flying

SAFETY

NOVEMBER 1983

Portrait Of A Pilot

Let's Hear It For The Heavies

Hypothermia Missing in the Atlantic

How Could Anyone Survive?

THERE I WAS

■ It was a clear Texas night, and I was looking forward to an easy mission with a good student. Since I had moved up to wing staff, I was not getting as much flying as I used to. In fact, if I didn't fly this mission tonight I would be non-current.

There was no problem as we breezed easily through the preflight, start, and takeoff. The cruise to the working area was beautiful with the stars bright overhead and the lights twinkling on the ground.

After we had done our area work, we returned to the pattern for some touch and goes. During the penetration I noticed some wispy clouds, but nothing to bother us. They just made the stars a bit dimmer.

The first few landings went very well, but then the pattern began to get crowded. There were some initial solos in the pattern, and this was slowing things down. On our fifth pattern we were behind a solo. He was slow turning final, so we had to break out. I was a bit angry at the missed pattern and pulled up very aggressively to break out and proceed to the re-entry. I found the point and started a hard pull down to pattern altitude again.

When I went to level off I seemed to be having trouble with the aircraft. The horizon had disappeared in the haze and the lights on the ground blended with the stars. I had no idea whether I was right side up or upside down. My student appeared to be just as confused. I went to the gauges and willed myself to believe them.

We recovered, and I got things back under control. I don't know how low we got, but my student says that he could make out the plants in the fields under us.

I'm a believer in spatial disorientation now and make sure I keep my proficiency up. ■

UNITED STATES AIR FORCE

flying

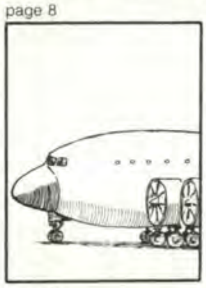
SAFETY MAGAZINE

AIR FORCE RECURRING PUBLICATION 127-2 | NOVEMBER 1983 | VOLUME 39, NUMBER 11

AFRP 127-2
Entered as a publication at the Second-Class rate (USPS No. 586-410) at San Bernardino Postal Service, 1331 South E Street, San Bernardino, CA 92403

page 2

page 8



page 12

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

SUBSCRIPTION — FLYING SAFETY is published monthly to promote aircraft mishap prevention. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished. Use of funds for printing the publication has been approved by Headquarters, United States Air Force, Department of Defense, Washington, D.C. Facts, testimony and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payments can be made for manuscripts submitted for publication in the FLYING SAFETY Magazine. Contributions are welcome as are comments and criticism. Address all correspondence and, Postmaster: send address changes to Editor, FLYING SAFETY magazine, Air Force Inspection and Safety Center, Norton Air Force Base, California 92409. The Editor reserves the right to make any editorial change in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will ensure complete accuracy of material amended in light of most recent developments. The contents of this magazine are non-directive and should not be construed as regulations, technical orders or directives unless so stated. Distribution: 1 copy for every 3.0 aircrew and aircrew support personnel.

Portrait Of A Pilot

■ **How do you log 7,700 mishap-free hours of single-seat fighter time as a test pilot, instructor pilot and fighter pilot complete with Mig kills to your credit, and still retain mission-ready status in the A-7 at age 56? Colonel John Marvin, Air National Guard advisor to the AFISC commander reveals his own strategies.**

CECILIA PREBLE
Assistant Editor

■ How do you log 7,700 mishap-free hours of single-seat, single-engine fighter time as a test pilot, instructor pilot, and fighter pilot complete with MIG kills to your credit, and still retain mission ready status in the A-7 at age 56? Colonel John Marvin, Air National Guard advisor to the AFISC commander reveals his own strategies.

At the tender age of 8, after his first flight in a Ford Tri-Motor, John Marvin charted the course of his life. "I knew then I wanted to be a pilot." Shortly thereafter he saw the movies "Test Pilot" and "Wings" and knew he wanted to become a test pilot and, or fighter pilot.

At 15 he earned his private pilot's license. Forty years and 8,400 hours later, as Air National Guard advisor to the commander of the Air Force Inspection and Safety Center, Colonel John Marvin can still say, "I have never had a flight mishap."

Colonel Marvin is a decorated veteran who scored two MIG kills in 100 missions over Korea. He spent 17 years of his career as a test pilot flight testing Air Force aircraft for North American Aviation, Mitsubishi Heavy Industries, and Republic Aviation, Inc. Just to liven things up, he also served as an Air Force combat crew instructor pilot at Nellis AFB during the Korean conflict and has also flown many hours as an Air National Guard fighter pilot. He logged 7,700 hours of his mishap-free time in single-seat, single-engine jet fighters. He has also flown 1,500 hours in various light aircraft. All told, he has flown close to 10,000 mishap-free hours in 52 different aircraft models. And he's still flying.

To what does he owe this success?

"I thought you'd never ask," he says, grinning. Part of his formula is so simple, it's easily overlooked. But he swears by it, and it's tough to argue with the evidence.

To a great extent, Colonel Marvin attributes his longevity and safety record to the professional instruction he received in flight training. "I was fortunate in my basic and advanced flying training to have excellent instructors who were combat seasoned. They passed their experiences on to me

ROLLA DAILY NEWS

United Press Wire Service — NEA Pictures and Features — Exclusive NEA Teleph otos—Largest Circulation in Phelps County

ROLLA, MO., THURSDAY, APRIL 10, 1952

Rolla Man Gets Second MIG In Korea

FIRST LIEUT. JACK MARVIN, son of Col. and Mrs. George Marvin of Rolla, is shown in above photo stepping from his jet plane after getting his second Communist MIG in the Korean war. He has now completed more than [illegible] missions over enemy-held territory, and his parents were informed recently that he had shot down his second plane. Lt. Marvin flies one of the U. S. Air Force F-86 Sabrejet planes, and is a member of the 4th Fighter Interceptor Wing. He is stationed at a base [illegible] miles behind the front lines. He is shown above, still in his "man from Mars" suit, complete with crash helmet. Another Marvin son, Capt. Frank Marvin, is stationed at the U. S. Military Academy at West Point, and is a flying instructor. The boys' father, Col. Marvin, is Professor of Military Science and Tactics at the School of Mines. They live at 9 Summit Avenue here. —U. S. Air Force Photo

on the ground and in the air. Three of my F-80 instructors were members of the Acrojets, the first official Air Force jet demonstration team. You can't get much better than than!

"After graduation, in June of 1949, I was assigned to the 27th Fighter Squadron at March AFB, California. Practically all of our pilots had fought in the big war, WWII. These were the people who were filling my head with valuable data that helped me survive the young inexperienced years, which are so critical, and now the old experienced years. I'm still in the business of survival and take my personal survival pretty seriously.

"Even though today our instructor pilots may not be as experienced as mine were, we must be doing *something* right because the accident rate has gone down from 36 when I graduated in '49 to 2.33 last year."

Much of the credit for Colonel Marvin's long, unmarred record is his. He has been careful about his health and enthusiastically advocates regular exercise, balanced diet and sufficient sleep.

"It's important to establish habits that will produce a healthy

continued

Portrait Of A Pilot continued

body and sound mind. Just like any mechanical device, the body must be fed the proper fuel and must be exercised on a regular basis so the components don't deteriorate,'' he says, adding, ''You also need periodic preventive maintenance. We weren't designed to withstand high G forces and the rigors of flying high-speed aircraft at extremely low altitudes, so a healthy, well functioning body is essential, as is a well functioning mind.''

Nor does he equivocate on bad habits.

''I feel very strongly that there are two socially acceptable practices that are counter-productive to good health and a good safety record. One is drinking and the other is smoking. Flying any type aircraft requires mental agility and good coordination. It is a well proven fact that alcohol and nicotine have detrimental effects on the brain and the body; so why abuse one of the greatest assets we have going for us as pilots — our health! I've been around too long to be so naive as to think I'll change any of the habits of you old heads out there who have survived despite yourselves, but maybe you young guys who drink and smoke will do it with some degree of moderation.''

This philosophy has kept Colonel Marvin in shape to fly the most demanding of combat profiles in the A-7 and still feel at peak efficiency while doing it, even at 56 years old.

''I feel extremely blessed and fortunate to still be flying. I guess the bottom line is if you want to be a 56-year-old, mission-ready fighter pilot, you've got to pay attention to all these things early in your career. You can't start at

Flying proficiency is a direct product of flying experience. Col Marvin attributes much of his success to the amount of mission related flying he received. This experience paid off for him in Korea where he shot down two Migs and damaged four.

age 56."

Just because Colonel Marvin never had a mishap doesn't mean there haven't been close calls. On one occasion, flight testing an F-86D (over the California coast) proved harrowing.

"I was up at 47,000 feet, making some speed runs, when the engine flamed out. I was about 80 miles from Fresno and couldn't get an airstart. Something had failed in the fuel control system. The canopy frosted over because I didn't have an air conditioner or defrost. Then the radio went out. I tried to conserve the battery — I'd turn it on, then off when I didn't need it. But then I lost the battery and all communications. With the canopy and windscreen frosted, the engine windmilling and minimal instruments, I had great difficulty maintaining my attitude and aircraft control. As I descended, the windscreen and canopy finally cleared. My main objective was heading for Fresno and getting it back on the ground. Fresno was home base, and I was familiar with the runways. Meanwhile, I took the opportunity to try a few more air starts, which didn't take. I managed to glide it back, dead stick it into Fresno, and pop the drag chute with no problems."

Another incident was more unnerving than it was dangerous.

"Once, when I was flying with the 27th Flying squadron, we were out doing some dog-fighting, one-on-one, my flight leader and I. I was sitting there, pulling max Gs, coming around the corner and trying to get on his tail, and just about that time, I heard a loud bang and felt myself falling and hitting the bottom of the airplane — hard! Then I was blinded by fluid in my eyes. I thought the plane had exploded, and I was bleeding profusely from a head wound, but as it turned out, the hydraulic seat had let go and bottomed out on me. Being as short as I am, I ride with a pretty high seat, so it had quite a way to drop. When the hose came loose, the hydraulic fluid squirted all over me. It was more disconcerting than serious. When I finally figured out what happened, there was no way I could get the seat back up so I had to undo my seat belt and kind of stand up to see where I was going. But when I stood up, I found my vision was greatly impaired by the irritation of the hydraulic fluid in my eyes. But as all good stories go, I regained just enough of my vision to make out shapes and discern the ground from the air and land safely back at March."

Colonel Marvin learned from these glitches and many others which he experienced because of the extensive cockpit time he built up. He cites the numerous hours pilots were permitted to fly as another advantage which has made him a safer pilot.

"We were able to go out and get enough experience in the airplane to make us safe pilots. I feel the more flying time you get in the weapon systems you're

continued

Being a fighter pilot is demanding and requires both physical and mental conditioning. In this business you seldom get a second chance.

You have to learn the basics first. Col Marvin attributes his survival in large part to the good flying habits he learned in pilot training. Without a solid foundation of flying skills, you cannot master the complexities of a fighter aircraft and mission.

Portrait Of A Pilot continued

current in, the safer you're going to be. We were not limited in flying time then. I recall back in the 27th FS, one month I got 120 hours of flying time. In fighters, that's almost unheard of. And as a combat crew instructor at Nellis, I averaged between 70 and 80 hours a month. That wasn't just flying around the flag pole, it was mission flying, going out and dropping bombs, shooting the guns and dogfighting."

The practice paid off. When Colonel Marvin entered combat in Korea, he had already logged 650 hours in the F-86, whereas "the average MIG pilot had about 5 hours in the MIG when he went into combat.

"The MIG pilots had a real morale problem. At times they'd sit on the ground for days without coming up to fight. So we would have to try to agitate them to the point where they'd come up and do battle with us.

"I was fortunate enough to get into a couple of engagements where I was able to shoot down two of them and damage four. At the time we had a 14-to-1 kill ratio (14 MIGs were destroyed to every F-86 lost). I attribute that basically to our superior pilots, our training, and to the F-86, which was one fine airplane."

Another positive aspect of Colonel Marvin's career has been his home life. He has always enjoyed the full support of his wife and family.

"My wife agreed wholeheartedly with me that the more flying time I could get, the safer I would be and that she'd be assured of having a long life with me. That was certainly uppermost in her mind. She never worried about me, which really helped me. I didn't have to worry about her worrying. She felt I was a competent, safe pilot.

"Domestic problems will certainly affect your ability to program your thoughts and to really become an integral part of that flying machine. If your mind is somewhere else, thinking about other things that don't pertain to the mission at hand, such as domestic problems, obviously something is going to slip by, and it could be disastrous. To a great extent, I owe my longevity to a very happy home life as well as a very supportive family."

Colonel Marvin also have strong religious convictions from which he says he has derived strength and support. As a man of conviction naturally he also expresses strong sentiments about the Air Force. He has observed numerous facets of Air Force flying throughout his service and has his own opinions on its shortcomings and its assets.

"I love the Air Force and the Air National Guard and find very little to criticize, but there are some areas I think we can improve on regarding flying safety.

"The most serious flight safety problem is still in the fighter community. When you look at the statistics, three fourths of our mishaps are in fighters.

"The number one cause of our problem in fighters has to do with the pilot's ability to fly the airplane — the main problem being loss of control of the aircraft. This means that pilots are either not capable of coping with the situation from a physical standpoint, or from a mental standpoint. Diversion of attention is a major factor here. It may be a matter of concentrating too much on an emergency and forgetting to fly the airplane, looking at a computer too long, or being engrossed in looking at the airplane that's trying to get at their 6 o'clock and not paying attention to their control inputs. Pilots should know the airplane so well that they can listen to it, so to speak.

"An airplane *speaks* to me. I asked one young pilot who had lost control and jumped out of one, 'didn't you hear the airplane talking to you?' He didn't know what I was really talking about. The point is that airplanes *do* talk to you. The old concept of feel is different in the Eagle jet and the Electric jet. I know you can't feel those airplanes the way you can the A-7. But if you consider the other aspects of flying besides trim feel, you can still approach this concept. What I mean is, you've got to be so integrated with the machine that you're a part of it, you're an extension of the aircraft and its systems. That's how you'll know the aircraft is talking to you.

"We've got to teach our pilots that you have to become part of that airplane and not just someone who mechanically moves the controls depending on certain flight conditions. The pilot must move them by instinct.

"One can become so mechanical in one's approach to flying that really understanding the aerodynamics of the airplane and how they can become an integral part of the loop is somehow lost.

"Our next big problem is collision with the ground, which goes along pretty much the same lines as diversion of attention. We can't prove it in most cases because the pilot isn't around to talk to, but we have reasons to believe that diversion of attention is one of the big factors in collision iwth the ground. Pilots are just looking at the wrong time.

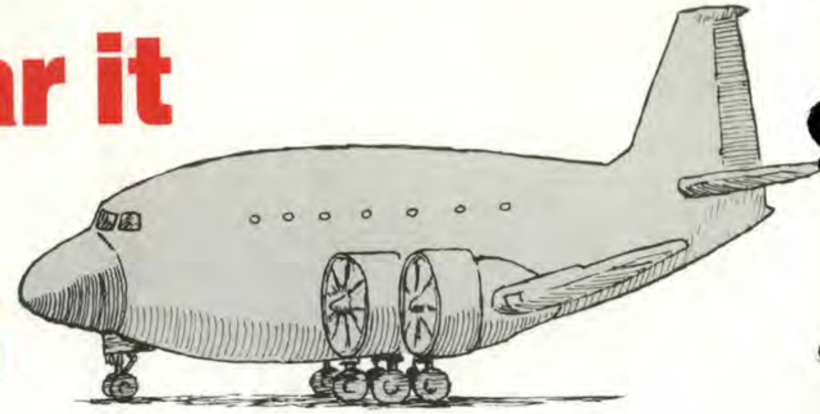
"A good example of this is the fact that in many of these collisions with the ground, the pilot is turning and looking. That's something you don't want to do. What I mean by turning and looking is looking behind, or above, looking for the leader or wingman, for the bogie. This is fine, usually, for overall situational awareness, but when you're at an altitude of 100 to 500 feet — that's not the place to be doing it. If you're turning the airplane, you want to make sure you know the flight path of the airplane, where it's going to be at that instant, one second from now, two seconds from now, and so on, and that's where you have to be looking. Your mind has to project on out as to what's going to happen, and you have to know what the airplane is doing right at that moment. This is where being an integral part of the loop comes in. If you're just sitting there along for the ride, you're probably going to end up a smoking hole, as many do.

"So those, I feel, are our biggest problems in safety. If we could eliminate those two things right there, control loss and collision with the ground, we would cut our accident rate down tremendously."

The Air Force program Project Warrior is designed to get Air Force people to think more deeply and seriously about our number one job — being ready to fight. Safety has a big stake in such an effort. Our goal is preserving the resources necessary to fight. We learn from experience, and the experience of a pilot like Colonel Marvin is invaluable as a guide to good flying safety attitudes. ■

One of the most serious flight safety problems in the fighter community today is pilot loss of control. Whether it's due to failure to cope with the situation, inattention, or whatever, correcting this problem should be our number one objective in flight safety.

Let's Hear it for the HEAVIES



MAJOR JOHN E. RICHARDSON
Editor

■ Now and then I receive complaints that *Flying Safety* does not give enough coverage to "big" airplanes. Since *Flying Safety's* objective is to provide mishap prevention information, we naturally focus on those areas where the majority of mishaps occur. Consequently, the "heavies" do not receive nearly the attention directed at their smaller tactical cousins.

I must admit that big airplanes do have mishaps, and I have collected a cross section of these from the AFISC files. The collection is instructive for it points out two or three factors which appear consistently in big airplane mishaps. So, in the interest of fair play — if not exactly "equal time" — I present the following information. These mishaps do not cover all the areas in which multiengine aircraft have had problems. Instead, I have concentrated on three areas which historically have been common factors in mishaps and which aircrews can directly address. These are failure to follow procedures, crew rest, and inattention.

Failure to Follow Procedures

▪ A B-52 was cleared for takeoff, and the start of the takeoff roll appeared normal to observers on the ground. Then, shortly after passing the 2,500 foot point on the runway, the aircraft veered abruptly to the right departing the runway. It traveled about 2,000 feet before exploding.

During the preparation for takeoff, the copilot failed to open the fuel crossfeed valves for the main tanks as required since tanks 1 and 4 were in a low fuel state. The IP did not notice this error prior to takeoff. At some time, one of the fuel boost pumps failed and was not detected. As a result of the combination of factors — no crossfeed, boost pump failure, low main tank fuel, and rapid acceleration on takeoff — engines 7 and 8 lost power. The crew was unable to control the asymmetrical thrust condition, and the aircraft departed the runway.

▪ A KC-135 was launched in support of an ORI with a student AC in the left seat and IP in the right seat. Shortly after lift off with the AC flying, No. 1 engine lost power. The IP retarded the No. 1 throttle to idle and called for control of the aircraft, but the AC failed to relinquish control. He alternately resisted then aided the IP's inputs. The result was a series of yaw and bank oscillations culminating in an impact 2,500 feet past the runway, 24 seconds after takeoff.

Both the IP and AC were guilty of procedural errors. The IP violated T.O. emergency procedures when he pulled the throttle to idle at a very low altitude. His action contributed to the control difficulties. Of course, the AC's failure to relinquish control contributed to the crew's difficulties and may actually have aggravated the dutch roll problem.

▪ A B-52 was on an IMC enroute penetration when the pilot's ADI malfunctioned. Suspecting an electrical problem, the pilot directed the copilot to check the alternator panel rather than assist with aircraft control. The pilot lost control of the aircraft and rather than turn the aircraft over to the copilot, he directed bailout. The copilot and navigator ejected successfully before the aircraft impact.

The pilot's ADI had failed insidiously during the early portion of the descent. The copilot, busy with the descent check, was not monitoring the flight instruments. The pilot did not recognize the ADI failure, and when the failure became obvious, he misinterpreted the indications as an electrical problem. The copilot also failed to recognize the true nature of the problem and did not assist in regaining aircraft control.

▪ A C-130 was on a PAR monitored ILS approach. The controller gave the weather as ¼ mile, visibility RVR of 2,200 feet, below minimums for the approach. The crew contained the approach and at decision height attempted to go visual without sufficient visual cues. The aircraft struck the approach lights 1,100 feet short of the runway threshold. After impact, the crew was able to execute a go-around and recover successfully at their alternate with only minor damage to the aircraft.

■ Not all procedural errors are the fault of the crew flying the aircraft. A C-141 crew was cruising at 41,000 feet when the aircraft experienced a couple of sharp jolts. The pilot disconnected the autopilot. There were several indications of No. 2 CADC failure. The pilot then re-engaged the autopilot. There was another abrupt yaw to the right, so once again the pilot disconnected the autopilot and yaw damper.

The aircraft then entered a violent yaw to the left, and as the pilot initiated recovery the aircraft became uncontrollable, yawing violently from side-to-side with bank angles exceeding 90 degrees. The nose fell through to a near vertical dive before the pilots were able to regain control and level off at 16,000 feet.

The aircraft had a history of

continued

yaw problems. The test switches for the system were inoperative (unknown to maintenance), so when the system was tested it always checked OK. Two days before the mishap, the same crew experienced a similiar emergency in this aircraft.

Following this, maintenance, operations, and flying safety all failed to take proper action to ground the aircraft or file the proper mishap reports. As a result, the troubleshooting of the problem was inadequate, and it was not fixed.

There was also a problem with the Dash 1 in that the procedures for excessive yaw in flight were inadequate. This led the pilot to disconnect the autopilot and yaw damper resulting in the loss of control.

Crew Rest

■ A C-130 was ferried to the depot for scheduled maintenance. The aircrew entered crew rest in preparation for a night departure the next day. Everything was normal after takaeoff until about 200 feet AGL. Then the aircraft began a descent and struck the ground wings level, slightly nose high, 425 feet left of the runway and 650 feet beyond the departure end of the overrun. The aircraft exploded after impact.

The crew was scheduled for 24 hours of crew rest but did not make the best use of this time. A combination of fatigue, an illusory runway environment and low instrument proficiency (the pilot's flying time in the previous 90 days was the minimum amount for qualification) all contributed to the unnoticed descent after takeoff and subsequent ground impact.

■ A C-141 was returning from a long mission. The crew received and acknowledged an erroneous clearance and then descended below minimum terrain clearance altitude crashing on the side of a mountain. The crew had not had any significant crew rest in almost 28 hours at the time of the mishap. As a result of this fatigue none of the crew detected the Air Traffic Control error or the actual position of the aircraft in relation to the high terrain.

■ A command and control aircraft was scheduled to serve as a back-up airborne Command Post. As a result of inadequate planning and scheduling, the crew exceeded their maximum crew duty day. No crew augmentation was provided. When finally alerted, the crew experienced a further lengthy delay for servicing prior to takeoff.

The combination of fatigue and frustration over delays contributed to the aircrew's inadequate planning for departure. They elected to take off on a runway other than that originally planned to save time. They did not consider the high terrain off the departure end of the selected runway and struck the ground on departure.

Inattention

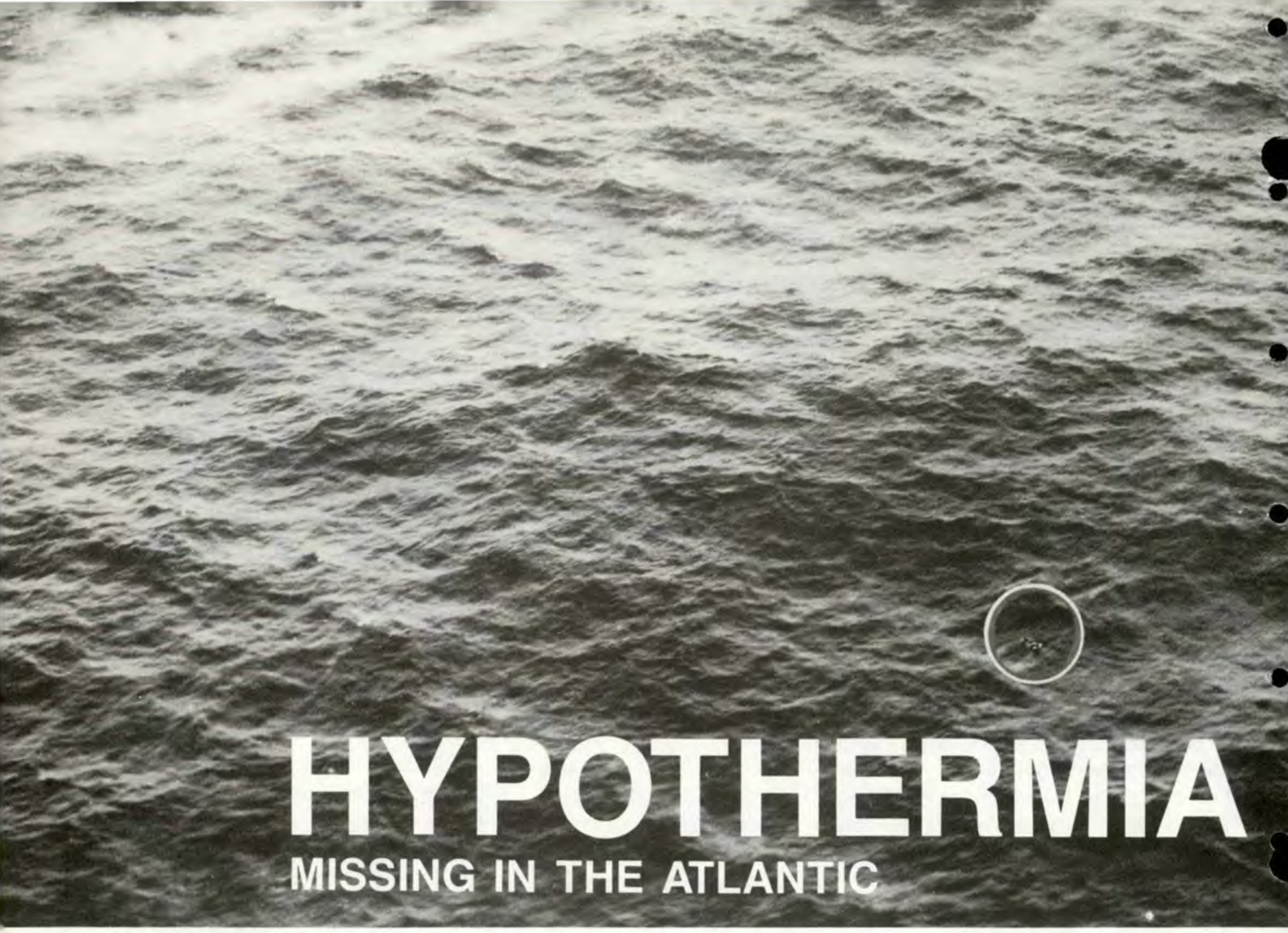
■ A C-130 was taxiing for takeoff at an enroute stop. While taxiing, the pilot's attention was diverted inside the cockpit to accomplish items on the before takeoff checklist. When he looked up the aircraft was angling left, so he corrected back to the right paralleling the left edge of the ramp. The engineer warned the pilot that he was too close to some obstacles on the left side. The pilot looked left but continued taxiing, estimating that the wing tip was clear. Just as he realized that the clearance was inadequate, the wing struck a light pole sustaining substantial damage.

▪ A KC-135 was returning from a mission and was descending on a TACAN/ILS approach. The crew was not paying attention to the details of the flight as evidenced by several omissions. The fuel off load had been reduced due to a smaller number of receivers. This made the KC-135 landing weight 5,600 pounds greater than normal. The crew did not communicate the overweight landing to the Command Post. Radio and radar contact with GCA was established passing 18,000 feet. Once the aircraft was established inbound, the aircraft was given a frequency change to approach monitor. The aircraft never made contact on the new frequency.

The investigators of the mishap found the altimeters still set to 29.92 rather than the proper altimeter setting. The crew had not contacted the weather station for current weather before beginning the penetration. The frequency change occurred just before the aircraft reached the minimum descent altitude for the sector of the approach it was on. The pilot continued descent below minimum safe altitude, undetected by the rest of the crew until ground impact.

▪ During a touch and go landing the IP on a C-141 raised the gear handle while still on the runway. Since the struts were partially extended, the gear began to cycle. The IP immediately put the gear handle down but the retraction cycle continued. The aircraft settled to the runway and slid to a stop.

This has been just a brief look at three problem areas. There need be no sermons or morals. The causes and corrective actions for mishaps like this are obvious to every crewmember. This article is designed as a reminder about where the problems are. ■



HYPOTHERMIA

MISSING IN THE ATLANTIC

SSGT ELIZABETH G. WARREN
3636 CCTW
Fairchild AFB, WA

■ The official report shows that at 2340 on the 14th of April 1882, the Titanic struck an iceberg and sank in water approximately 32°F. Only 712 of the 2,201 persons on board were able to leave the ship in lifeboats or to swim to a lifeboat. The rescue ship, Carpathia, reached the scene within one hour and fifty minutes and saved nearly all the people in lifeboats. Those not in boats were not so lucky; despite the fast response time of the Carpathia, all of the 1,489 people in the water were dead. They all had life preservers, the weather was clear, and none died from an inability to keep afloat. It's evident that cold water caused these deaths, but how, specifically, does cold water kill? What is immersion hypothermia and how can aircrew members who are forced down in a cold water environment minimize the dangers?

Hypothermia is the lowering of the body's inner core temperature. When a person is immersed in cold water, the skin and subcutaneous tissues cool very quickly. As cooled blood circulates through the heart and brain, these organs become impaired. Our bodies are simply electrochemical machines; these chemical reactions are slowed by cold. If the brain cools too much, unconsciousness will result. Cool the heart too much and fibrillation or heart failure will result. However, drowning may also occur as the arms and legs become numb and uncontrollable and thinking becomes clouded.

An understanding of how the body reacts to cold water exposure and knowing the proper preventive steps will help delay the damaging effects of cold stress and will also improve a survivor's chances of living until rescued.

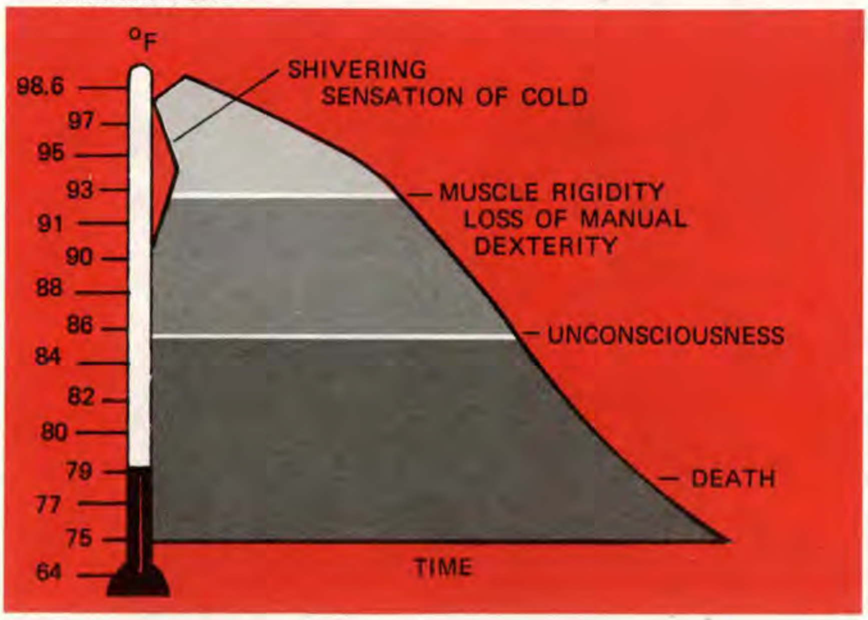
Imagine the body consisting of an inner core and outer layer. Within the core, heat is produced as a result of normal body functions such as food digestion. This heat production process is referred to as metabolism. The body's regulatory system tries to keep the core's temperature at approximately 99.6°F despite variations in the ambient temperature. Of course, the body can only do this within certain limits. Cold water immersion is one example of the body needing to help to maintain core temperature.

The two major ways a person in cold water loses heat is by conduction and convection. Conduction is the process by which heat is transferred away from the body by direct contact with a cold object. Heat passes from the object of high temperature, the body, to the object of lower temperature — in this case, the water. Certain materials are better heat conductors than others. Water conducts heat about 25 times faster than air. Convection, in this case, is the heat removed from the body by a passing flow of cold water. Water flowing or moving around the body is more chilling than still water at the same temperature. If nothing is done to halt the lowering of the body's core temperature, hypothermia will result.

As previously mentioned, if cooling is severe, the body will be unable to conserve or produce enough heat to survive. The symptoms of hypothermia related to body core temperatures are:

- From 99 to 96 degrees: Shivering becomes intense and uncontrollable. Ability to perform complex tasks is impaired.
- 95 to 91 degrees: Violent shivering persists. Difficulty in speaking, sluggish thinking and amnesia start to appear.
- 90 to 86 degrees: Shivering decreases and is replaced by strong muscular rigidity. Muscle coordination is affected, producing erratic or jerky movements. Thinking is less clear; general comprehension of the situation is dulled and may be accompanied by total amnesia. The victim is generally still able to maintain posture and the appearance of psychological contact with his surroundings.
- 85 to 81 degrees: Victim becomes irrational, loses contact with environment and drifts into stupor. Muscular rigidity continues. Pulse and respiration are slowed.
- 80 to 78 degrees: Unconsciousness. Victim does not respond to spoken word. Most reflexes cease to function at this temperature level. Heartbeat becomes erratic.
- Below 78 degrees: Failure of cardiac and respiratory control centers in the brain. Cardiac fibrillation. Probable edema and hemorrhage in lungs. Death. Often one of the terminal events before death is labored breathing in which a whitish froth wells from the mouth from the congested lungs.

TEMPERATURE



Several factors other than water temperature affect cooling rate and survival time. These include physical characteristics of the subject, use of a personal flotation device, protection afforded by clothing, and behavior in the water.

An unclothed individual of average body build would be helpless as a result of hypothermia after approximately 20 to 30 minutes in the water at 42°F and 1½ to 2 hours in the water at 62°F. With thick conventional clothing, these times can be increased to approximately 40 to 60 minutes and 4 to 5 hours respectively. Unusual builds cause great survival time deviations. Thin people become hypothermic more rapidly than fat ones. Very fat persons may survive almost indefinitely in water near 32°F if they are warmly clothed.

This illustrates that in fat people, as in whales and seals, it is the insulation quality of a thick fat layer, and not so much fur or clothing that contributes to their survivability. The body can be compared to a bottle — the bigger the bottle, the more it will hold; the better insulated it is, the slower it will lose its energy. Air Force weight standards pretty much rule out this survival technique for crew members.

For thinner people, clothing is of vital importance. Even though experiments have shown that anti-exposure dry suits have only one-half the protection of a wet suit, it can do much to increase a survivor's life expectancy. One way it does this is to protect the areas of high heat loss: head, neck, groin, and the sides of the chest. The reason it is important to insulate and protect these areas is that here, major arteries and other blood vessels come close to the body surface.

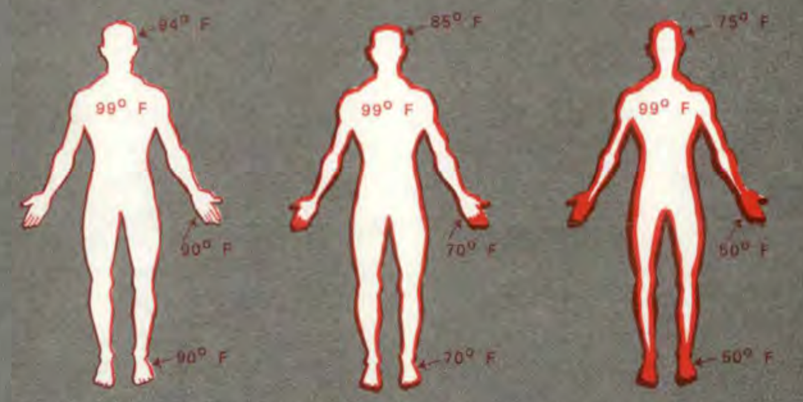
continued

Blood in these vessels can be very rapidly cooled. It is important that the core of the body be kept warm. Skin temperatures of hands and feet may be 40 to 50 degrees below that of the core. This is due to the fact that the body is using the extremities to insulate the vital organs.

Most of the dangerous, life-threatening heat loss from the body in cold water, therefore, takes place from the trunk and not from the limbs. Because of conduction, it is *not* true that in cold water survivors can stay alive longer by exercising, swimming, or treading water. Wearing a flotation device then is a must. Not only is it better to remain motionless in cold water, in the great majority of cases, moving around actually accelerates death from hypothermia.

When a person swims, blood is forced to flow into the large muscles of the upper body; it is then cooled as it flows close to the body surface. It has been discovered that survival time can be increased by about one-third merely by remaining still in the water rather than swimming. If, for some reason, an aircrew member has no flotation equipment, then, of course, some sort of swimming is inevitable.

The technique of drownproofing, where the head is lowered into the water and then gently raised to breathe, should *not* be used in cold water. Use of this flotation method will cause a person to cool about 82 percent faster than if floating with the head out of the water. In other words, if the head and neck are kept out of the water, a person would be able to survive twice as long. As for treading water, even if it is done slowly, using just enough energy to keep afloat, a person will cool about 35 percent faster than if remaining still. Remaining still and, if possible, assuming the fetal or Heat Escape Lessening Posture (HELP) will increase survival time.



This depicts the effect of cold on the body's surface and core temperatures, showing decline of temperature of the skin and extremities while inner core maintains its warmth. The figure at left represents comfortable warmth; at center, mild cold; at right, severe cold. (Based upon a schematic drawing in "Death from Cold" by Marlin B. Kreider, APPALACHIA, June 1960.)

This position was developed to slow the cooling process by protecting as much as possible the critical areas subject to high heat loss. Using the HELP position, it was determined that survival time is approximately double the time a person would last while swimming or moving. If there are several people in the water, huddling close, side-by-side in a small circle, will also help to preserve body heat.

H.E.L.P.

(Heat Escape Lessening Posture)

In very cold water, it should be remembered that unless land is *very* close, survivors *should not* swim unless there is absolutely no chance of rescue and they are *certain* they can make it. Tests using expert swimmers have shown that while some have been able to swim eight-tenths of a mile in 50°F water, others were overcome by hypothermia within 50 yards.

The following table shows predicted survival times for an average person in 50°F water.

Situation	Predicted Survival Time (Hours)
No flotation	
Drownproofing	1.5
Treading Water	2.0
With flotation	
Swimming	2.0
Holding-still	2.7
HELP	4.0
Huddle	4.0

It should also be recalled that distances on the water are very deceptive.

Without a raft in cold water, chances of survival are obviously less than if a means of getting out of the water were available; however, a positive mental attitude *will* improve chances of extending survival time until rescue comes. The will to survive does make a difference!

Survivors should board their life raft, if one is available. This must be done as soon as possible as the loss of hand dexterity occurs rapidly (less than one minute) with total body immersion in cold water 32°F.

Finger skin temperatures drop close to water temperatures in a remarkably short period of time. Dexterity is first affected at a hand skin temperature of 55-65°F. At skin temperature of 50°F, numbness and decreased sensitivity occur, knot-tying ability decreases by 25 percent, and grip strength decreases as much as 50 percent.

Once the safety of the raft has been reached, danger is not over. Since survivors will be wearing wet clothing, wind chill replaces the peril of water chill. In a wind, in wet clothing, a survivor can lose body heat up to 240 times faster than in dry clothing.

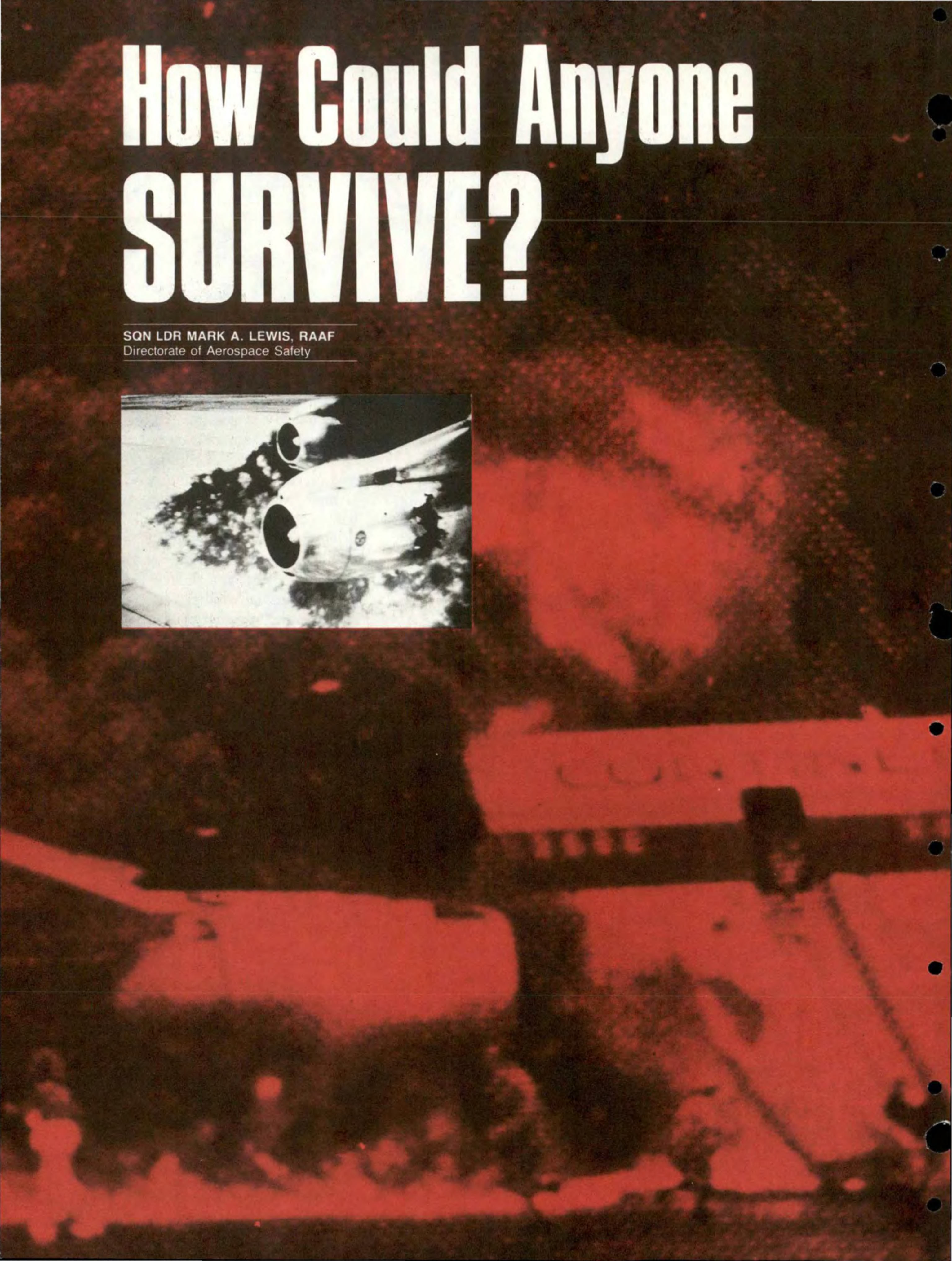
As quickly as possible, before the hands get too cold, carry out all necessary functions in the raft. These actions may include clamping of the equalizer tube, bailing out water, erecting canopy or spray shield, operating radio/beacon, inventorying survival items, signaling, etc. Shielding wet bodies from the wind is very important as hypothermia can still occur. If the raft does not have an insulated floor, use any materials available under the buttocks. The helmet should not be used as a seat unless the hood of the anti-exposure suit is worn. Remember, radiated heat loss from the head is significant — keep it covered. Huddling close to other raft occupants will also conserve body heat.

The possibility of cold water immersion, although unpleasant to think about, is an experience aircrew members must consider if they fly over water. Advanced planning, preparation, and thought on your part can be a significant factor in a successful struggle with this environment. Your actions in cold water will often determine whether or not you will survive until recovered by rescue personnel.

Above all, you must remember that a strong will to survive is indispensable in this situation ■

How Could Anyone SURVIVE?

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



Photographs for this article taken from slides provided by Transportation Safety Institute, Dept. of Transportation, Oklahoma City, OK.

After a crash the cabin of an airliner is a dangerous place. You may have to depend on your own resources and abilities to survive. As these pictures show, you may have a very difficult time unless you have planned ahead. Know where your nearest exit is. Count the number of rows from your seat to the exit as soon as you take your seat. Later you may not be able to see because of smoke or darkness. Also, be sure you know how the emergency exit door operates before you have to use it.

■ A multimillion dollar aircraft slams into the ground. A once proud airliner is down. As you walk through the twisted wreckage, you wonder how could anyone survive?

The aircraft wreckage shows signs of severe heat damage. Rivers of aluminum have now solidified. Wing spars strong enough to support the aircraft now droop like toothpaste — a silent testimony to the heat of the fire. One person survives; the person next to him does not. Why does this happen?

Investigation and analysis reveal much that is common to all crashes and survivors. What can you expect if you are involved in a crash? How can you be a survivor?

In the crash of a modern airliner, some particular kinds of structural damage frequently occur. The cabin tends to rupture in several areas. These areas are:

- Just behind the cockpit
- Forward of the wing front spar
- Behind the wing rear spar and
- At the tail section

These breaks tend to cut the fuselage into sections — like waterpipes. The fuselage and floor can warp. Seats can tear loose, and the overhead storage bins fall down. Exits can be jammed by this distortion.

Heat is often present. The wings of today's airliners are largely filled with fuel. If the wings rupture, there can be thousands of gallons of fuel spilled. There are many sources of ignition for this fuel, so fire is common.

Where there is fire — there's smoke. Smoke and fumes from the airliner's interior are particularly deadly. The gases created by burning interiors are highly toxic. They include carbon monoxide, hydrogen cyanide, hydrogen sulphide, hydrogen chloride, hydrogen fluoride, and sulphur dioxide. The smoke generated by fires can be so thick that it is impossible to see the person sitting next to you.

Winds of 30 mph and more can be created inside the fuselage. These winds are caused by a ''chimney effect'' of fire combining with a ruptured cabin area.

The environment of the crash can create many hazards. Nature can supply snow, rain, strong winds, darkness, and so on. Hills, forests, lakes, and flatlands will provide other hazards for the survivors.

This, then, is the environment you could be faced with. What can you do to survive? Actually, you can do a great deal.

Determination to Survive

The first and most important component of survival is your own determination to survive. You must be prepared to rely on yourself and your own knowledge.

In several recent airline incidents where passengers have died, the crew survived. The flight crews are trained to open the exits after

continued

Some kinds of structural damage are very common in airline crashes. The cabin tends to rupture in predictable places, such as behind the cockpit and at the tail section. This can warp the fuselage, tear seats loose and jam emergency exits.

an emergency. They then call passengers to the exit. When conditions threaten their own survival, they may have to abandon the aircraft. This can happen with you still alive and inside. You are going to have to get yourself out. Passenger testimony, from survivors, is full of phrases like "I planned my own escape" and "I knew I had to get myself out." What type of planning can you do? It actually starts before you get to the airport.

Dress to Survive

This is an area where you can directly influence your ability to withstand heat and flames. Some general rules of thumb are:

- Wear long sleeves and long pants to protect and shield your skin from the flames and heat.
- Wool offers the most protection.
- Polyester is the best synthetic, and not all synthetics are bad.
- Light colors reflect more radiant heat than dark.
- Multiple layers of clothing are better than a single layer.
- Loose weaves catch fire more easily than close weaves.
- "Fuzzy" materials are bad.
- Tight fitting clothing is dangerous because it allows direct heat transfer through the clothing to the skin.
- Very loose clothing is dangerous.
- High heeled shoes are dangerous.

If you are unsure of the flammability of an article of clothing, this simple test will help. Burn a few loose strands of the material. If it melts, don't wear it. If it chars, it is safer.

Choose Your Seat Carefully

You can simplify your emergency exit from the airliner if you sit next to an exit. That solves the problem of finding it in the smoke of darkness. It also reduces the distance you need to travel if you are injured. For example, I always ask to sit next to an overwing exit.

Know How the Exits Operate

This can start as you enter the aircraft. The doors you walk through have signs concerning emergency operation. Read them. Which way do the handles turn? Are they the same on both sides of the aircraft? They usually rotate in opposite directions. How does the door operate? Does it push out? Does it pull in and turn, etc? There are many variations in use today. Be familiar with how to open the exits. There are many examples of crashes where passengers died at the exit because they did not know how to operate it. Don't be one of those.

Listen to the Briefing

The emergency briefing will be given by the flight attendants. Listen to it. Identify *all* of the exits. The one nearest to you may not be usable. If there are people between you and the exits, observe them for potential hazards. Are there any obese people who may block the exit? Is the person near the exit strong and healthy looking? The overwing exits weigh over 60 pounds; could they lift that weight? Door exits may jam and need to be forced open; are they strong enough to do that? These and other factors influence your planned exit route.

Ditching Procedures

Who listens to those unless you

Overhead racks and galleys often come loose in an aircraft crash. They can jam exit routes, so be prepared to adopt an alternate plan. Study the diagram of the aircraft.

Do you know what to do in case of a ditching? Very few people pay attention to those instructions unless they're on an ocean flight. The approaches to many airports are over large bodies of water. You could easily end up in the water on almost any flight. You should know what to do.

In the aftermath of an aircraft crash, confusion and panic can be your biggest problems. The faster you leave the aircraft, the greater your chances of avoiding toxic fumes, fire or other hazards. If you exit over a wing, try to go off the back side since it's closer to the ground. You can't get away from the airplane very well with a broken leg. A situation like the one on the right above is exceptionally dangerous.

fly over the ocean? You should. Have you ever noticed how much water there is around many airports? Combine this with the fact that the majority of accidents occur on take off or landing. You may be ditching — you should know what to do.

The Brace Position

This is generally shown on the emergency information cards. One aspect of this position which is not covered adequately is the position of your legs. They should be out in front of you — not tucked under your seat. This will prevent them from swinging forward in a crash and hitting the seat in front of you. You don't need broken legs if you want to escape from the aircraft. Feel the seat bottom in front of you next time you travel. It consists of a metal bar covered by cloth. This bar has broken the legs of many passengers in crashes.

Plan an Exit Route

You must be prepared to exit without being able to see where you are going. Count the number of rows of seats to the exits nearest you. For example, you may be sitting six rows of seats in front of the overwing exit — two more rows and there is another overwing exit. It is now possible to feel your way to the exit. When you arrive at the exit, you are not safe yet. How do the slides work? Do you go off the back of the wing or off the front? It is better to slide off the back of the wing because it's closer to the ground. How do you get off the wing? Whatever happens, sit down and slide off rather than jump. It is a long way to the ground from the wing. Don't break a leg now.

Do Not Breathe Fumes

The toxic gases given off as products of combustion can be partially filtered. The best available filter may be a water soaked cloth held over your mouth and nose. Many toxic products are water soluble. Dry cloth is better than no filter at all. Breathe in a shallow manner and as little as possible. Hold your breath if you can, at least until you are clear of the smoke.

Exit the Airliner When It Stops

The faster you leave the aircraft, the greater your chances of avoiding toxic fumes, heat, or any other hazard. You must plan to exit the aircraft without assistance from others. If you are injured, do not wait for help. Help yourself. If the crew and other survivors are able to help you, then that is a bonus. The crew may be incapacitated or otherwise occupied. You cannot count on their assistance.

If you are traveling with your family, you have added responsibilities. Make sure that they know how to survive. Discuss your plans with them. If you must evacuate through smoke, have them hold onto each other. Their hand on your belt can provide a secure lifeline. Your problems will be different if you have little children. Think about what you will do for them.

This list of considerations is intended as a guide. There are other obstacles I have not addressed here. They will be created by the varying dynamics of each individual crash.

If you have thought about these topics, then you will have a basis on which to plan your survival. If you plan your own exit, you may become the survivor who helps others to safety. ■

Tomorrow I Awake A . . .

CAPTAIN JOHN W. SIMMONS
80th Division (Training), USAR

■ Everyone loves recognition, especially aviators. I am on the eve of a much coveted recognition for having earned enough flying hours and having been a pilot long enough to be awarded the senior aviator wings. Reflecting on what it means to me, is it one of those events that Peggy Lee talked about in her song, "If That's All There Is, Let's Keep Dancing and Break Out the Booze . . .?" Is it just another opportunity for a drinking bout with your buddies at the O Club? I have elected to make it something more than that so I have prepared this article.

What possessed an otherwise fun loving Army aviator to do that? Suddenly I had a yearning to share the experiences I have gained and the knowledge that I have received as a result of almost 10 years of mishap-free flying. I have a younger brother, recently graduated from flight school, and I would like to share that knowledge with him as well as with every aviator. Based upon my experiences, what legacy can I leave those who will continue to fly?

When you speak of legacy, you speak of leaving something behind that will benefit others. Can I share those experiences encountered en route to my senior aviator badge? Am I so experienced that someone can learn from me? I would like to distinguish the experienced pilot from the novice pilot. That distinction has nothing to do with the number of hours accumulated, for I am firmly convinced that a high-time pilot can be just as inexperienced as the young aviator who recently graduated from flight school. Let me explain that.

If you accumulate 2,000 hours and encounter nothing unusual,

SENIOR AVIATOR

nothing that hasn't been discussed in the operator's manual or included in your training, then what experiences have you had? Each of us, on the other hand, who have flown a given numbers of hours will have learned several lessons the hard way. How many hours do you accumulate before you try to start an aircraft without turning the main fuel on, even though you and your copilot have used the checklist? In my opinion, that is an experience. You can learn from that. You learn that the checklist is there for a purpose — it is not something to be used in a perfunctory manner, but something that you should reason your way through. If you survive enough experiences you become an experienced pilot.

If I could give one piece of advice to every inexperienced pilot, it would be: survive enough other aviator's experiences so that you become experienced; learn from the mistakes of others. How and why do you learn from the mistakes of others? Well, if you learn from their mistakes, you are guaranteed that you won't commit the same mistake. You must distinguish "learning *of* the mistakes of others" from "learning *from* mistakes of others." If you merely read mishap accounts, scoff at the pilot, and say, "Oh, I couldn't do that, I am a much better pilot," then you are learning "of the mistakes of others." However, if in reading the mishap scenario, you mentally fly the aircraft, mentally visualize all the indications, the malfunctions, the noises, the sensations, analyze the situation, and then determine a course of action, you have truly learned from the mistakes of others.

As you look around the aviation community, military and civilian, you realize that very few pilots are as fortunate as the Air Force aviator.

That fortune comes in the form of aircraft mishap briefs, *Flying Safety* magazine, and your command's flight magazine. These are not forums for the Air Force to air its dirty laundry, but rather they give information you can use to your advantage. Use them to continually review your operating and emergency procedures.

As I have said, make the most of mishap briefs. Take one of those scenarios, read through it, put yourself in this situation, and actually react to it. You need to run through this mental scenario for two reasons.

First, you will gain the experience of having actually encountered that problem, and secondly, whatever it is inside your brain that causes you to remember things, you will have cut a new path through those neurons so that some day you can draw on that wealth of experience should you ever encounter a problem. You have become experienced by learning from the mistakes of others — become experienced by having survived other pilots' experiences. If, as described earlier, you mentally recreate the scenario, you will gain an "experience," you will review your operational and emergency procedures. (While in the simulator and while flying, mentally recreate as many experiences as possible.)

If presented the choice between having senior wings pinned on tomorrow or being responsible for reducing the accident rate in half, I would look the commander in the eye and demand both. Tomorrow I awake a senior aviator for I have survived all the experiences to date in accumulating the requisite hours and months of flying. Tomorrow the accident rate can be reduced in half if each aviator gains experience from the mistakes of others. Survive the other pilots' experiences, use the flight safety literature to become an experienced aviator, and my reflections on the eve of that coveted recognition will have been worthwhile. ■

About The Author

Captain Simmons is aviation safety officer of the 80th Division (Training), USAR. After serving on active duty for 5 years, he spent 1 year with D Company, 26th Aviation Battalion, Florida National Guard, as a scout pilot and has been with the 80th Division Aviation Section for 3 years. He is employed as a civilian attorney with the Applied Technology Laboratory, Fort Eustis, Virginia.

Lightning Strike Protection Devised For Future Aircraft

■ ". . . And may a lightning bolt strike me where I stand if that's not the truth!" So goes the close of one beverage commercial, as everyone dives away from the lightning bolt which immediately follows.

Aeronautical Systems Division's Flight Dynamics Laboratory at Wright-Patterson AFB, Ohio, is developing protection for those — specifically aircraft and crews — who can't always dodge out of the way in time.

Under a joint program with the US Navy, US Army, Defense Nuclear Agency, Federal Aviation Administration, and the National Aeronautics and Space Administration (NASA), the laboratory is developing and testing a "balanced protection scheme" for four classes of future aircraft. These include fighters, helicopters, large transports and bombers, and very small vehicles such as cruise missiles.

According to Jack R. Lippert, technical manager for the laboratory's Atmospheric Electrical Hazards Protection Program, lightning strike and other electromagnetic hazards (both nuclear and non-nuclear generated) could present a real problem for future aircraft.

"With increasing sophistication of aircraft electrical components," Lippert said, "and increased use of composites and resistive metals such as titanium, both the aircraft and its components could be more susceptible to damage from lightning strikes. We are working to eliminate this potentially dangerous situation."

Where today's aluminum aircraft skins act as "lightning rods" or "Faraday cages*," to a certain extent conducting electrical current produced by lightning away from the interior of the aircraft and providing some shielding against electromagnetic fields — affording some protection to sensitive components like computers — most composites and electrically resistive materials do not provide the shielding effectiveness of metal skins. They resist current, causing heat build-up in the aircraft skin and allowing diffusion of the current into the vehicle's interior.

A lightning strike to or near a composite or resistive skin often results in establishing an electromagnetic field inside the aircraft which may induce current in the wiring. These induced currents may play havoc with modern electronics and can be responsible for damage and permanent upset which, if it does not force the aircraft down, will at least require a considerable amount of "down-time" for repairs.

Conducted under contract with Boeing Military Airplane Company (BMAC) in Seattle, Washington, the laboratory's program for a "balanced protection system" also considers protective measures against other sources of electromagnetic interference, such as on-board and external radars and the wide area nuclear phenomenon of electromagnetic pulse (EMP), and electronic warfare equipment. This situation could result in one piece of electronic equipment interfering with the one next to it.

"Our approach," Lippert said, "recognizes all the basic types of electromagnetic hazards, and considers the different means of protection which are — or may become — available."

Boeing currently is studying various methods of protection which, according to Lippert, may be used independently or in

*A grounded metallic screen completely surrounding an object to protect it from external electrostatic influence.

combination. These include shielding the whole aircraft, to the extent possible, with a metalized layer, so that the skin will act like a Faraday cage; shielding specific signal/power conductors and component bays which contain the most sensitive equipment; putting filters, diverters, or other such devices between aircraft wiring and sensitive equipment to prevent stray impulses from inducing permanent damage or interfering with their performance; and eliminating signal wiring to the extent possible and replacing it with fiber optics, which would carry information in the form of light, rather than electrical impulses.

Under the contract, BMAC is studying which methods or combination of methods are most efficient in terms of how added weight/volume affects mission performance in a particular class of aircraft. They also are considering the reliability, maintainability and cost effectiveness of the various protection concepts.

Laboratory program manager for the effort is Rudy C. Beavin. He noted that correction of this problem becomes critical for future aircraft, especially those being considered for use in the 1990s and beyond.

"In future aircraft," he said, "computers will be used to do most of the actual flying. In addition, the Air Force is increasing emphasis on night-in-weather operations. All these factors are pushing to make lightning a more severe threat. We need to address those issues now, and that is what the laboratory is doing."

Preliminary testing, in the form of a vulnerability assessment, currently is being conducted under Phase I of the contract at BMAC's Development Center in Seattle. It involves simulating lightning strike effects on an F-16 aircraft mockup with composite forward fuselage and aluminum rear fuselage.

This mixture investigates the impact of using composite structures but still preserves the electrical parameters of a full-scale, operational F-16, so that results of the assessment can be applied to a full-scale fighter. Boeing also will be obtaining state-of-the-art, advanced technology equipment, from other vendors, for inclusion in their vulnerability assessment.

Similar tests on an Air Launched Cruise Missile were completed at the Sandia Lightning Facility, Albuquerque, New Mexico, the second week of August.

Phase II calls for demonstration and testing of the actual protection systems on full-scale testbeds — one fighter and one helicopter. These testbeds have been chosen as representing the most diverse types of requirements for protective systems. Unlike most other aircraft, helicopters are extremely weight-sensitive, and therefore will require systems involving mostly light-weight protective measures, such as fiber optics.

Earlier Flight Dynamics and materials Laboratory programs have addressed solutions to other parts of the lightning strike problem, and resulted in the concept of using metal diverter strips or metalized layers with large composite or resistive aircraft sections.

Current related efforts include NASA's research into flight operations, the Army's research on fiber optics and other protective methods for helicopters. In addition the Navy is conducting further research into the technical base for protective methods. The Defense Nuclear Agency's multi-agency cooperative EMP hardening technology program and aircraft EMP technology development program are designed to resolve the issues associated with nuclear EMP hardening of strategic aircraft and identifying EMP vulnerabilities of existing aircraft respectively, as well as continuing Air Force lightning threat characterization and vehicle system protection studies. ■

"Lightning" is applied to an F-16 mockup at the Boeing Military Airplane Co. Developmental Center as part of a vulnerability assessment for Aeronautical Systems Division's Flight Dynamics Laboratory. Simulated lightning is generated, and applied to the skin through wires which run from the generator to the mockup. The forward section is constructed of composite materials, and the aft section is aluminum, which preserves the electrical characteristics of the full-scale F-16 aircraft. The wire netting over the mockup provides a return path for the electrical circuit.

IT'S ALL DOWNHILL

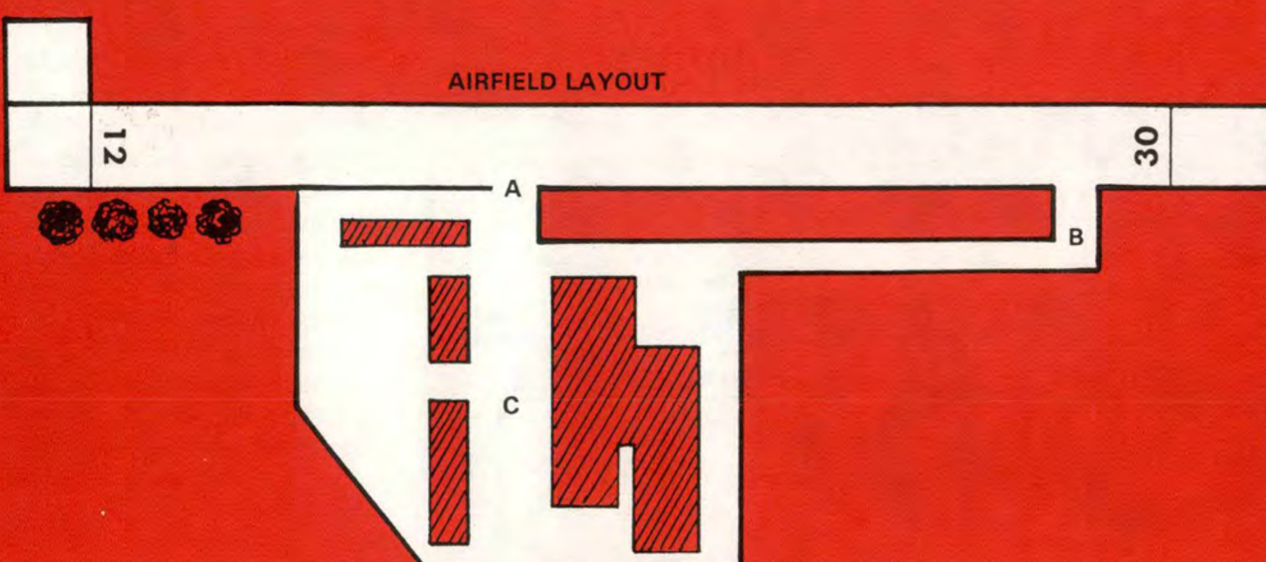


Figure 2

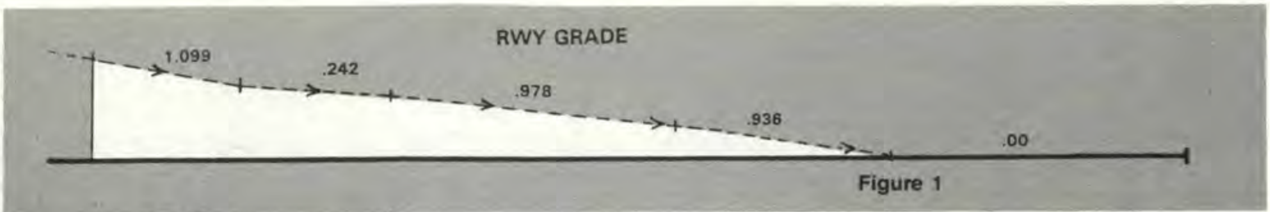


Figure 1

MAJOR STEVE TURNER
55th Strategic Reconnaissance Wing
Offutt AFB, NE

■ Most of you have probably heard a horror story or two about landing on Runway 12 at Offutt AFB. Just reading the IFR Supplement will give you a clue as to what's in store for you. We probably see more transient traffic here than any other SAC base, and if you happen to arrive on the right day, a landing on Runway 12 can be a real handful. This article hopefully will put you in the "forewarned is forearmed" category and you won't have to add to the list of horror stories.

Crosswinds

While the crosswind velocity is no worse than at many other bases, the physical environment and numerous obstructions can make even a 15 knot crosswind landing tricky. Invariably, you will have a right cross, and except for a high likelihood of wind shear on short final, normal inputs will be required until approaching the landing flare. In the flare however, the line of trees and several buildings immediately adjacent to the right side of the runway (see Figure 2) tend to break up the crosswind and make it unpredictable. It often appears to die out completely, but this is not always the case. Fly the airplane! The obstructions end about halfway down the runway and at this point you'll get that crosswind back at full force. Anticipate the requirements for additional aileron into the wind and you shouldn't have any problem. Remember, if you're doing a touch and go, this is just about the point at which you will be stabilizing at touch and go power and the effects will be even more pronounced.

Runway Slope and Visual Illusions

Refer to Figure 1 and you will see that there is a significant downslope (average of .6%) and that some of the worst part of it is in the area where you're trying to get the machine stopped. Obviously a reduced RCR is going to complicate matters. To make things worse, there is a displaced threshold on both ends (1001 feet on Runway 12), so the usable runway is reduced to 10,700 feet. Additionally, the combination of a 3.0 degree PAR glide path (no ILS available), the downsloping runway, and the fact that the terrain immediately preceding the runway threshold is approximately 60 feet lower may give you some visual cues that make you feel uncomfortable. This is not the time to get creative with your glide path. Use all available information, remember the displaced threshold, and plan for a normal landing. If your normal landing is 3,000 feet or more down the runway, now is the time to start rethinking your technique, not when on short final to this particular runway.

Odds and Ends

Several other unique situations exist at Offutt that you need to be aware of. Approach to Runway 12 is over Omaha and your final will take you over two civilian airports at 2,000 feet AGL or less. Watch out for airborne "cornhuskers."

Additionally, the base is adjacent to the Missouri River which is one of the prime victor airways for our fellow aviators of the feathered variety. Heads up is the name of the game. Fill that jumpseat with an extra set of eyeballs.

Offutt is home of the 1 ACCS, sole Air Force operators of the E-4. While approach control and tower will do an excellent job letting you know the location of the very-heavies, know in your own mind what you want for wake turbulence spacing and don't hesitate to ask for more if you need it.

Finally, be aware that the taxiways for access to and exit from the runway are not located at the end (see Figure 2, Points A and B). This may require a 180° turn on the runway if your ground roll is a little long. Expect transient alert to park you somewhere near Point C.

Plan ahead, enjoy your trip and a hearty welcome to Offutt. – Courtesy *Combat Crew*, Aug. 83. ■

G Restrictions

Earlier this year TAC restricted F-16 pilots to a maximum of 6 Gs below 10,000 feet AGL.

Subsequent investigation of the physiological effects of high G have allowed modification of those restrictions. The following is a quote from the TAC message on this subject.

"A pilot's abillity to sustain high G levels, given adequate training, conditioning, protection, and awareness, has received much emphasis and has been demonstrated in the controlled environment of a centrifuge. To translate that capability to the dynamic, inflight regime, pilots must:

- Understand the maximum G tactically required for a given mission scenario. For example, few missions require G levels in excess of 6.0 to 7.5.
- Anticipate situations where maximum G can be expected during a specific flight (i.e., initial offensive turn, sliceback into a fight, or a low altitude break).
- Control the application of G to ensure individual capabilities are not exceeded. To accomplish this, it is first imperative to ensure that the G suit is properly fitted and connected and to perform the proper anti-G straining maneuver. Second, avoid applying ("snatching") Gs so rapidly that visual cues are bypassed. One possible technique is to apply Gs no faster than you can feel them increase. With this technique, visual warning cues are present and G level can be controlled to prevent blackout, and in the worst case, loss of consciousness.

"The high G environment is still a danger zone, and we are continuing to pursue hardware improvements and training initiatives that will allow aircrews to better cope with this environment. Until these initiatives are complete, continued emphasis on the potential for G-induced loss of consciousness is required; therefore, 'G awareness/tolerance' (maximum required G, anticipated high G maneuvers, and anti-G techniques) will be briefed for all flights where high G levels are anticipated. Due to the progress made to date, maximum G below 10,000 feet AGL is raised to 7.5.

"The 7.5 G restriction applies to all F-16s and to F-15 aircraft modified with the over-G warning system (G limits for F-15 aircraft without this system and all other aircraft remain in accordance with the flight manual). The requirement to brief 'G awareness/tolerance' will be included in a forthcoming IMC to each 55-series regulation."

Oops

An 0-2 pilot was flying a combat training mission and had expended nine of the planned ten rockets on board. On the last pass, he armed the rockets and started the turn to final. During the turn, the ground party called him on the radio. In responding to the radio the 0-2 pilot accidentally pressed the rocket trigger button in lieu of the radio transmit switch. The rocket fired and landed off range, but still on government property.

The pilot had placed the master arm switch on prior to final in violation of directives. This set the stage for the accidental firing.

TOPICS

Brought Up Short

A flight of two F-16s were returning to base from a mission with unexpended live ordnance. Due to the ordnance, the aircraft were cleared to land opposite normal traffic to avoid overflight of populated areas. Both aircraft pilots planned to land over the raised MA-1A barrier on the approach end of the runway. The first aircraft landed uneventfully. Then, the wheel of the second aircraft contacted the raised MA-1A upper webbing. This threw the lower cable up so that it engaged the raised tail hook of the F-16, and the aircraft stopped very abruptly.

The aircraft were forced to land with unexpended ordnance because they were unable to find the target. The pilots had misset the coordinates in their INS. As a result, they were off course throughout their mission and never did find the target. Neither pilot made use of a map to verify their position.

G-Induced LOC

In a recent fighter mishap, it appears that the pilot was not wearing a G suit and, as a result, lost consciousness during an abrupt maneuver.

The disorientation experienced by the pilot following the LOC made it impossible for him to control the aircraft and he ejected.

Reversed Trim

When the pilots of a C-5 did their before take off check they found that the pitch trim actuators on both the pilot's and copilot's yokes moved the trim indicator in the direction opposite to the commanded input. The discrepancy had been overlooked during the flight engineer's checks.

Only a Small Tree

A C-130 pilot was taxiing for takeoff at an unfamiliar civilian field. The aircrew were concerned about clearing a building close to taxiway but failed to notice a small tree even closer — until the right wing of the C-130 struck it.

Back Injury

An F-16 pilot was engaged in an ACT mission for the first time in 28 days. While in a hard (8.5 G) turn, the pilot reversed his position in the cockpit from looking over his right shoulder to looking over his left. He felt a twinge in his lower back but ignored it.

After the flight, the pilot's back continued to bother him, so he went to the flight surgeon where the problem was diagnosed as a pinched nerve in the lower spine. In the opinion of the doctor, the layoff from high G was a factor in the injury.

MAIL CALL

EDITOR:
FLYING SAFETY MAGAZINE
AFISC (SEDF)
NORTON AFB, CA. 92409

Ops Topic

I would like to take exception to the inferred responsibility of the Loadmaster for the incident described in an article in the "Ops Topics" section of your June 1983 issue. In the article entitled "Collision With the (Power Cart) Ground," it was stated that "After No. 3 was started, the Loadmaster cleared No. 4 for start without confirming that external equipment — the power cart — had been removed." According to T.O. 1C-130B-1 the Loadmaster is not responsible for confirming external equipment removal prior to starting No. 4.

The procedure is: "Clear No. 3" — Copilot; "No. 3 clear" — Loadmaster; "Remove external equipment" — Flight Engineer. At this point T.O. 1C-130B-1 (Ch. 2 Pg. 2-26) states "Continue with checklist"; "Clear No. 4" — Copilot; "No. 4 clear" — Loadmaster; "External equipment" — Copilot. At this point the Loadmaster confirms that the external equipment has been removed. The Loadmaster in the article made no error by not confirming the removal of external equipment prior to starting No. 4 and, therefore, is in no way responsible for the incident.

Bruce E. Carver
314 TAW/SE
Little Rock AFB, AR

The purpose of this Ops Topic was to identify the consequences of the pilots' failure to follow the checklist. There was no intention to imply responsibility for the occurrence to the Loadmaster.

In Support of the Heavies

I like your magazine but I have one complaint. Why don't you give us heavy drivers equal time? We have an important part of the Air Force mission, too. It seems that all you ever write about is fighters. You could put a couple of transport/bomber articles in each issue.

A Heavy Driver

The mission of Flying Safety *magazine is mishap prevention. Consequently, we address those problems which are most significant to the Air Force. With the fighter/attack mishap rate four times that of the heavies you can see why we pay so much attention to fighters. But we don't ignore the big airplanes. Every issue has at least one or two articles that are applicable to your operations. You big airplane drivers should be congratulated for the fact that we in* Flying Safety *have so little to write about you.*

There I Was

I would like to see an anonymous story program like the Navy's Anymouse.

Avid* Flying Safety *Reader

We have one called "There I Was." The program is totally anonymous and the inputs can cover lessons learned from any flying related occurrence; close calls, near misses, errors of judgment or good saves. The input should be addressed to:

Director, Aerospace Safety
AFISC/SE
Norton AFB CA 92409

Be sure and identify your input as a "There I Was," but don't include your name. We are looking forward to seeing your story.

"LOC From High G"

I would like to express my sincere pleasure in reading the excellent article "LOC From High G," July issue. The article was very informative and brought to a head an important factor in our high performance aircraft. I was very impressed with the right-now solution for LOC.

I am presently working as a government service employee at Kirtland AFB, waiting to go onto active duty to pilot training. The outlined weight and aerobic training program was just what I was looking for. *Safety counts!*

John E. Wallin
Albuquerque, NM

☆U.S. GOVERNMENT PRINTING OFFICE: 1983 — 683-026/13

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.

CAPTAIN

James A. Faber

474th Tactical Fighter Wing
Nellis Air Force Base, Nevada

■ On 3 December 1982, Captain Faber was leading a twoship of F-16s on a cross country flight when his master caution and flight control system (FCS) discharge lights illuminated indicating a problem in the inverter/battery system providing power to the flight controls. Captain Faber manually activated the emergency power unit (EPU), noted the run light was on, and the FCS discharge light was out. A short time later, the aircraft experienced a momentary total electrical system failure, resulting in dumping of the INS with associated caution lights. The electrical system panel now showed emergency generator failure with the main generator still good and the EPU run light on. Then the overheat caution light came on. The critical nature of the overheat light coupled with Captain Faber's system knowledge led him to believe the EPU was malfunctioning causing the overheat. Though this situation is not covered by the checklist or Dash 1, Captain Faber elected to turn off the EPU, and the overheat light went out. He reset the remaining lights and configured for landing on a strange field, at night, with only 7,000 feet of runway. After landing, he realized that his aircraft was contaminated with hydrazine and that airfield personnel were unaware of its characteristics, so he instructed the Tower to keep all personnel clear and upwind of his aircraft. After egressing and inspecting the aircraft, Captain Faber found a large hydrazine spill. His forethought prevented the potential contamination of ground personnel. When conditions allowed a detailed inspection of the aircraft, fire damage was evident in the EPU bay, confirming the accuracy of Captain Faber's analysis and the seriousness of the situation. Captain Faber's systems knowledge led him to an accurate assessment of a problem not previously encountered, and his decisive action after landing prevented possible loss of the aircraft and injury to ground personnel. WELL DONE! ■

When it's AUTUMN in the valleys

It's WINTER in the hills

DRESS TO SURVIVE