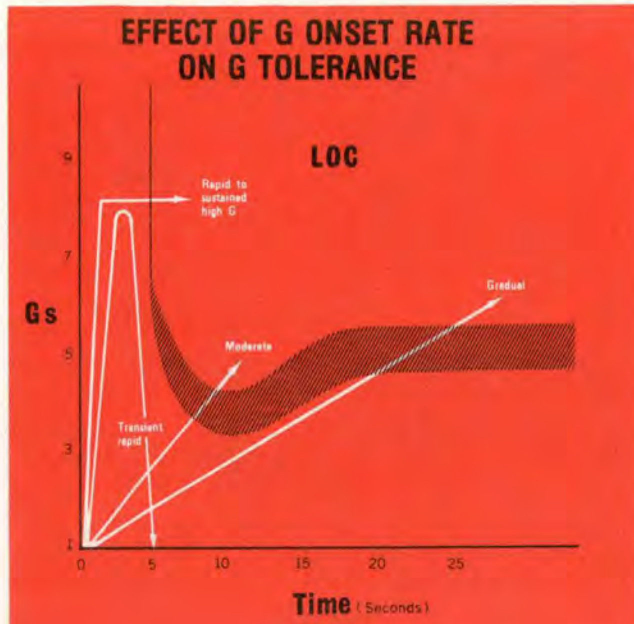

Figure 4

broke hard right at 800 AGL after delivery to deconflict with frag from No. Two's bombs and simulated SAM attack. Impacted ground 12 seconds later. LOC strongly suspected.

The Facts

Because of our anatomical and physiological make-up, grayout or blackout (vision loss) occurs at 3.5-5 positive G unless the straining maneuver (M-1 or L-1) is performed properly or the anti-G suit is used. These visual losses can be postponed to much higher G levels with the use of both a proper straining maneuver and an anti-G suit. Figure 1 depicts a normal G tolerance curve. The individual is protected initially for several seconds because of an oxygen reserve in the eyes and brain. Without a proper straining maneuver, blood pressure drops at head level and visual signs (tunnelling, grayout and/or blackout) occur. If the G onset is gradual, cardiovascular reflexes will raise blood pressure somewhat, providing a little more G tolerance. Without protection, however, beyond 5.5-6 G, LOC is likely.

One method of preventing vision loss is to use either the M-1 or L-1 straining maneuver. The use of an effective straining maneuver will raise the level of vision loss and subsequent LOC by 2 G (Figure 2). The combination of an effective straining maneuver plus a snug, well-fitted, and properly connected anti-G suit can raise tolerance to at least 9 Gs. Figure 3 presents another strategy of coping with the onset of grayout or blackout as it starts to occur by varying the number of Gs commanded.

Vision loss can interfere with orientation and target acquisition, and has been implicated in several mishaps. Visual impairment can be a significant problem when maneuvering hard at low altitudes, and is probably a factor in collisions with the ground more often than we recognize. From the physiological standpoint, it is not a big problem, and will reverse almost immediately upon resumption of blood flow to the eye, either by relaxing the G or by increasing the straining maneuver. More importantly, the margin between any vision loss and LOC is narrow — and LOC is a big problem.

For reasons not well understood, once actual LOC occurs, the victim will stay unconscious for a variable period of time, regardless of blood flow to the brain. On the centrifuge, this period of total incapacitation averaged 15 seconds (range 9-21 seconds). This is truly a case of "to see or not to see, perchance to sleep."

While use of this strategy of relaxing Gs as vision loss occurs may be effective for slow rates of G onset, it cannot be relied upon when undergoing rapid onset (greater than 2 G/sec) to the high sustained G levels possible in the F-15/16. As shown in Figure 4, in high performance aircraft, LOC can occur without the warning of vision loss.

This LOC is most commonly accompanied by amnesia for the event and is followed by a recovery period of confusion, disorientation, and reorganization. During this recovery, which averages another 10 seconds, the victim is regaining awareness but lacks time sense and is mildly to moderately apathetic. Further, studies on the centrifuge (Navy) show a decrement in mental performance (choice reaction time and simple computation) lasting up to two minutes.

continued

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The Solution

Have we finally reached the limits of man's physiological tolerance in high performance aircraft? Must we now limit our technology to safeguard the man in the equation? Not if we can help it, and we can!

The solution is multifaceted. No one part will totally solve the problem without the other. It consists of effective education and training in high G through use of the human centrifuge, improved equipment such as the new high-flow, ready pressure anti-G valve and anti-G suit, better medical selection procedures, further research into the rapid onset, high sustained G environment and, the easiest of all, physical conditioning to better tolerate the effects of Gs. Some of these improvements will take time and resources to fully implement. They are all essential, however, to effectively solve the problem of G-induced LOC. One of these efforts can contribute significantly to managing this problem right now. This effort is the cheapest of all — high-G physical conditioning.

The Right-Now Solution

The primary means of combating high-G problems include: anticipating the Gs and beginning the straining maneuver early to "get a jump" on the Gs; frequent exposure to the high-G environment; a properly performed straining maneuver such as the L-1/M-1; and a correctly fitted (and connected) anti-G suit. The effectiveness of beginning the straining maneuver prior to the onset of G is enhanced by cardiovascular and muscular fitness. The relationship between physical fitness and G tolerance has been a subject of investigation for many years. Evidence from research and operational experience validates the direct relationship between proper physical conditioning and increased G tolerance in high performance fighters. The data indicate that the best program is one that consists of weight training, neck exercises and *moderate* aerobic training.

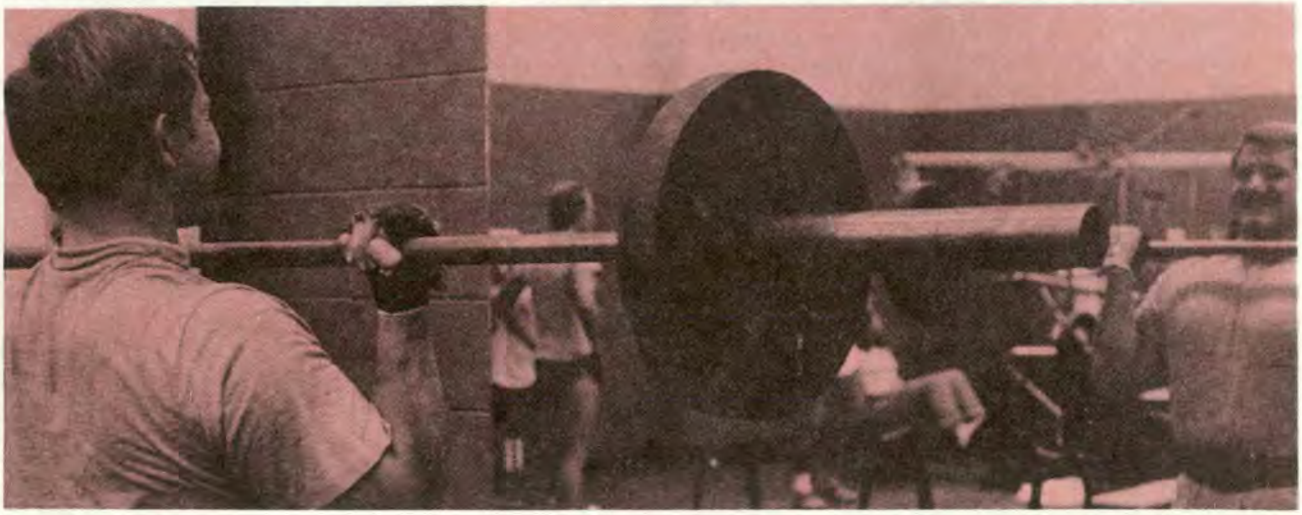
The following guidelines are recommended for overall physical conditioning of high-performance fighter aircrew:

▪ Weight Training. Use about 70 percent of the maximum weight for one repetition, i.e., if the maximum weight an individual can bench press is 200 pounds, the repetition weight should be about 140 pounds. Do two or three sets of 10 repetitions each, three days/week. Recommended exercises are:

- Arm curls
- Bent over rowing
- Bench presses
- Upright rowing
- Lat-machine pull downs
- Chin-ups or behind the neck chin-ups
- Sit-ups
- Leg presses or half squats
- Calf raises

▪ Neck exercises. Isotonic, with either manual or weight resistance. Do these three days/week with weight training. The neck should be exercised in both directions in all three planes of motion (flexion and extension; turning right and left; pulling toward right and left shoulder).

▪ Aerobic training. Exercise only for 20 to 30 minutes. Running distance should not exceed three miles per day. The goal should be to attain Cooper's Category V (excellent) aerobic fitness classification (9:45-10:45 time for a 1.5 mile run for a male between 20 and 29 years old.) Ensure adequate warm up and cool down, three days a week. Alternate aerobic conditioning days with weight training and neck exercising days. Note: *Excessive aerobic conditioning* such as running 8-10 miles a day may decrease G tolerance and increase the potential for sudden loss of consciousness when exposed to the high-G environment.



The best way to ensure that weight training is actually done on a regular basis is to set aside space in the squadron for the equipment and schedule workouts at specific times; i.e., make it convenient. Individuals who have not previously been involved in a weight and aerobic training regimen must remember that this type of activity will increase their metabolism and cause an increased loss of body fluid through perspiration. Adequate water replacement is a must. Many individuals will discover an increase in appetite after they have begun weight training, which is normal. However, there is no documented evidence that protein powder or other dietary supplements are of any benefit during weight training. As a general rule, aircrews should not work out on the day they are scheduled to fly if the workout precedes the flight. Problems that might result from a preflight workout involve muscle recovery time, possible depletion of glycogen (sugar stored in the muscles), dehydration and fatigue.

Do It Now

This program can be initiated right now. It enhances pilot capabilities during high-G maneuvers and contributes to overall physical fitness. The evidence is overwhelming. This program will improve your ability to perform. The increased muscular fitness creates a physiological environment where muscles use oxygen and nutrients more efficiently. Thus, you perform at a high physical state. Another benefit of this program is the overall increased feeling of well being that accompanies your increased muscular and aerobic fitness.

In many respects, the fighter crewmember is a very special kind of athlete. He can prepare himself for the physical demands of his chosen profession by regular participation in a well balanced physical conditioning program. The price is right; the benefits high. ■

HIGH G TRAINING

COLONEL WAYNE A. JOHNSON
Chief, Aircrew Standards
Aerospace Medical Consultants Div
HQ AFMSC

■ High G training has been instituted for a limited number of Tactical Air Command pilots and flight surgeons who fly in high performance aircraft. Training will be provided squadron representatives who will then return to their respective units to instruct other crew members. This program has generated several questions which this article is intended to answer.

- Why are we now having high G training?

Because we now know that G-induced loss of consciousness (LOC) crashes aircraft and kills aircrew. Although suspected in the past, it had not been proven until recently.

- What is the objective of such training?

The objective is to improve one's tolerance to handle Gs through a better understanding of acceleration physiology, by training an effective coordinated straining maneuver, and through optimizing and use of anti-G equipment. In addition, it will include information on the recommended physical exercise, weight conditioning and aerobics to improve G tolerance.

- If the crew member experiences loss of consciousness (LOC) during this training, will he or she be grounded or medically disqualified for further flying duties?

Passing out/LOC while on the centrifuge will not in and of itself be cause for medical grounding. Everybody's "lights" will go out if tolerance levels are exceeded — a normal response when blood is pooled in the lower parts of the body. It certainly is better and safer to pass out on the centrifuge (because you're not doing all you can do to improve G tolerance) than experience it while putting your high performance fighter through its paces. There it's embarrassing at best, and can be fatal at worst.

- Will other pilots of high performance aircraft be required to undergo high G training?

Hopefully so. Because of the seriousness of G induced LOC, it is essential that those flying high performance aircraft know as much as possible about the effects of high G, how to prepare for it and how to cope with it in the currently available high performance aircraft. It is anticipated that high G training will be required of crew members performing such duties in the future when facilities are available to accomplish the "hands on" training on a broad scale. ■

Never Teach Your Girlfriend To Drive

SQN LDR MARK A. LEWIS, RAAF
Directorate of Aerospace Safety

■ For many years now I have heard this advice given in all seriousness. I have heard the associated horror stories, and we probably all know someone who has suffered the loss of a potentially beautiful relationship by not heeding these words. I now have a variation on this story because I decided to teach my young lady to fly. What happened made me a wiser man and a better IP.

At the time, I was a hotshot IP at a basic flying training school, and I was instructing on weekends at the Aero Club. You might say that I was certainly current in basic instructional technique. I had met a young lady of considerable charm and good looks and had decided to offer her something none of her other particular beaus could — the chance to learn to fly. Her father was a frustrated WWII pilot and was keen for her to obtain her pilot's license. He helped me to persuade her that here was the chance of a lifetime. So, with much enthusiasm on my part and some reticence on hers, we embarked on this project.

Initially, all went well. She absorbed the ground instruction and worked hard to understand all she was told. Her attitude was a good mixture of aggression and caution, and I had decided that she was a pleasure to teach. We covered the first few flights with ease and started into level turns. It was here that I started to learn about myself.

Until this flight, she had understood everything I had told her, but she had unaccountably started to use the trim in the wrong direction. This is not hard for a hotshot IP to correct — a few simple words, redemonstrate, and everything is magically clear. The quick remedial tuition became a long session. With the problem now deeply engrained rather than eradicated, I lost my temper. As any student would tell you, this is a common reaction from confused IP's. Surely I could not be at fault because I was a hotshot IP. The misunderstanding must be all her fault.

My young lady did not agree with this reasoning and turned to me angrily, telling me where I could place the bugsmasher, that I could fly her home, and forget about any future lessons or relationship. This was not even remotely what I had in mind, so it was up to me to resolve our conflict of interests.

The post-flight debrief was a learning experience for me. She accused me of poor instructional technique in that I:

- Was not complete in my pre-flight briefings.
- Was confusing in my airborne demonstrations.
- Did not check to see that she had understood the lesson rather than accidentally achieved the desired results.
- Had a dull, boring, and monotonous voice.

The amount of humble pie I was required to consume was mind boggling. I knew that I was guilty as charged and that in all honesty, this had become typical of my performance. It was now up to me to convince my very critical young lady, and myself, that I could and would improve the package I offered to my students. I even had to make the effort to put some enthusiasm into my voice, which is not easy to do with a mouth full of humble pie.

Well, that's all behind me now, and I believe that my value to the Air Force as an IP was greatly enhanced by my experience. Could you teach someone you care for, without a change in your instructional technique? I hope you could.

The story would not be complete without telling you that my young lady did go solo, that she is now my wife, and that she is no less critical now than she was then.

I recommend that you do teach your young lady to fly. If you survive the experience, you may learn a great deal about yourself as an IP. ■

F/FB-111

MAJOR JAMES R. HUDDLESTON

■ Despite the fact that throughout 1982 the Air Force had the lowest Class A flight mishap rate in its history, the F/FB-111 still experienced a higher than anticipated rate. Although the 1982 forecast predicted a loss of six F/FB-111s, the final tally exceeded the prediction by a staggering 50 percent with nine aircraft destroyed and 10 Class A mishaps.

These mishaps resulted in a 10.45 Class A accident rate — the second worst yearly rate in the history of the weapons system. Despite an almost indetectable effect on the mishap statistics, numerous programs and initiatives have evolved to solve problems and deficiencies in this sophisticated, complex weapons system.

Nine aircraft losses during 1982 were attributed to logistics, with operator involvement contributing to two of those mishaps. Logistics areas involved include three engine- and two TFR-related mishaps. One mishap was caused by each of the following: Flight controls, fuel, electrical, and bleed air systems.

Problem areas in the engine included a combustion chamber pin not in place, a low cycle fatigue failure of the number one fan hub, and a number three bearing failure.

The TFR mishaps were attributed to the system failing to process TFR signals to the E-scope or flight controls and a TFR/flight control malfunction of an undetermined origin.

The flight control mishap resulted from an HTSA valve design deficiency which allows FOD to enter and jam the horizontal stabilizers. The mishap involving the fuel system resulted from a leak in the F-2 fuel bay tank. Improperly installed electrical leads on the AC power panel and a bleed air duct clamp bolt failure completed the logistics involvement summary.

Numerous programs to improve the reliability and safety of the weapons system were initiated and expedited throughout the year.

- A Blue Ribbon Panel was organized to investigate causes and recommend short-term solutions to TFR problems. There are currently 40 action items under evaluation and examination. Some of the major action items include getting the contractor to brief unit aircrews on the operation and capabilities of the flight control and TFR systems, simplifying and clarifying maintenance troubleshooting procedures and technical data, and revising and clarifying Dash One flight control and TFR system information. Recommendations to improve simulator maintenance reliability, parts supply, and more realistic simulator/aircraft handling

continued

F/FB-111

continued

characteristics are also being considered.

▪ Special reporting for uncommanded flight maneuvers, which began in 1981, has resulted in the submission of 92 special reports. Forty-four special reports have been closed with known causes. Major problem areas identified include connector pin continuity, yaw computer, and damper-related problems. Five reports remain open and 25 have been closed with undetermined causes. Eighteen reports have not been classified pending receipt of the five open reports.

▪ Stabilization brake parachute (SBP) and recovery parachute (RP) entanglement caused by yaw and lateral center of gravity eccentricity was identified as a problem during an ejection from a past mishap. An extensive engineering effort has resulted in the development of a system which severs the SBP upon deployment of the RP in the low speed mode. The SBP and RP entanglement problem is not a factor during high speed mode ejections.

▪ Reduction of crew module ejection injuries received extensive emphasis during the year. With approximately 30 percent of the crew module ejections resulting in nondisabling back injuries, a seat incorporating energy attenuators and optimized aircrew positioning is being evaluated as a feasible means of reducing ejection injuries. A new recovery parachute is also being considered that will reduce the rate of descent to 25 feet per second compared to the current 32 feet per second. The slower descent rate will reduce kinetic energy absorbed during landing, thereby reducing spinal loads. The foam impact attenuation bag evaluated earlier has too many limitations and is not a feasible modification.

▪ A 90-day safety TCTO has been issued to correct the problem of inertia reels rupturing during the ejection sequence. Recent tests of gas generators have shown that during periods of temperature cycling, the main propellant grain swells and the ignition material cracks. When this condition exists, the fixed gas generator will produce gas at a high rate so that the peak pressure experienced in the power retraction device of the inertia reel may exceed the burst strength of the reel housing. The gas generators are being replaced with a cartridge common to other Air Force aircraft.

▪ An interim fix for the horizontal tail servo actuator FOD problem includes a split collar. This split collar will eliminate the possibility of foreign objects entering the mechanical stop area and preventing the valve from returning to neutral. The valve manufacturer will redesign the rod end and incorporate the redesign through program depot maintenance (PDM) and normal repair and overhaul procedures.

The system manager has been responsive to those problem areas and is working toward solutions for each one. Continued efforts by all concerned, from crewmembers to depot personnel, will result in an improved weapons system. Keep up the good work! ■

T-33

MAJOR ERNEST A. BRIGGS, CF
Directorate of Aerospace Safety

■ The T-33 has a proud history of over 33 years' service with the USAF. As you can see by the T-33 Class A mishap rates (Figure 1), we have certainly improved our record since the "good old days."

The Air Force still has approximately 200 Lockheed T-33s in service, varying in age from about 24 to 31 years old. Not many active flyers have that kind of service!

The primary users of the T-33 are TAC, ANG, AAC, and PACAF. The aircraft serves for training and defense system targets.

For those interested in history, the T-33 lifetime (to December 1982) Class A mishap rate is 13.85; 1,184 aircraft have been destroyed, and these mishaps have accounted for the loss of 590 lives. The Air Force added three Class A mishaps during 1982 which accounted for the three aircraft destroyed, two fatalities, and three people injured.

Let's take a closer look at the three mishaps.

■ The aircraft was on an air combat training mission — some people still use the T-33 for ACT, BFM, etc. — the engine overheat light illuminated, and a vapor or smoke trail was noted. The crew noticed smoke and fumes in the cockpit and when a fire started in the fuselage they ejected. The aircraft hit the water and was destroyed. One crewmember received major injuries and the other minor injuries.

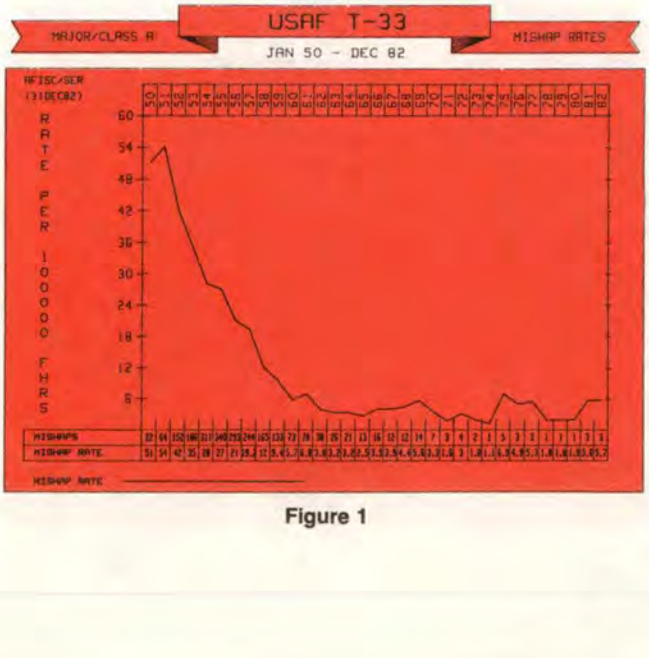


Figure 1

■ The mishap aircraft was on night departure from a foreign air base for a target mission when it crashed into a mountainside. The aircraft was destroyed, and the solo pilot fatally injured.

■ The pilot was on a training mission accompanied by a rear seat passenger. During the mission, the aircraft began to roll inverted and the nose dropped steeply below the horizon. The pilot was unable to correct the aircraft attitude and initiated a dual-sequenced ejection. One crew member died and the other received minor injuries.

The T-33 weapon system is continually monitored, and efforts are in progress to improve reliability and safety. Each year approximately 10 aircraft receive an analytical condition inspection (ACI) — a detailed look at the aircraft for signs of anything that may require increased attention. The T-33 is old but it is still sound. This venerable aircraft has provided yeoman service for many years and is capable of providing many more productive flying hours. Everyone associated with this fine old aircraft — pilots, maintainers, supervisors — must ensure that the "grandmother" of the fleet is afforded the care, attention, and respect she has earned throughout her illustrious career.

Our continuing task is to learn from previous mistakes — to be constantly aware of, and avoid, the many hazardous situations which are part of an accident-producing formula.

The analysis and forecasting experts predict two T-33 Class A major mishaps in 1983. Mishaps are never exactly the same but are often so similar that there is no doubt some foresight and the application of proper preventive measures could have broken the fateful sequence. Our mishap rate (Figure 1) shows we are learning our history lesson, but we must continue to learn, and apply what we have learned to our everyday T-bird operations. ■

O-2

MAJOR GORDON N. GOLDEN

■ The USAF and Air National Guard operate 107 0-2A aircraft built in the late '60s in the forward air control (FAC) mission. The 0-2, affectionately known as the "Duck," is in service with AAC, TAC, PACAF, and AFSC. The average 0-2 today has around 5,500 hours of acumulated flying time.

Figure 1
0-2 Class A Mishap History

Operations	
Collision with Ground	10
Midair Collision	6
Pilot Induced Flameout	6
Pilot Induced Control Loss	5
Landing	4
Take Off	1
	32
Logistics	
Fuel System	5
Engine	3
Flight Controls	2
Propellers	1
Electrical	1
Structure	1
	13
Other	
Weather	1
Miscellaneous	3
Undetermined	1
	5
Total	50

As you can see from Figure 1, ops has the lion's share with 64 percent of the mishaps. Within the logistics factor area you'll note that 62 percent of the mishaps involved the engines or fuel system.

1982 Review

An 0-2 Class A mishap in 1982 involved an engine failure and retention of external stores on a go-around attempt. There were no class B mishaps.

In the Class C/HAP category there were 79 reports of which 59 were engine related. Of these, 56 involved shutdowns, failures, or "quits," and 33 occurred in flight. In the special interest area of "quits," 37 occurred in 1982 with 19 due to undetermined reasons. The trends in engine failures for all causes (Figure 2), and engine failures for an undetermined reason (Figure 3), are both down slightly.

Other areas of significance in the logistics Class C/HAP area were five shutdowns resulting from faulty fire warning systems, and three landing gear incidents including two collapsed nose landing gears.

The operators were not to be forgotten. There was one formation midair, one gear-up landing, and one gear-up touch and go among the Class C's in 1982.

Figure 2

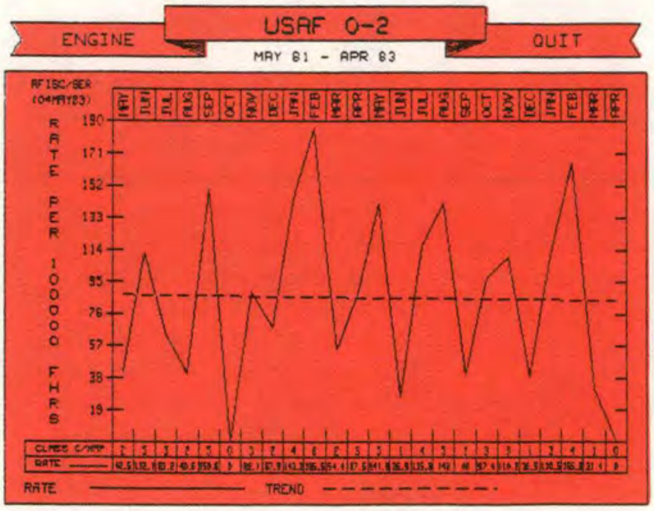
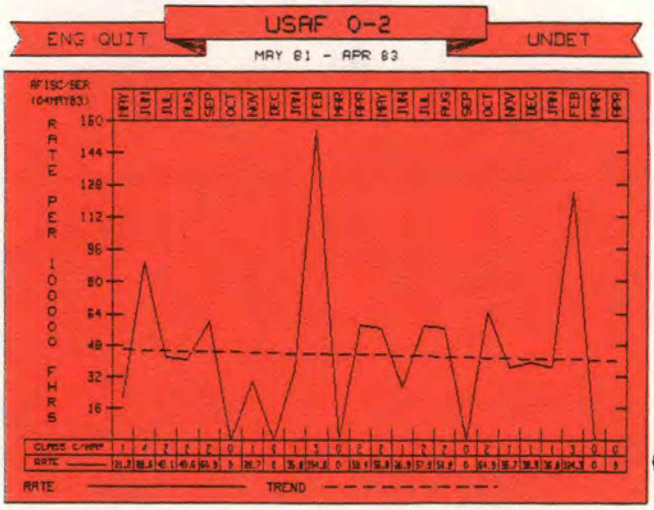


Figure 3



1983

The Class A forecast for the 0-2 in 1983 predicts one destroyed aircraft resulting from an engine loss. As of the end of April there were no Class A or Class B mishaps.

There were 33 Class C/HAP reports as of the end of April. Engines lead with 25 incidents. Fourteen of the engine incidents resulted from the engine failing or being shut down in flight. The only other mishaps at the end of April were: Two involving landing gear; two involving the fire warning system; two prop FODs; a gear indicator light failure; and an underserviced unfeather accumulator.

0-2 Safety Mods

As a result of mishap recommendations and material deficiency reports, safety modifications continue to be implemented on the 0-2. Some of those mods completed or in process in 1982 were:

- The alternator fail light modification was completed.
- The magnetic compass replacement mod for the 0-2 finished kit proofing in February 1983 and installation should begin soon.
- The state-of-the-art emergency locator transmitter (ELT) tested at Patrick AFB has been accepted and the modification process has begun. Replacement of the present ELT in the 0-2 and OV-10 is scheduled to start in 8 to 12 months.

Heads Up

The 0-2 operating environment will continue to place the pilot in the area of low altitude flight where collision with the ground can never be taken lightly. Midair collision with civilian aircraft because of the common operating parameters and the aircraft's small size will also be a major concern for the 0-2 operator. Even though the trend in engine failures is slightly down, the loss of an engine, and the resulting underpowered condition, will continue to present a potential for Class A mishaps in 0-2s. ■

OV-10

MAJOR GORDON N. GOLDEN

■ The OV-10A has been a part of the Air Force inventory since 1966, and a total of 76 Broncos are in service with TAC, PACAF, and USAFE. The accumulated flying hours average around 7,000 per aircraft, which is high considering the type mission. There is no follow-on aircraft for the forward air control (FAC) mission, and even though the OA-37 is taking part of the OV-10A mission in PACAF, the replaced aircraft are not being retired.

Mishap History

The OV-10A has a history of 31 Class A mishaps with 27 total fatalities. There have been 29 ejections from the OV-10A, with 23 successful for a success rate of 79 percent.

A breakdown of the lifetime Class A experience is shown in Figure 1.

Figure 1
OV-10 Class A Mishap Experience

Operations	
Pilot Induced Control Loss	12
Midair (1 formation, 2 helicopter, 1 RF-4C)	4
Take Off	1
Collision with Ground	2
	19
Logistics	
Fuel	3
Engine	6
Propellers	1
Landing Gear	1
	11
Undetermined	1
Total	31

As you can see, the largest category of mishaps belongs to the

continued

OV-10

continued

operators with 12 pilot induced control losses. However, not far behind are the logistics fuel and engine categories which equate to a flameout for the pilot. In other words, it pays to know your single engine procedures and parameters.

1982 In Review

In 1982 there were two Class A mishaps. One was a formation midair that resulted in two destroyed aircraft and one fatality. Another mishap occurred when a fuel pump drive spline failed shortly after take off. Flying airspeed could not be maintained, and both pilots ejected successfully. There were no Class B mishaps in 1982.

The OV-10 finished 1982 with 72 Class C and HAP mishaps. The largest category among these mishaps was engines with a total of 48. Within the engine category the oil system had the most frequent appearance with a total of 14 reports (six indicator or transmitter problems). Also, within the engine related area there were 11 flameouts of which five involved flight through icing conditions.

The other categories of Class C/HAP mishaps that appeared with any frequency in 1982 were propellers with 10 reports and landing gear with five reports.

In the operator area there was one inadvertent gear-up landing.

1983

The 1983 forecast for the OV-10 predicts we will have one Class A mishap as a result of pilot induced control loss.

At the end of May there were no OV-10 Class A or Class B mishaps. There were 39 Class C mishaps. Twenty-four of these were engine related including eight flameouts. Five of the reported flameouts or shutdowns this year have occurred while airborne. In the operations area there has been one formation midair Class C, and one taxi mishap.

OV-10 Safety Mods

There were several ongoing safety related actions to improve the OV-10 in 1982. The status of some of these actions follows.

- The modification to allow dimming of the landing gear warning light was completed on all aircraft in April 1983.
- The oil-wetted fuel pump drive spline modification for the T76 has a forecast implementation date of July 1983. This mod will ensure that the fuel pump drive spline is lubricated continuously.
- The state-of-the-art emergency locator transmitter (ELT) tested at Patrick AFB has been accepted and is in the modification approval process. Earliest implementation will be 8 to 12 months downstream.

Summary

The areas of highest potential for an OV-10 Class A are midair collisions, engine failure, or control loss. In the final analysis they all count on you, the pilot, to bring them home safely. ■

Search and Rescue Satellite Aided Tracking

COSPAS – SARSAT

COL PETER W. WARN
Aerospace Rescue and Recovery Service
Scott AFB, IL

■ Since the mid-1970s, the United States and several other countries have been exploring the feasibility of using satellites to detect and locate emergency transmissions from aircraft and ships in distress. This led to the formation of Search and Rescue Satellite-Aided Tracking (SARSAT). Partners in the project are the United States, Canada, France and Norway. The Soviet Union also participates as a member having launched a COSPAS spacecraft (similar to SARSAT); hence COSPAS-SARSAT. Other nations, such as the United Kingdom and Japan, have also expressed interest in COSPAS-SARSAT and the list of participants can be expected to grow.

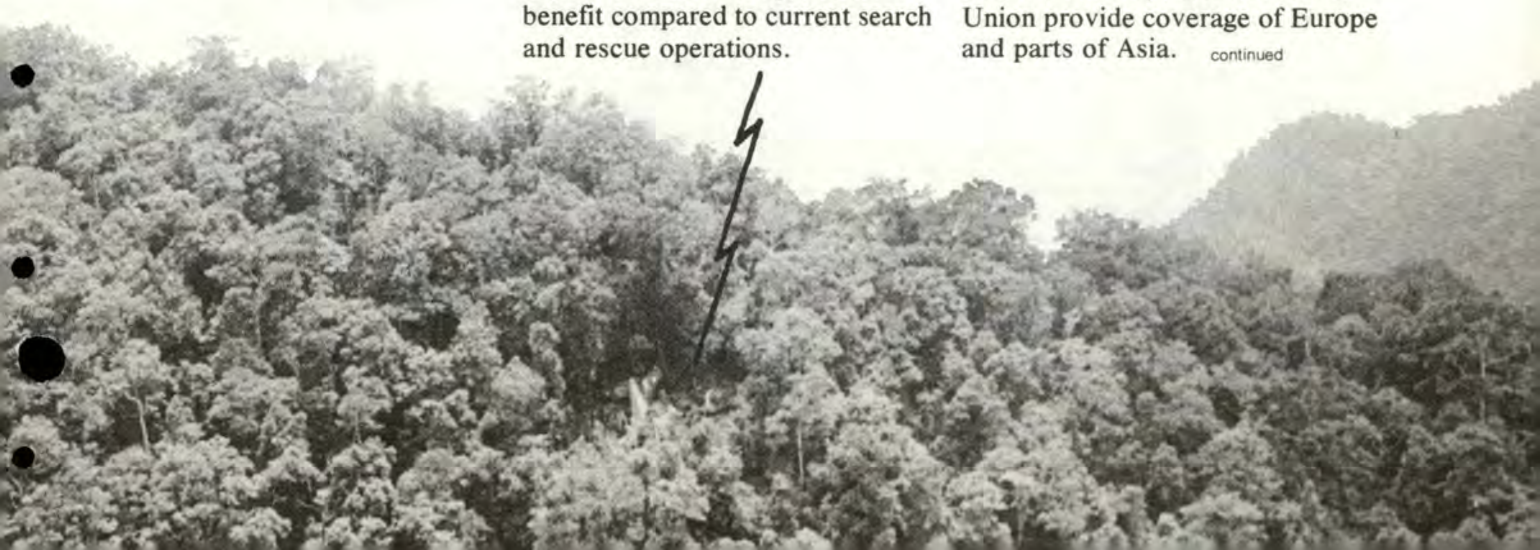
Present monitoring of emergency locator transmitters depends largely on voluntary reporting of distress signals. This system provides irregular coverage at best, with large coverage gaps in remote regions where the need for rapid response to incidents is most acute.

The probability of finding survivors and their chances of survival diminish with each minute after an incident occurs. Records averaged from overall experience have indicated that the life expectancy of injured survivors decreases as much as 80 percent the first 24 hours after a mishap, while the chances of survival of uninjured survivors rapidly diminishes after 3 days (AFM 64-2) (See Figure 1).

Rapid location via satellite can significantly reduce search and rescue costs and length of time search and rescue teams are exposed to hazardous conditions often encountered during their missions. In full operation, a series of satellites (both U.S. and Soviet) will orbit the earth and regularly pass over every spot on the globe to pick up whatever distress signals are broadcast. This coverage, which began testing January 1, 1983, is expected to have a significant benefit compared to current search and rescue operations.

In the United States, the Air Force, National Aeronautics and Space Administration, Coast Guard and National Oceanic and Atmospheric Administration have cooperated to equip a TIROS-N weather satellite with special components to receive and retransmit distress signals. A ground system is in place consisting of a U.S. Mission Control Center manned by the Air Force at Scott Air Force Base, Illinois, and three satellite receiver stations or local user terminals. One is located at the USMCC and two are operated by the Coast Guard at San Francisco, California, and Kodiak, Alaska.

A Canadian terminal at Ottawa, Ontario, extends coverage into the Atlantic Ocean. Thus, four North American terminals provide 121.5, 243.0 and 406 megahertz coverage over the continental United States, Alaska, Mexico, densely populated areas of Canada, and the maritime regions. Additional terminals in France, Norway, and the Soviet Union provide coverage of Europe and parts of Asia. continued



SARSAT

continued

The COSPAS-SARSAT concept involves the use of multiple satellites in low, near-polar orbits "listening" for distress signals. Signals received by the satellites are relayed to the network of ground terminals. The location of the emergency is determined by measuring signal frequency shifts, known as the Doppler Effect, as the satellite passes overhead. This information is relayed to the Mission Control Center which alerts the appropriate Rescue Coordination Center. The RCC begins the actual search and rescue operation according to pre-established procedures.

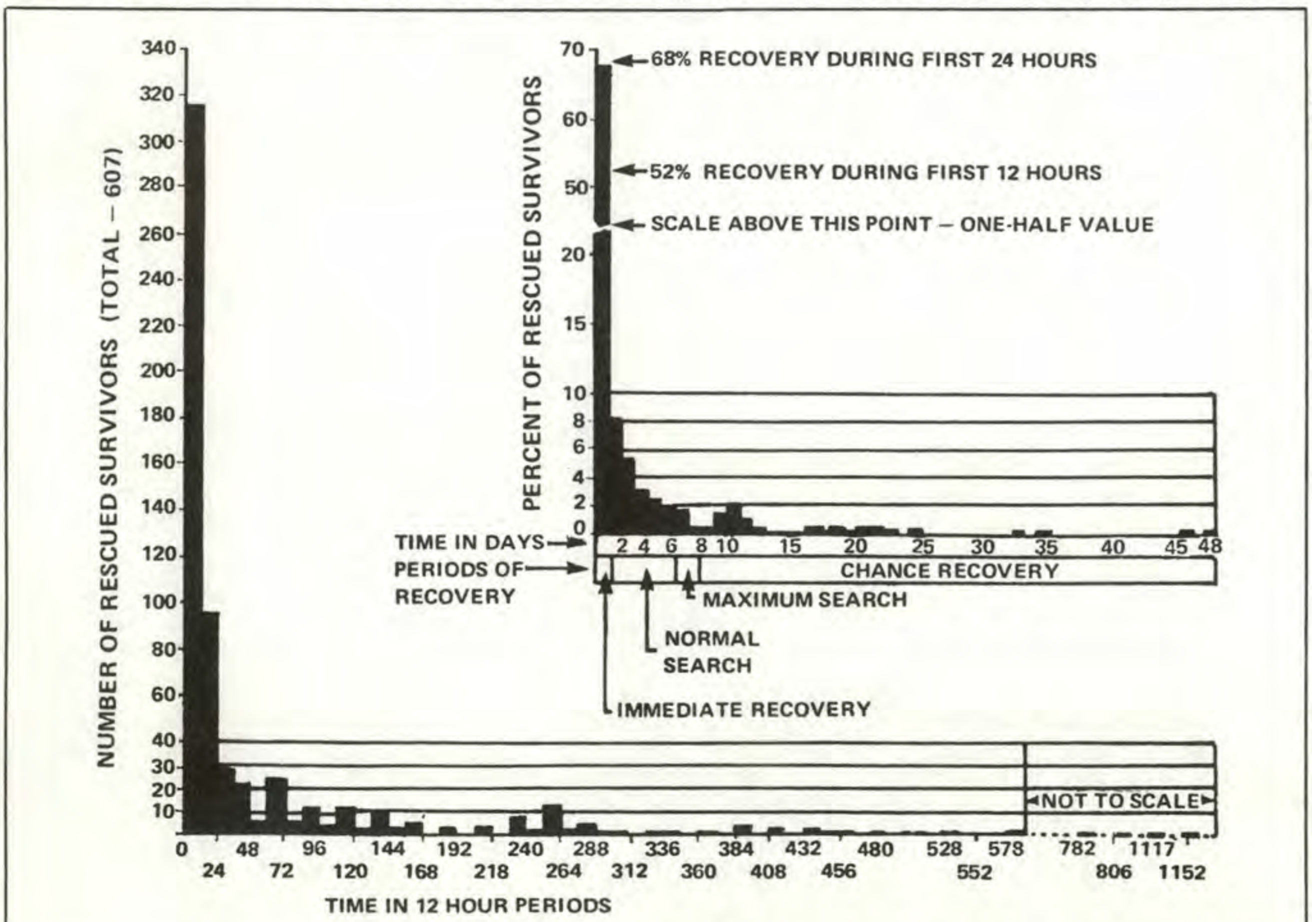
Two experiments will be conducted within this concept. The first is designed to validate satellite detection of distressed aircraft and vessels now equipped with emergency transmitters operating at 121.5 and 243.0 megahertz. This service will be real time and will be limited to areas within 1,250 miles of local user terminals.

A second experiment uses transmitters designed specifically for satellite reception and operating at 406 megahertz. The 406 beacon will provide improved detection capability; more precise location; worldwide coverage; and the capability to transmit identification, nationality, classification (aircraft or ship), and nature of distress of elapsed time since the incident occurred. The 406 experiments will form the technical basis for a gradual evolution to a highly effective, worldwide emergency locator system.

COSPAS-SARSAT will operate in two modes: regional and global. In the regional mode, detection coverage is provided on 121.5, 243.0 and 406, but is limited to those areas within a 1,250-mile radius of a local user terminal. In the global mode

Figure 1

SURVIVOR RECOVERY TIME. Rapid response in a SAR effort is essential. An injured person's survival changes are reduced by 80% in the first 24 hours after an accident. As the figure shows, even for the uninjured, survival chances after the first 3 days rapidly diminish.



(operating only on 406), full earth coverage is provided by storing data in the spacecraft telemetry subsystem until it is transmitted to a ground station. This enables coverage of areas of the globe which are out of range of the ground terminals.

The goal of COSPAS-SARSAT is to pinpoint a distress signal within 12 nautical miles of 121.5 and 243.0 transmitters and 3 nautical miles of 406 transmitters. However, accuracy of locating a target depends upon the noise and interference background detected by the satellite, the characteristics of specific emergency transmitters, and an accident's location relative to the satellite orbit.

The first COSPAS-SARSAT launch was on June 30, 1982. Technical testing of the satellite and ground system began on September 1, 1982, and continued through December 31, 1982, at which time the demonstration and evaluation phase began. The demonstration and evaluation phase will take approximately 15 months and will determine how much COSPAS-SARSAT enhances the search and rescue system already in use.

If all goes well, COSPAS-SARSAT will significantly reduce the time from when distress occurs until the site is reached by rescuers. By reducing this time, chances for survival following an aircraft crash can be enhanced five-fold.

The system has already proved its worth in assisting SAR efforts. The following are two examples of what the system can do.

The first occurred last September. RCC Victoria was alerted by a Flight Services Station that a Cessna 172 on a VFR flight through British Columbia, Canada, was overdue. The chartered aircraft carried three persons who were continuing the search for the son of one participant who had disappeared on a similar flight earlier. (This previous incident, after the fruitless expenditure of over 1780 flying hours, had been placed on "reduced status" by Canadian SAR forces.)

It was determined later that the Cessna 172 had stalled as the pilot flew up a blind valley. The crash site was a heavily forrested (15-meter trees), over a 1-km long valley surrounded by 2,100-2,400 m high mountains. All parties on board survived, but each suffered broken bones and multiple scratches and bruises.

COSPAS-SARSAT will significantly reduce the time from when distress occurs until the site is reached by rescuers.

The Emergency Locator Beacon aircraft (ELBA) antenna was broken off on impact. Recognizing their plight, the survivors removed the ELBA, and carried it to the top of a hill in an attempt to extend its transmitting range. The broken antenna was stuck straight into the ELBA connector slot.

Search aircraft failed to locate the crash site visually or even to pick up the ELBA signal; thus, RCC Victoria contacted RCC Trenton to initiate monitoring of the next appropriate COSPAS satellite pass over the crash area. The Ottawa SARSAT LUT tracked Cosmas 1383 and identified from its transmissions two probable crash-site locations in the search area. After reprocessing, one was determined to be a sideband; the more probable location was passed on to RCC Victoria.

A SAR Buffalo aircraft was dispatched and it eventually picked up the ELBA signal while circling the area at high altitude. A parachute-rescue team was deployed, survivors were treated and then airlifted out by SAR helicopter.

It should be noted that the crash site was 50 km north of the intended flight route. RCC Victoria estimates that at least 3-4 more days probably would have been required to find the survivors without the satellite information. Moreover, the pilot possibly might not have survived. As it was, however, medical aid reached the site 26 hours after the crash.

Later the same month, there was another incident. This involved a Piper Cherokee charter airplane carrying a single passenger to a hunting camp site near Casey, Quebec. RCC Trenton received a Mayday report, with vague position data, from the Montreal area control center.

A SAR Buffalo was sent to the area to perform an ELBA and visual search. Meanwhile, however, more definitive ELBA location data were obtained from the COSPAS satellite; the crash site was quickly found and para-rescue personnel were deployed. The pilot was deceased, the passenger injured. Total time: less than 6 hours to the recovery of the survivor.

On September 30, U.S. SAR teams were directed quickly by COSPAS location information to an air crash site in New Mexico, only to find both aircraft occupants dead on their arrival. Nevertheless, the satellite-derived crash coordinates greatly reduced search time, according to NASA officials in Washington, D.C. — Adapted from ICAO Bulletin Dec 82. ■

CECILIA PREBLE
Assistant Editor

■ There was a time when exercise flying was fun, or at least exciting, but in today's chemical defense scenarios many crews approach such missions with something less than enthusiasm. This is partly because the current chemical warfare defense (CWD) ensemble is cumbersome and uncomfortable. It's a hot outfit and as the perspiration flows and the Gs come on, the helmet and mask begin to slide around. The hood and helmet reduce peripheral vision and complicate checking six. Breathing is laborious and the gloves make even the most precise pilot feel ham fisted.

The ensemble consists of the following items: cotton long underwear, cotton socks, a charcoal undercoverall, plastic tube socks, nomex coveralls, leather flying boots, cotton glove inserts, neoprene gloves*, nomex gloves, MBU-13/P mask, HGU-39/P helmet*, HGU-41/P protective hood, CRU-80/P filter pack, M13A2 charcoal filters, plastic overboots, and a plastic overcape. No small wonder aircrews are so concerned about restriction of movement.

There's a light at the end of this dark tunnel and it's not the train, it's TAWC, the USAF Tactical Air Warfare Center at Eglin AFB, Florida. The TAWC Chemical Warfare Defense Division has been evaluating this gear since 1980 and is now concentrating on improving and refining the present ensemble.

"Things are really looking up," according to Major Al McClure, Chemical Warfare Defense Branch Chief for Tactics. "We're going to see physical as well as psychological improvements for pilots flying with the new ensemble."

The first generation ensemble has been evaluated extensively and improvements are already being released to the field. The first, a new helmet, is form-fit, lighter and designed for everyday use. This HGU-55 helmet stays in position better than its predecessor which was designed for Army helicopter pilots. It is also compatible with the CWD mask and helps keep the mask in place. It solves the problem with hot spots and since it's the same helmet aircrews will use every day, pilots will not have to adjust to it.

The second advancement should be in, or on your hands no later than the end of 1983. This one, new gloves, minimizes the ham fist problem. These gloves are about one-third the thickness of the previous version and are, therefore,

*These items are being replaced

CWD Gear: Practice Pays Off

very tactile. You can still expect to wear three layers on your hands: the light cotton insert, to absorb perspiration; the new butyl glove, for protection against chemical agents; and the regular nomex glove. In spite of the numerous layers, the new combination presents a dramatic improvement in tactility. In these gloves you can even pick a dime up off a table.

TAWC is looking into improving additional aspects of the ensemble. In the near future the anti-stretch cord in the oxygen hose will be lengthened. This should reduce the restriction to the wearer's head movement and simplify checking six.

Fogging has proved to be a problem with the CWD ensemble mask. According to Major McClure, "The only two causes we know of are an improper seal and/or a sudden change in cockpit temperature. To ensure against fogging, we recommend aircrews check their masks for good fit before leaving the ground. If they still experience fogging, they have a couple of options: If the problem is a loose mask, go on 100 percent oxygen and select either Test Mask or Emergency on the regulator. Cold, dry oxygen will surge to the mask and clear the fog. Once it's clear, try to adjust the seal.

"If the cause of the problem is a sudden change in cockpit temperature, adjust the cooling or heating to eliminate the contrast."

A recent ejection has illustrated the importance of training and experience with the CWD gear. A few months ago, an A-7 pilot was on a training flight in the partial gear (helmet, mask, filter, gloves) when his engine failed, forcing him to eject. The CWD gear did not interfere with the safety of his ejection. However, the mishap investigation has highlighted the need for adequate instructions concerning landing in trees while wearing the CWD gear.

Research at TAWC has shown that as aircrews gain experience in the present CWD ensemble, they become more comfortable with it.

"We've noted a steep improvement in the learning curve with just a couple of flights," says Major McClure. "The more you use it, the better it gets."

Major Ron Gray, 4485 Test Squadron (TESTS), Eglin, has participated in testing the ensemble since December 1981. He's flown more than a dozen sorties and is one of only four Air Force pilots to have flown in the full gear in the F-16 (single seat). Also involved in this aspect of TAWC's test are Lt Col Roger Taylor and Maj Nick Holoviak, 4485 Test, and Capt Jim Curran, 4484 Fighter Weapons Squadron.

"The chem defense gear, as we know it today, is really uncomfortable — that's a known fact," says Maj Gray. "The ensemble is hot and bulky, which makes it hard to move around in the small F-16 cockpit. The old gloves presented an added difficulty because the switches are small and it wasn't easy to feel their position. But experience and improvements in the gear have contributed a lot toward resolving all these problems.

"The first couple of sorties, I didn't like the gear at all. By the third or fourth flight, it was still uncomfortable but I found I was more comfortable with my ability to perform the mission. I was already learning to adjust, to do things differently."

Major Gray has gained enough experience to fly combat tactics in the CWD gear.

"On one mission, where we did an air refueling and flew low level, I was barely aware of the gear affecting my mission accomplishment. I've modified the way I work in the cockpit to compensate for the gear. For two weeks before that mission, I'd flown quite a few sorties and I could really feel the experience paying off."

TAWC will conduct operational tests of a complete new integrated system in 1984. The Integrated Chemical Defense System (ICDS) will include a new helmet, mask, shroud, and oxygen system among other modifications. The basic system is designed for everyday use and aircrews will add chemical protection as the threat dictates.

"To the best of our knowledge," says Major McClure, "The CWD ensemble works *if worn properly*. It has been tested against live agents (not at Eglin) and has proved effective. If all the parts fit and are worn properly, it will protect against all known chemical agents." ■

The following aircrew chemical defense ensemble emergency operation procedures have been extracted from T.O. 14D1-2-1 for information only. Everyone who flies with the CWD ensemble should be thoroughly familiar with all the procedures in this T.O. and/or your aircraft dash 1. continued

CWD Gear continued

Aircrew Chemical Defense Ensemble Emergency Procedures

PRE-EJECTION/BAILOUT

WARNING: Do not delay ejection or bailout for the following procedures if conditions dictate.

1. Take the hood off before initiating ejection or bailout, unless you're in a contaminated area, then keep it on.
2. Force the CBO mask retention strap bayonets (if equipped) into the receiver assembly as far as possible.
3. Tighten the helmet chin strap.
4. Ensure the filter pack carrying straps are tight.
5. Activate the emergency oxygen bottle as required (if not automatically activiated).

POST-EJECTION/BAILOUT OVER LAND

Over land, perform all normal procedures except for removal of the hood, mask, helmet and filter pack. Keep these on through the parachute landing until you can determine contamination levels. CAUTION: Reinstall the filter pack, antisuffocation coupling or depress the end of the CRU-80/P inlet valve, otherwise, your breathing will be restricted.

HEADGEAR REMOVAL AFTER LANDING (No Contamination)

1. Separate the hood straps (if equipped) and separate the Velcro on the front of your hood. Pull the hood off from back to front of the helmet.
2. Disconnect the right bayonet (if equipped).
3. Disconnect the helmet chin strap.
4. Remove your mask and helmet simultaneously by grasping the nose of the mask and pushing up from front to back.
5. Disconnect the mask from the filter pack and discard.
6. Disconnect the filter pack from the harness attaching bracket and harness chest strap, and discard it.

POST-EJECTION/BAILOUT OVER WATER, SUFFICIENT ALTITUDE

Sufficient Altitude — 7,000-14,000 feet.

1. Perform the normal canopy check.
2. Lean back, separate the Velcro on the hood front. Pull the hood off from back to front and discard it. If it hangs up, take it off with the helmet.
3. Disconnect the right bayonet.
4. Disconnect the helmet chin strap.

Since pilots only fly in the partial gear, these chemical defense ensemble emergency procedures are only applicable in worst case situations, i.e., war. The cautions, notes, and warnings, however, are important for peace time flying as well as during war.

5. Remove your mask and helmet simultaneously by grasping the nose of the mask and pushing off from the front to the back. If you encounter resistance, check if the bayonet/chin strap has been released.
6. Disconnect your mask from the filter pack.
7. Discard your mask and helmet.
8. Check/deploy your survival kit.
9. Activate the life preservers and connect the Velcro.
10. Perform the four line modification.
11. Place hands on the releases and prepare for release after entering the water.

WARNING: If, during water drag, you encounter difficulty releasing, be prepared to grasp the riser above the release to remove tension and effect release.

POST-EJECTION/BAILOUT OVER WATER, LOW LEVEL ESCAPE

1. Activate the life preservers.
2. Place your hands on the releases and prepare to release after water entry.

NOTE: You can remove your head gear and activate the survival kit after entering the water.

WARNING: You will be unable to breath approximately one minute after the filter pack submersion/water saturation. If your head gear gets hung up, you can gain extra breathing time (in the water) by disconnecting the mask hose from the filter pack and holding the hose end out of the water.

POST-EJECTION BAILOUT, IMMEDIATE WATER ENTRY

1. Place your hands on the parachute releases and be ready to release after you enter the water.
2. Activate the life preservers.
3. Take off your head gear and activate the life raft.

CAUTION: Try to remove the filter pack. If you can't, be careful as you climb into your life raft since the pack has sharp edges.

WARNING: Be aware of the filter pack's antisuffocation coupling and its function.

NOTE: You should experience the antisuffocation coupling function during training.

ILS Frequency Congestion?

Chances are you have seldom planned precision approaches from opposite ends of the same runway and compared what you found. Then this true story of an inflight emergency may hold a surprise for you.

Single Frequency — Multiple Occupancy

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106th Aerospace Rescue
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Suffolk County Airport
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■ We had just begun the second leg of a helicopter IFR training flight when we encountered a critical in-flight mechanical emergency. We either had to land Jolly 83 as soon as practical or we would be faced with an autorotation in IMC. In the process of safely returning the aircraft to VMC and to the ground, we discovered a "Murphy" in the system that could have adversely affected our safe recovery.

We were cleared for a RWY 24 departure from McGuire AFB. During departure brief, my crew and I set up for an ILS 24 to McGuire as an emergency return. The localizer 110.1 (I-JTQ) was tuned and identified and a 237° course was set in the CDI. Both pilots' radar altimeters were adjusted to reflect the correct HAT.

On climbout, while passing 3,000 feet 10 NM southwest of McGuire, we observed the number two torque go to zero. Shortly thereafter, a large oil leak from the main transmission was observed which was spewing oil into the cabin and out the right side of the aircraft. Loss of transmission fluid requires the crew to land as soon as practical. Depending upon where the leak occurred, it would normally allow a 1.5 gallon emergency sump to provide lubrication to the gear box high speed inputs.

If so, we had approximately 30 minutes to find a safe place to land. But if both torques were lost, it meant the emergency sump was lost and an immediate autorotation was required. Besides having the number two torque at zero, the number one torque was providing erroneous readings and fluctuations of ± 10%. It was readily apparent that the 1.5 gallon emergency sump was being pumped overboard and that an autorotation was imminent. continued

ILS Frequency Congestion:

Single Frequency — Multiple Occupancy continued

The problem is that the number of ILS instrument approaches exceeds available frequencies. In an effort to solve this "ILS frequency congestion" problem, ATC has set up ILS approaches to opposite runways (or reciprocal runways) on the same localizer frequency.

The likelihood that Jolly 83 would be able to fly the 20 NM to set up for the ILS 24 and then fly 10 NM back to the field on the ILS 24 — approximate distance 30 NM — seemed remote. We declared an emergency, then requested a lower altitude and vectors for an emergency descent for an IFR return to McGuire. We also requested and were given clearance to make a 180° turn in order to return to the vicinity of the base. The current weather at McGuire was reported as a 400-foot overcast, one mile, with three-tenths of the field obscured in fog. Approach control was extremely busy and, to make matters worse, there was a Husky 83 on the frequency.

The similar sounding call sign plus the verbal congestion of about 10 other aircraft did not help the situation. Sensing that time was of the essence, I directed the copilot to set up for an ILS RWY 6 approach. Because of radio congestion, ATC directed the Jolly to change from VHF departure frequency to a UHF frequency. When Jolly 83 came up on the UHF frequency we encountered a UHF radio failure and were unable to transmit or receive.

During the time that VHF communications were being reestablished, the copilot had set up for an ILS to RWY 6. Approach plates were opened to the correct page, the inbound course was set in the CDI, the localizer was observed to be set at 110.1 and as the copilot checked the ID he received an audible set of "Dit-Dahs." He informed me that he had a good ID. I did not observe any off warning flags on the CDI.

The indications on my CDI showed that the course was off to the left and that we were paralleling course. We made a left turn to a northwesterly heading to intercept the course. Jolly 83 maintained this intercept for a short while, anticipating a quick intercept and a right turn for the ILS 6. At this point, I became suspicious of the ILS reliability. I felt the in-flight winds were not strong enough to require the initial left turn. Based upon the aircraft's headings and directions of turns since initial take off, the ILS course should be off the right side of the aircraft.

When the aircraft failed to intercept the course after a very short time, we became concerned that, although we had a "good ID" and no off flags, for some unknown reason we were receiving erroneous information. So, we proceeded direct to McGuire TACAN still anticipating being forced to autorotate in IMC conditions. Finally, we were able to reestablish VHF communications.

Once we reestablished communications we requested a modified PAR approach to RWY 24. During this sequence an audible rumbling (metal-to-metal) was emanating from the unlubricated gearbox. The GCA controller essentially vectored the crippled Jolly over the PAR missed approach point at 2,000 feet and gave it a right 180° turn advising the crew that they were well above glide path, approaching the missed approach point. During this descent, I felt yaw kicks, and the flight engineer observed number one torque at zero. These indications now meant an autorotation was required. Fortunately, Jolly 83 was already in a descent similar to autorotation in an effort to capture the PAR glide slope. The aircraft broke out of IMC at 250 feet AGL over the approach end of RWY 24. We made a power on landing and shut down immediately.

Two days later, I returned to McGuire to investigate the mechanical aspects of the mishap. I stopped by the RAPCON facility to deliver my sincere thanks to the GCA controller. In talking to the Tower chief, I explained the sequence described earlier. From this discussion I found the reason for my "erroneous ILS indications."

Because of the density of aerodomes (civilian and military) in the northeast U.S., there is an unusual number of ILS approaches in one particular area. The problem is that the number of ILS instrument approaches exceeds available frequencies. In an effort to solve this "ILS frequency congestion" problem, ATC has set up ILS approaches to opposite runways (or reciprocal runways) on the same localizer frequency.

In reality, there are two separate pieces of ILS equipment on the same localizer frequency. Only one ILS can be operated at a time and this is controlled by ATC (either in the tower or at RAPCON). It is like having two separate residents at one address. The only way to distinguish which one is operating properly is to check the Morse Code identifier. Each ILS residing on the same frequency has a different four-letter identifier.

During our instrument sortie, we experienced a condition that initially meant we had to land as soon as practical. Based upon cockpit indications, this initial condition was rapidly evolving into an immediate autorotation situation. Without instrument guidance, autorotation in a weather condition with ceilings as low as 250 AGL and areas obscured in fog is extremely hazardous. In this situation, obstruction clearance or a safe emergency landing area could not be guaranteed.

While trying to regain VMC and experiencing a radio failure, Jolly 83 attempted to fly an ILS RWY 6 at McGuire. The copilot during the "heat of the battle" heard an audible but incorrect set of Morse Code identifiers. The pilot did not observe any off warning flags and, in fact, there were none. Partly because of the radio failure, ATC was unaware of the Jolly's urgency to regain VMC. Consequently, they continued operating from RWY 24, and thus were unable to set up for ILS RWY 6. Jolly 83 was unaware of the fact that there could be more than one ILS on the same frequency and that only one could be operated at a time.

When Jolly 83 tuned in the front course for what was thought to be the ILS RWY 6, we found we were receiving back course information from ILS RWY 24. We were unknowingly flying a back course unpublished approach with the back course heading (instead of the front course) set.

Fortunately, we were all aware of our position and reasoned that we were receiving improper course guidance. It is difficult to say what would have happened had we failed to detect this situation. I am certain that Jolly 83 was moments away from making an IMC autorotation. If we had continued with the incorrect intercept, it is evident that because of the lack of lubrication in the main gear box, we would have had to autorotate somewhere over Fort Dix, New Jersey.

It is true that Jolly 83 should have checked for the correct Morse Code identifier, but during this emergency, we were all extremely busy. Because of the cockpit workload, the copilot equated an audible set of Morse Code identifiers with reliable navigation. Unfortunately, the audible ID was for ILS RWY 24 and not ILS RWY 6.

This "ILS frequency congestion" problem (two or more separate residents at one address) should be briefed to all aircrews. In this particular situation, IMC conditions and low ceilings, main transmission problems, similar sounding call signs, radio failures, and ILS disparities, all helped to prove that Murphy's Law still exists. Not only is it true that what can go wrong will go wrong, but what has gone wrong once, could go wrong again.

In this situation, it cost our crew valuable time while trying to safely recover an aircraft. What would have happened if there had been a mountain in the area where Jolly 83 attempted to make the erroneous intercept? Is it possible for a controller to inadvertently switch the equipment from ILS RWY 24 to ILS RWY 6? In my opinion, it is possible for this type of anomaly to recur. Flight crews should be cautious when identifying an ILS and ensure the correct Morse Code identifier for the intended ILS is being received.

A review of AFR 60-5 indicates that in some cases ILS's on opposite ends of the same runway with different frequencies do not

continued

have the interlock feature and, consequently, allow for simultaneous operation (i.e., Griffiss AFB, NY). Normally, simultaneous ILS operations in opposite directions would create an air traffic control nightmare and would not be feasible. However, since the Air Force does not publish ILS Back Course Approaches for Air Force bases, an ILS to the reciprocal runway could provide a distressed aircraft an abbreviated and excellent means to use a precision approach as an emergency return to the field.

Although our crew was technically correct in briefing an ILS RWY 24 as an emergency return to McGuire, in flight we became suddenly aware that because of the nature of our emergency we did not have the capability to fly the published ILS to the active runway (RWY 24). (Jolly 83 was only equipped with a TACAN and an ILS. It was not equipped with a VOR.)

In retrospect, it may have been a good idea to attempt a TACAN approach to RWY 6 during this combination of transmission troubles and radio difficulties. The obvious advantage would be that we would not have had to retune and identify the station. (This is not completely correct since Jolly 83 had COYLE TACAN tuned and identified anticipating a turn after reaching 4,000 feet.) We would only have to reset the CDI and readjust the radar altimeter. The main disadvantage to this idea would be the fact that the minimums for this approach were 428 feet AGL — Jolly 83 broke out at 250 feet AGL.

The main problem with the ILS single frequency multiple occupancy syndrome is awareness. After conducting an informal survey of my fellow aviators, I found many pilots unaware of the fact that two separate ILS's for the same airport could be on the same frequency. I would say that this is due in part to the fact that aircrews do not normally make a comparative analysis of opposite direction ILS's. Most normal instrument flight planning sessions include an in-depth study and comparative analysis of instrument approaches in the same direction. Pilots do not normally plan for precision approaches from opposite directions.

The other problem is the misconception or myth which exists among Air Force pilots that only one ILS is on a particular frequency. The frequency range for ILS is 108.10 to 111.9, graduating on odd tenths. As a result, there are only 20 ILS frequencies that can receive precision approach information.

A study of the ILS approaches associated with the three major metropolitan New York airports shows that there are 13 ILS approaches on six different frequencies. The three ILS's at Newark are all on the same frequency but each has a different Morse Code identifier — two parallel and one opposite direction. Kennedy has three ILS's on one frequency; the combination here is opposite end of each parallel runway and an intersecting runway (RWY's 4L, 22L, and 31L.)

In response to the anticipated critical comments from the Monday morning quarterbacks, I agree the underlying lesson to be learned is tune and identify properly. An audible set of Morse Code identifiers on the assigned frequency does not necessarily mean the correct or intended ILS is being received properly. In defense of my copilot during this emergency, I felt he did a great job. Given the same set of circumstances, I'm certain I would have also equated an audible ID as being a "good ID." The problem was that it was difficult to listen and interpret Morse Code soundings while a grumbling, grinding, and groaning sound echoed from an unlubricated gearbox.

It would have been much easier to gloss over this aspect of my inflight emergency and not "tell the world" about the pecularity that we discovered; However, I feel it is very important to share the lessons learned from the incident with other aircrews. To learn of this ILS anomaly by reading about it in a magazine is considerably easier than learning about it in flight. ■

JOHN F. KENNEDY INTERNATIONAL AIRPORT NEW YORK			
ILS	41L	110.9	I - H 1 Q
ILS	4R	109.5	I - JFK
ILS	13L	111.5	I - TLK
ILS	13R	NO ILS	Blank
ILS	22L	110.9	I - IWY
ILS	22R	109.5	I - JOC
ILS	31L	110.9	I - MOH
ILS	31R	111.5	I - RTH
LA GUARDIA AIRPORT NEW YORK			
ILS	4	110.5	I - LGA
ILS	13	108.5	I - GDI
	22	110.5	I - URD
NEWARK INTERNATIONAL AIRPORT NEW JERSEY			
ILS	4L	108.7	I - EWR
	4R	108.7	I - EZA
	22:	108.7	I - LSQ

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UNITED STATES AIR FORCE

Well Done Award

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

FIRST LIEUTENANT
Scott L. Wheeler

FIRST LIEUTENANT
William A. Meyer, III

18th Tactical Fighter Wing

■ On 7 September 1982, First Lieutenant Wheeler and Captain (then First Lieutenant) Meyer, were in an RF-4C egressing from the range after the final target run of a tactical reconnaissance mission. After reaching their planned cruise altitude for return to base, Lieutenant Wheeler noticed an unusually large fuel decrease — from 4,800 pounds to 3,800 pounds. Checklist procedures were accomplished in an attempt to stop the fuel loss, but the source of the leak could not be determined from cockpit indications or from external observation. Fuel flow indications were normal. Total fuel quantity was decreasing 100 pounds every 20 seconds, and power reductions appeared to have no effect on the fuel leak. With home base 67 miles away and total fuel 2,500 pounds, Lieutenant Wheeler turned toward the nearest suitable divert field which was 30 miles to the south. The Tower was contacted and an emergency declared. Lieutenant Wheeler maintained 350 knots and proceeded directly to a position for a modified base turn to final. The turn to final was started at 300 knots, with 600 pounds of fuel remaining. Touchdown was normal, with less than 30 seconds of flight time. During landing roll, the left engine flamed out, and 10 seconds later the right engine flamed out. Post flight inspection of the aircraft showed a major leak coming from the left auxiliary air door area, with fuel streamed along the underside of the aircraft. Lieutenant Wheeler's recognition of a serious emergency coupled with Lieutenant Meyer's timely direction and assistance probably saved a valuable aircraft and possibly prevented loss of life. WELL DONE! ■

USAF SAFETY AWARDS

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Major Phillip G. Anderson
832d Air Division
Luke AFB, AZ

Major Anderson experienced an extremely complex emergency while flying an F-104 functional check flight on 26 February 1982. While performing an afterburner climb to 41,000 feet the throttles stuck and power could not be reduced. Through outstanding airmanship he was able to descend from altitude and successfully land the aircraft.

Major Stephen S. Brown
9th Strategic Reconnaissance Wing
Beale AFB, CA

Major Brown was flying a night training mission in a U-2 aircraft when the flight controls of his aircraft froze in the fore and aft position resulting in complete loss of elevator authority. Through outstanding airmanship, he accomplished a night landing in crosswind conditions by using power and stabilizer trim to successfully land the aircraft.

Captain Paul H. Vanzandt
81st Tactical Fighter Wing
RAF Bentwaters, UK

As Chief of Flight Safety for the 81st TFW, Captain Vanzandt contributed significantly to important overall improvements in the safe operation of the A-10 aircraft and to flight safety in general.

Staff Sergeant Michelle Stonoff
355th Tactical Training Wing
Davis-Monthan AFB, AZ

As Flight Safety Technician, 355 TFW, Sergeant Stonoff identified aircraft towing procedural problems, developed a program for use of power equipment, and contributed significantly to improved flight line safety.