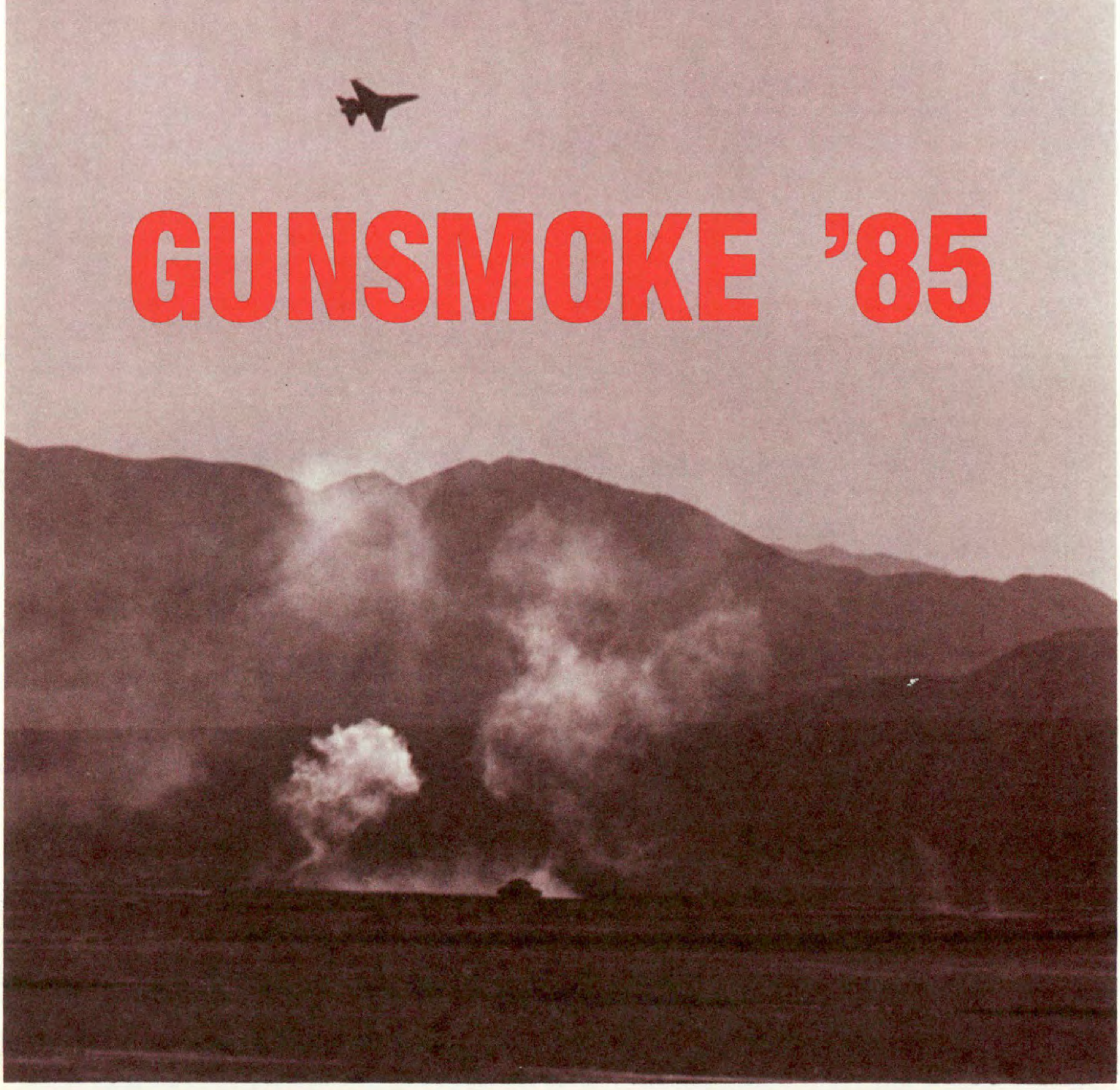
flying SAFETY

NOVEMBER 1985

Surviving The Winter Emergency

May The Force Be WITH You

Spatial Disorientation



GUNSMOKE '85

THERE I WAS

■ . . a brand new T-38 IP full of motivation, determination, and apprehension. Somehow things changed being on the other side of the table — the "IP" side. It only took one of those first few sorties for this new pilot to realize the awesome responsibility of UPT flying. I learned that well on an initial solo formation sortie.

Oddly enough, this day was not characteristic of the weather at our base. It was clear; not a cloud in the sky. Our mission included the standard two-ship formation profile: Pitchouts, rejoins, echelon turns, wingwork, and close and extended trail. A piece of cake. Right? Read on.

A few minutes into the departure, my solo wingman informed me he had a problem. He said, "Sir, I've got a problem with my No. 2 engine. I think it's flamed out." I directed him to take the lead as we continued to FL230. It became apparent he hadn't lost an engine, as we were still close to our departure airspeed and at a high power setting.

We leveled off and accomplished all required checks. I analyzed his malfunction as a simple gauge failure — realizing that my analysis of his problem was only as accurate as the information he gave me.

Our solo lead led us to our high recovery fix followed by a high penetration. To be conservative, I declared a "precautionary" with Center because I detected some apprehension on his part. With the descent check complete, I flew chase position as we left FL240 for the formation approach. As we passed through 9,000 feet MSL, with the field in our 12 o'clock position, my student lead began a descending left turn. This should have alerted me.

After passing 5,000 feet and still in the descending left turn, RAPCON directed us to turn right. The airfield was now in our 2 o'clock position. He didn't respond to RAPCON's call. I answered RAPCON re-emphasizing his directed level off at 2,000 feet and a right turn back on course. Still no response from my problem child. Passing through 3,000 feet MSL, time was running out. I repeated RAPCON's instructions and our call sign along with his name. No answer.

Could he be radio out? Why the descent? I was becoming very tense as 1,000 feet MSL went by, so I gave it another try. Using his first name, then our call sign, I said, "Roll out; climb now; use burners!"

As we passed 500 feet MSL (average terrain elevation 250 MSL), our leader suddenly rolled out and immediately began a climb. Thank God!

I followed and continued to talk him down. We flew a straight-in landing, dropped him off, and then circled around for a full stop. With my heart still pounding, I was wondering if there was anything else I could have done.

Here are some of the lessons I learned:

- If a member of your formation begins to do something unexpected, direct specific actions as soon as possible — suspect oxygen problems and follow checklist procedures.
- Before it goes too far, command a bailout. Remember the 2,000-foot rule. We can always replace the aircraft.
- Never hesitate to declare an emergency.
- If you suspect oxygen problems, have the aircraft, occupants, helmet, mask, etc., impounded for inspection.
- Send those involved to the flight surgeon.

The investigation revealed that the student hyperventilated, fixated inside the cockpit, and lost all situational awareness. Remember: The symptoms of hypoxia and hyperventilation are very similar and sometimes difficult to differentiate. Be sure and stay alert, and *never* let down your guard. ■

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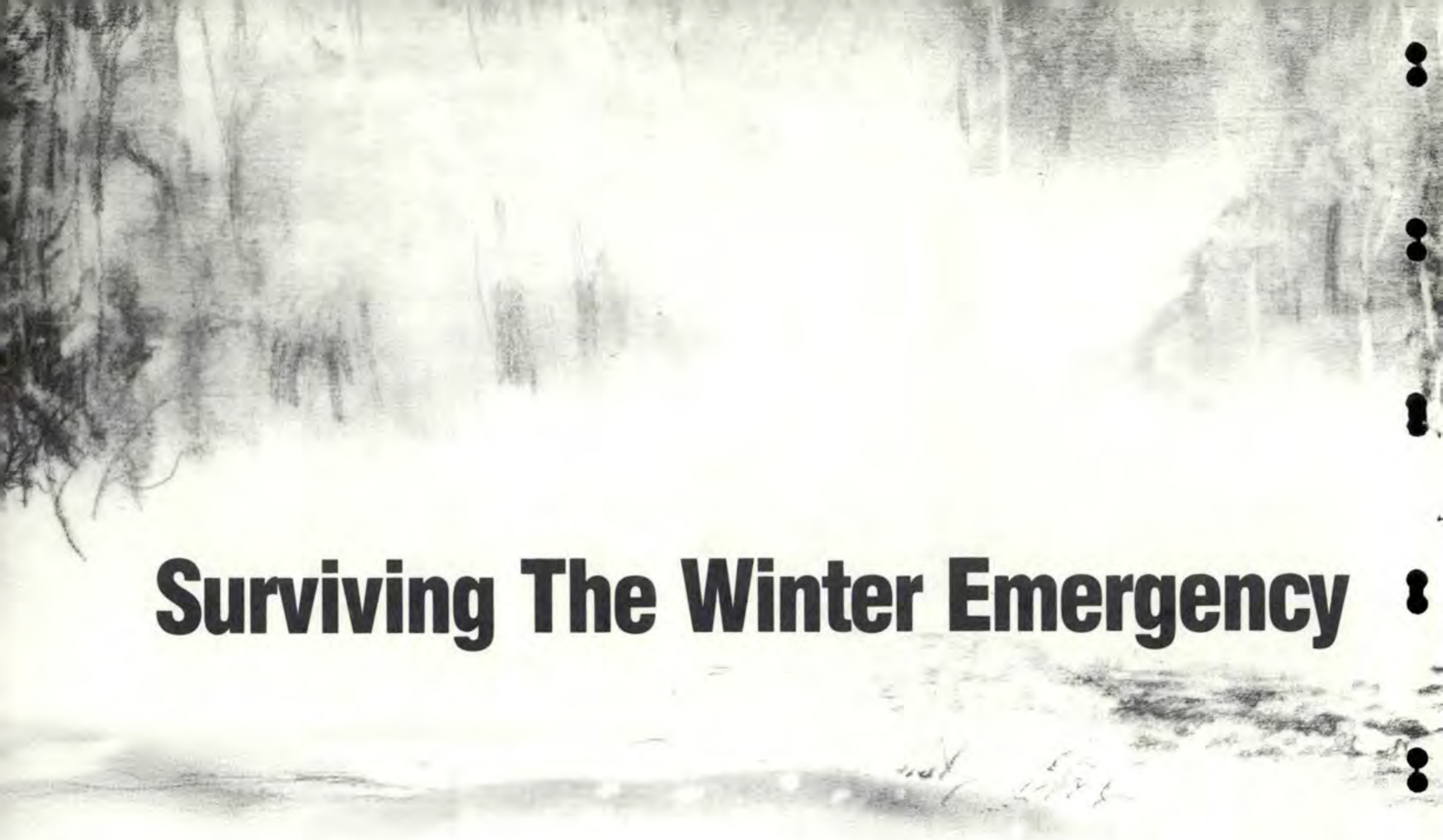

Surviving The Winter Emergency

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■ Each year, many people die needlessly because they are not prepared to deal with a winter emergency. Whether you're an avid outdoorsman or driving your car across the country, the possibility of having to deal with a winter emergency exists.

The first thing you must do is *admit* you could get caught in an emergency situation. Would you get in your car if you knew you would slide off the road and spend 48 hours stranded in a snow bank; or, would you go on a hunting or hiking trip knowing you would become lost and stranded in subzero temperatures? Of course not. You must realize these unplanned situations could happen to you. The next step is to plan what you would do if you find yourself in an emergency situation.

First, do not panic. Panic leads to poor decisions in this type of situation. Realize that fear and anxiety are going to be present. Your challenge is to control that fear and turn it into positive actions.

Use the acronym STOP to aid this process.

STOP. Get control of your emotions. Take a few deep breaths and calm yourself.

THINK. Consider all the variables of your situation. Ask yourself how you might use equipment you have with you. What is your physical status? Are you injured? These and many other questions should be asked to help focus your attention on correctable problems.

OBSERVE. Look at your surroundings. Are there life threatening problems which may require immediate attention? Protection from the elements, treating medical problems, and controlling panic in yourself and others are factors to consider.

PLAN. After considering these factors, form a plan of action which will ensure your safety and prevent needless endangerment of life — your life!!

You are now ready to proceed with the other decisions necessary for your survival.

What will it take to survive? First and foremost is a strong "will to survive." Overlook minor discomforts and maintain a positive mental attitude. You must want to live more than anything else. Keep your spirits high. You should believe that no matter what, you will return from your situation. Never give up hope. People have survived the most trying of circumstances without training or equipment, with only the sheer will to live. You must foster that same type of attitude.

Once you have conquered fear and fostered a positive mental attitude, you are ready to begin taking measures to ensure your survival. Remember, Mother Nature doesn't necessarily care about you. If you're clad in shirt sleeves and hiking shorts in bad weather, your chances of survival are substantially reduced. You can thwart Mother Nature by prioritizing your needs.

Do this by recalling the rule of 3s. You can live approximately *3 hours* without proper clothing and shel-

ter in a cold environment. You can live *3 days* without replacing body fluids by drinking water, and you can live in excess of *3 weeks* without food. These figures are certainly variable; however, they do give you an idea of which order to use in prioritizing your needs.

Three hours is not very long in an emergency situation. The clothing you're wearing is your first line of defense against the elements. Given the choice of the type of clothing you wear into a cold environment, you should remember wool garments will retain a portion of your body heat, even if wet. Cotton clothing, such as jeans, are next to useless when wet. Many synthetic fibers are available today which have excellent insulative qualities and will retain heat even if wet. These fabrics should be included in your outdoor wardrobe.

Down garments have been a perennial favorite of outdoorsmen. While they are lightweight and provide excellent insulation, they lose much of their insulative properties when they become wet. If down clothing is worn, an outer protective shell should be worn to repel water. Gore-Tex® fabrics are an excellent choice for this since they are waterproof and yet allow body moisture to escape. This function prevents the greenhouse effect of rubberized rain garments. Some extra clothing of these types should be kept in your vehicle.

The old backwoodsman's saying, "If your feet are cold, put on a hat," applies significantly since the loss of body heat from the top of your head and neck can exceed 40 percent of your total body heat loss. Wear a hat, preferably a wool stocking cap, which will also protect the neck and ears.

Use the acronym COLD as a guide for the wearing of clothing.

CLEAN. Keep your clothing clean. It will insulate better. Don't sit on the ground. Avoid spilling anything on your clothes.

Avoid **O**VERHEATING. If you are wearing too many garments, you will sweat. In a cold environment, this perspiration will freeze robbing you of valuable body heat.

Use the **L**AYER SYSTEM. Wear your clothing loose and in several layers to provide a means of regulating the loss of body heat. If you become chilled, you can put on an extra layer of clothing. Conversely, if you are too warm, you can take off a layer of clothes. Your clothing should be loose and nonconstricting to prevent any loss of circulation which may result in frostbite.

Finally, you should keep your clothing **D**RY. Your garments will keep you better insulated if they are dry.

The next consideration is shelter. If you're in a vehicle, stay in it. The benefits of constructing another shelter do not outweigh the advantages of staying in your car.

If you're stranded in the wild, look for a shelter which will protect you from wind, precipitation, and cold. Natural shelters such as caves, rock outcroppings, and tree wells can provide good protection. If none of these are available, you can use a tarp or large sheet of plastic.

A variety of shelters may be constructed to afford protection. If you do not have a tarp, you may choose to construct a shelter using natural materials. An A-frame or lean-to

continued

Surviving The Winter Emergency

continued

Avoid panic and take a positive attitude toward surviving. Your first priority is a shelter that can be quickly constructed from available materials.

using available materials for a framework can be constructed fairly quickly. Add a fire with a heat reflector for warmth.

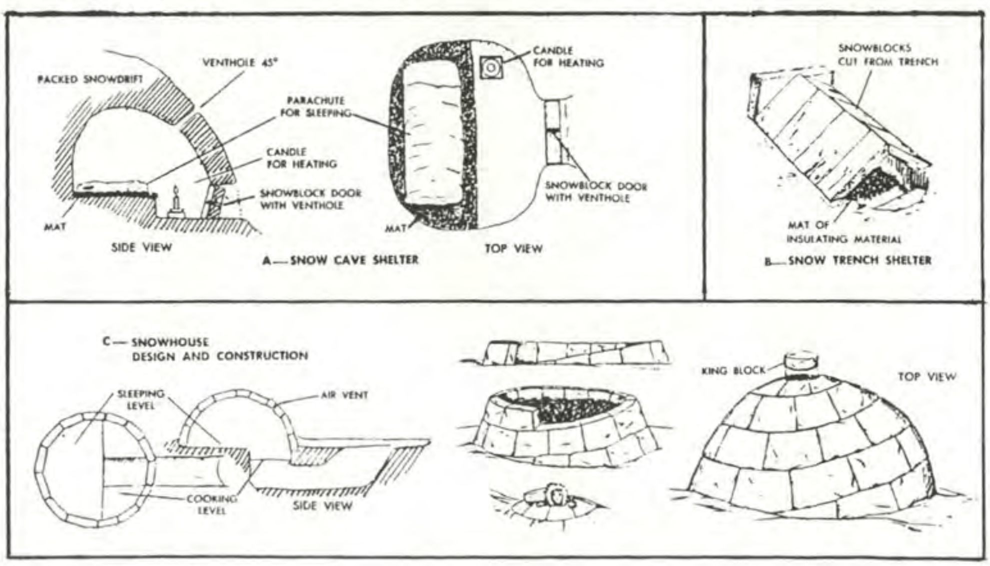
Another type of shelter is the snow cave, which can be dug with a shovel or even gloved hands if need be. Burrow into a wind packed snow bank and hollow out an area large enough to get you out of the elements. The smaller the shelter, the less body heat required to raise the temperature inside.

If possible, you should build a sleeping platform 18 inches above the entry way. Since warm air rises, this will be the warmest area of your shelter. Cut a snow block or place snow in a tarp or similar material and close the entrance to prevent needless loss of heat.

A candle should be burned inside the shelter for several reasons. A burning candle will raise the temperature inside your shelter several degrees. In addition, after nightfall you will need the light to see as well as for the obvious morale boost it will provide. Finally, the candle will give you an indication of the air quality inside your shelter. A strong flame indicates good air quality. If the flame becomes weak, more ventilation should be provided.

A ventilation hole should be made with a stick or other implement at a 45-degree angle up from the doorway, approximately three-fourths of the way up from the floor. In addition, another vent should be made at the entrance of your shelter. These ventilation holes are required, especially if you burn Sterno® or a backpacker's stove. Check your vent holes often as falling and drifting snow may plug them. Carbon monoxide poisoning is a strong possibility if an open flame is burned without proper ventilation.

Variations on the basic snow cave can afford protection as well. A natural depression in the snow can be improved by piling snow on all sides. For roof protection, either cut snow blocks for the roof or lay poles or skis across the top and cover with a tarp or blanket and snow. The same snow cave procedures apply with this shelter concerning ventilation holes.



A. The snow cave is a very effective shelter, but requires a deep snow bank. The smaller the shelter, the less body heat required to raise the temperature inside.

B. The snow trench is easier and faster to make, but is less effective than the snow cave. This shelter can be built anywhere enough hard-packed snow is found.

C. Like the snow trench, the snow house doesn't require deep snow, just hard-packed snow. This type of shelter requires a lot of work and some skill in cutting and fitting the blocks, but makes an effective shelter for one or more people. Keep it small to conserve body heat.

Finally, if the snow is only a few inches deep, you can still make a shelter. Pile it several feet high, wait several hours for the snow to settle, then hollow it out.

With all shelters, do not forget to insulate yourself from the snow or damp ground beneath you. A closed-cell foam pad, blankets, or a 4- to 6-inch bed of tree boughs should serve this purpose nicely.

The next factor to consider is water. Water sources include springs, streams, lakes, and ponds. If you have the means, these sources should be purified by boiling for 10 minutes or by chemical purification tablets. This precaution is necessary to prevent giardia, an intestinal disorder which is contracted from drinking unpurified water. However, you need water even if you cannot "purify" it.

Other sources of water will include snow, rain, and ice. Falling snow and rain may be caught in a container. As long as the container is clean, these sources need not be purified. If given the choice between melting snow or ice for drinking water, use ice as it will yield more water by volume.

Even at rest and with little food intake, 2 to 3 quarts of purified water daily will prevent dehydration. If you are doing anything physical at all, you will need to increase your water intake. Preferably, you should drink warm water heated in a container by a fire or by holding it close to your body. Drinking warm water will prevent loss of precious body heat. Drink water often, even if you're not thirsty, if sufficient water is available.

Food is the next consideration. If you have prepared beforehand, you will probably have some high carbohydrate food such as peanuts, candy bars, or granola. Eat these snacks periodically to help your morale. If you have no food available, remember you can survive weeks without any food at all.

You can use plant food sources such as evergreen tree needles for tea and wild rose hips or the common cattail as food supplements. You might consider setting simple snares for small animals or procuring insects as food sources. Some prior study of edible plants can aid you in positive identification of wild edibles. Do not jeopardize your safety by foraging for food.

Keep your clothing dry to preserve insulative qualities. Any wet clothing must be changed and dried as soon as possible.

Making an effective signal can shorten the length of your wilderness emergency. A signal is anything which draws attention to you. If you're stranded in a car, a piece of red or orange material should be tied to your antenna to make your vehicle more visible, even if covered by drifting snow. Commercial signal mirrors or vehicle mirrors should be used periodically to scan the horizon. Improvised mirrors may be made from any shiny surface; for example, tin foil, metal, or glass. Road flares carried in your car should be close at hand in the event you see or hear rescuers. Fires during darkness and smoke during daylight hours can be used to draw attention.

The contrast of your signal to the surrounding background is the key to a successful signal. In a heavily forested area, white smoke may be obtained from piling evergreen boughs, moss, damp wood, or vegetation on a fire. When the background is primarily snow, you may wish to use a black smoke signal. This color of smoke is obtained from burning petroleum products such as a spare tire, foam rubber, oil, or plastic. You should wait to use expendable signals until you see or hear rescuers.

continued

Have fire material prepared and ready to light if you see or hear potential rescuers.

Surviving The Winter Emergency

continued

It's not easy for airborne searchers to find and identify the one tiny speck that could be a survivor in the vast panorama of terrain features passing below them. To increase the chances of being spotted and rescued, it's up to the survivor on the ground to provide the searchers with as large and clear a signal as possible.

Other common signals are three blasts of a whistle, three rifle shots, or three blasts of a horn. Beating a stick on a tree, banging two pieces of metal together, or simply shouting "help" can also be effective.

Ground to air signals may also be used. This type of signal visually disrupts the earth's surface to let rescuers know someone is in distress. Your signal should look like it has been made intentionally and is not a freak of nature. This is accomplished by using letters of the alphabet which are universally recognized as distress symbols. Your signal should have very straight angular lines, and you should make the signal as large as time and materials permit. You should ensure your signal contrasts well with the surroundings. Construct it where it will have 360 degrees visibility from the air. The logical locations for your signal would be in a meadow or on the top of a barren ridge or mountain. These signals should have a 6 to 1 ratio. That is, make the vertical line of each letter six times longer than it is wide.

Snow may be tramped out around your desired signal shape. Snow piled on each side of your signal will cast a shadow and effectively increase its visual size. Orient your signal east and west — it will cast a shadow for most of the day.

Burnt logs may be used as a signal in snow conditions, and grass can be cut or trampled into a desired shape. Dirt can be dug up laying the sod next to your signal for shadow effect.

There are five internationally recognized symbols. They are:

- A "V" which means you require assistance.
- An "Arrow" which means you proceeded in the direction the arrow indicates.
- An "X" which indicates you need medical assistance.
- A "Y" or "N" which mean yes or no respectively.
- The old familiar SOS may be used, but three letters may be more difficult to construct. One effective signal is usually better than several hastily constructed ones.

Remember, you want your signal to work 24 hours a day. You will need to check it periodically to ensure wind or snow have not covered or damaged it. Keep in mind the things which will attract attention: Contrasting signals, out of the ordinary sights, and movement or unusual noises. Your signals are not limited to the ones mentioned. *Your signal need only attract attention.*

Often an emergency situation will be accompanied by some type of injury. An injury, whether major or minor, detracts from your ability to survive. For our purpose, we will consider two types of medical problems — life threatening and nonlife threatening. This article cannot take the place of a first aid course or emergency medical training. You should take advantage of these types of courses *before* you find yourself in a potentially dangerous situation.

Among the most common of the life threatening problems is hypothermia. Hypothermia is a lowering of the body core temperature. It is common when temperatures are 55 degrees Fahrenheit and lower. Rain, wet weather, and wind add to this problem. Some factors that will predispose you to hypothermia are poor conditioning, inadequate nutrition, dehydration, fatigue, thin build, wet clothing, exhaustion, and use of alcohol or tobacco.

One of the first symptoms associated with this problem is shivering. Never ignore this symptom. Your body is trying to tell you that you are losing body heat faster than you're producing it. Other symptoms include muscle tensing, fatigue, a feeling of deep cold or numbness, poor coordination, stumbling, thickness of speech, disorientation, a decrease in shivering followed by a stiffness in muscles, blueness of skin, and a slow or irregular pulse.

Hypothermia is a killer. If you or any of your group appear to be suffering from any of these symptoms, take immediate action. The first priority is to reduce the loss of body heat. Do this by replacing wet clothing with dry garments; sheltering the person from wind and weather; providing insulation from the cold ground, snow, or rocks; and putting on water and windproof gear.

The next priority is to warm the person by replacing lost heat. If conscious, the victim should remain near a fire and drink hot liquids. If the person can't be warmed this way, it may be necessary to strip off all the victim's clothing, as well as yours, and get into a sleeping bag together. Keep talking to help the person remain conscious.

People die needlessly every year of hypothermia. Prevention of this problem by wearing proper clothing, eating foodstuffs, and shel-

Use maximum contrast to make your signals more easily seen to rescuers. This use of fire producing light smoke against the dark trees plus the straight man-made dark lines against the white snow and irregular, natural shapes of the landscape are readily distinguishable.

tering yourself from wind and rain are primary considerations.

The next life threatening medical problem is carbon monoxide poisoning. Carbon monoxide is a colorless, odorless, tasteless gas produced everytime a carbon-containing material burns incompletely. The reason this gas is so dangerous is that hemoglobin in the blood combines with carbon monoxide 250 to 300 times easier than with oxygen. When the blood is full of carbon monoxide, it can no longer carry adequate amounts of oxygen.

This is an insidious killer. Sometimes the victim shows few, if any, symptoms. Many times these symptoms are only recognizable after it is too late. The symptoms include headache, dizziness, weakness, and unconsciousness. The symptoms may resemble intoxication. Cherry-red lips and skin are classic indicators. A person exposed to a one-percent concentration of carbon monoxide in the air will become unconscious in a matter of minutes. Without oxygen, the victim will die.

As with many life threatening problems, *prevention* is the watchword. Keep the exhaust system on your vehicles in good repair. If you are stalled in your vehicle, make sure you have adequate ventilation when the engine is running. When you are in any enclosed space (i.e., snow cave, emergency shelter, or tent), make sure proper ventilation is provided if you burn anything — even a candle.

Another medical problem, which in itself is not immediately life threatening but can detract from your survivability, is frostbite. Frostbite is a freezing of tissue. The most susceptible parts of your body are the extremities — fingers, hands, toes, ears, nose, cheeks, etc.

Two types of frostbite may occur, superficial and deep. Superficial frostbite involves the skin and immediate underlying tissues. The affected area may appear white and waxen while feeling cold to the touch.

Deep frostbite is far more severe, and as the name implies, involves the freezing of deeper tissues. If the freezing of tissues has been severe, death of the tissue may result and gangrene may later appear. After rewarming, the area will become numb, swollen, and blue or purple in color. The injury at this time becomes extremely painful and is very susceptible to refreezing. If the damage is more severe, blisters may appear, slowly drying up over a period of 2 to 3 weeks.

If you suspect you have frostbite, do not rub the area; tissue damage will occur. Likewise, never rub or place snow on the affected area. Place a warm hand over the area. This will usually prevent progression of the injury. Use the buddy system to check each other often for signs of frostbite and take precautionary measures. Deep frostbite should be left frozen until you reach a medical facility. Rewarming the area will make the person a litter case, as well as rendering the area more susceptible to refreezing. Again, *prevention* is better than any cure.

The final medical problem is dehydration. In any emergency situation, your life may depend on your water supply. You need a minimum of 3 to 4 quarts of water a day to maintain your body's water table. If you do not drink water in adequate quantities, dehydration occurs.

Some of the symptoms of dehydration are:

Thirst	Dry mouth
Fatigue	Indistinct speech
Dark urine	Difficulty walking
Increased pulse rate	Diminished appetite
Nausea	Dizziness
Vomiting	Headache
Vague discomfort	

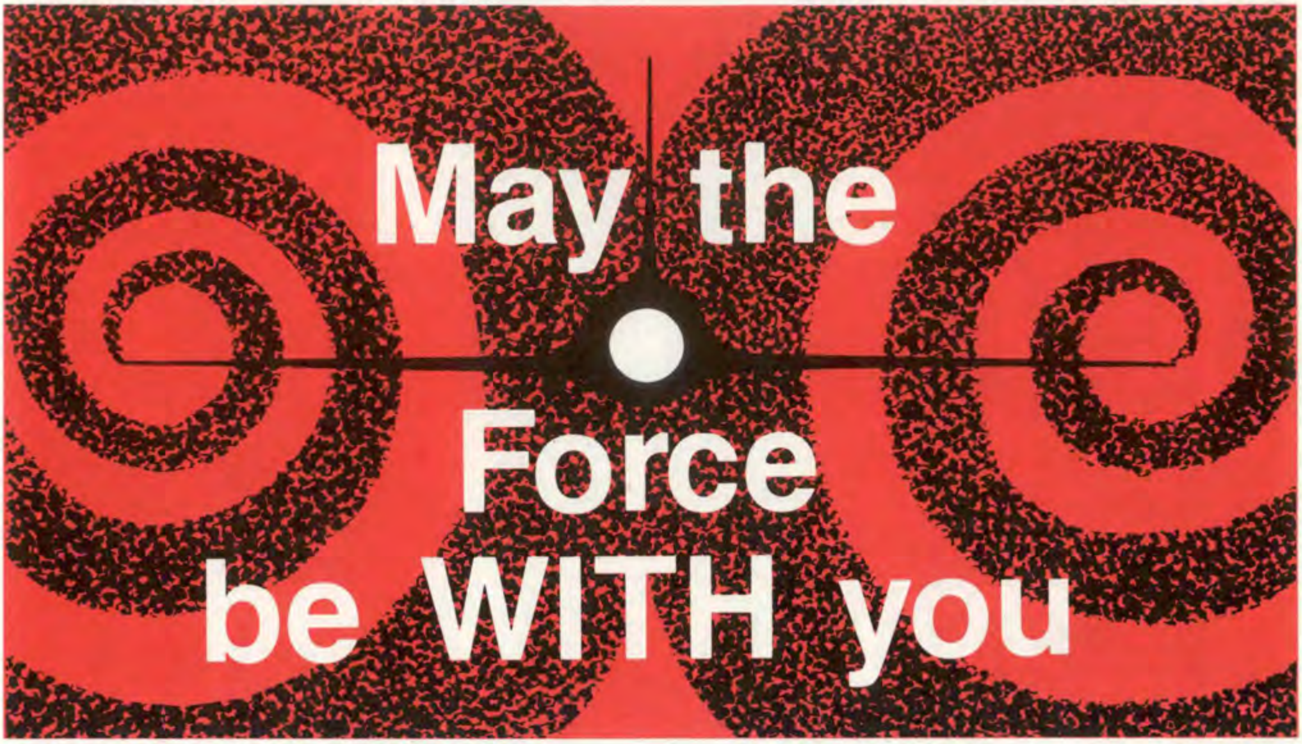
Later stages of dehydration are:

Delirium
Spasticity
Painful urination
Swollen tongue
Inability to swallow

Before you become thirsty, drink water. Light colored urine is a good indication of proper water intake. If urine is colored at all, drink more water. Having large amounts of water on hand will do you no good if it simply sloshes around in a canteen. Drink water even if you are not thirsty. If you have a headache, chances are your water intake is inadequate. The effects of dehydration come on quickly. Prevent this debilitating situation through an adequate water intake. This is not as easy as it sounds when it is cold, so it requires effort.

Many needless deaths can be prevented. Knowing how to deal with a winter emergency can avert a tragedy. Approach your winter excursions with adequate preparation and the knowledge that no matter what situation presents itself, you will return — *alive*. ■

May the Force be WITH you



LT COL JIMMIE D. MARTIN
Editor

■ Two experienced pilots were flying a T-38A on a night cross-country mission. They were approaching their destination on GCA final at 1,500 feet. The night was clear, and it had been a good flight. Both pilots were looking forward to getting the aircraft on the ground and stretching their legs.

Suddenly, the aircraft rolled into 90 degrees of bank. Startled by the unexpected roll, the front seat pilot assumed control and rolled the aircraft back to level flight. There were no warning lights, no system failures to explain this sudden occurrence.

Approximately 3 seconds later, while the pilots were trying to decipher what had happened, the aircraft rolled inverted. Once again, the pilot fought to regain control of his aircraft. He had lost 500 feet by the time the T-38 was flying right side up. There were no apparent malfunctions. It was as if some mysterious force had taken momentary control of the aircraft, and the pilot was unable to do anything until the force let go.

Then they saw it — the mother ship. Now they knew where the force was coming from. It was a C-130 about one mile ahead of them and to their left at about their same approach altitude. The force? — wake turbulence.

Wake Turbulence Defined

Wake turbulence isn't a new phenomenon. There was a lot of worry about it (and some very serious accidents) when the jumbo jets were introduced. Since that time, we have learned a lot about wake turbulence and have practically eliminated the serious accidents attributed to it. But, we didn't just discover wake turbulence when the jumbo jets came along. The earliest known reference to it came from the works of Leonardo da Vinci. In the early days of flying, our predecessors in the leather helmets and long white scarves called it "prop wash," and the jet age ushered in "jet wash."

There are significant differences between "prop or jet wash" and wake turbulence. Prop or jet wash is produced by the aircraft's engine. Although the force generated by jet wash can be serious, it is only effective for a few hundred feet.

Wake turbulence is caused by an airfoil producing lift. It can be a hazard for up to 5 nautical miles (NM) and generates tremendous force. This force is capable of causing serious structural damage. It is a combination of downwash and two counter-rotating vortices rolling off the wingtips. The highest rotational velocity is at the center of the core of each vortex. The vortices trail behind and below the aircraft and descend at about 500 feet per minute to about 900 feet below the generating aircraft. The vortices then gradually dissipate at rates that vary with atmospheric conditions. In calm winds, wake turbulence has been experienced as much as 15 miles behind an aircraft at cruise, although 2 to 5 NM is more common.

Cruise Flight Encounters

Some recent examples of encountering wake turbulence in "cruise" conditions include the following:

■ An A-37B three ship was joining on a KC-135 for refueling. At approximately 1 to 2 miles back, the No. 2 aircraft flew through the tanker's wake and experienced a negative 1-G unload followed by a positive 2.5-G roll to the right. During the roll, the right engine flamed out.

■ A C-141B, flying as No. 5 in a nine-ship formation airdrop, hit heavy wake turbulence. The aircraft rapidly rolled into a 45-degree left bank. Postflight inspection revealed buckled leading edge panels on the right wing.

■ An F-16A on final for a low level Maverick delivery flew through his leader's wake. The turbulence was so severe it bounced the pilot's head against the canopy and sprained his back.

Some aircraft have even flown through their own wake turbulence.

■ During a local live fire training mission in a sustained left bank, an AC-130A flew through its own wake. There was no damage, but the Hercules was unresponsive to the pilot's aileron inputs for 5 to 10 seconds.

■ A KC-135A was on its second refueling with an F-106A at night. The GCI controller directed the KC-135 to turn 220 degrees to the right. As the F-106 moved into the contact position, both aircraft experienced a slight, rapid pitchup, and the boom hit the F-106's intake. It was later determined the KC-135 had flown through its own wake, and the atmospheric conditions were such that wake turbulence could remain in the area for up to 20 minutes.

Mission Encounters

Our fighter aircraft continue to encounter each other's wake turbulence with great regularity. The results vary from engine flameouts to serious structural damage. Here are some examples:

■ An F-106 completed a simulated gun attack on another F-106. As the pilot began a 4-G breakaway to the left at 1,000 to 2,000 feet back, he went through the target's wake. The extreme turbulence subjected the aircraft to loading from negative 1.5 to positive 7.8 Gs, and he came out of it on a nose-high right bank. The left external tank was lost, and four feet of the leading edge of the left wing was damaged. There was also minor damage to the vertical tail.

Be particularly cautious of wake turbulence during air refueling operations. Flying through the wake could produce results varying from engine flameouts to structural damage.

■ An F-4C was between two F-14s during a DACT mission. The F-4 WSO was watching the trailing Tomcat while they were attacking the F-14 in front. As the WSO turned his head to look over his left shoulder, the Phantom flew through the lead F-14's wake. The F-4 went from 4 Gs to 0.5 Gs and back to 4.5 Gs. These G transients forced the WSO's head down, and he hit the canopy breaker knife handle on the left canopy rail damaging his helmet visor and disorienting him.

■ During a DBFM engagement with an F-4E, a T-38A flew through the Phantom's wake approximately 2,500 feet back. The Talon crew felt a mild thump, and the aircraft went from a negative 2 to a positive 5Gs. Postflight inspection revealed the T-38's UHF/ILS antenna was missing, and the vertical stabilator had buckles and stress tears in the skin.

■ An F-4E on an ACT mission flew through lead's wake approximately 2,000 feet back. The aircraft was subjected to an unsymmetrical airframe overstress that most likely caused a structural failure/deformation to the left outer wing. The aircraft almost immediately began a series of uncommanded and uncontrolled left rolls. Unable to fully recover aircraft control, the crewmembers ejected.

■ During a DACT sortie against an F-4, an F-16 passed through the Phantom's wake and was subjected to a major over-"G" of 9.8 Gs.

At low altitudes, such as during

continued

Wingtip vortices created by the C-5/747 are especially dangerous for other aircraft during landing or takeoff. The vortices have tangential velocities of approximately 9,000 feet per minute.

takeoff and landing, the vortices descend until they hit ground effect — about 25 feet above the ground. They then move outward from the flightpath of the generating aircraft at a rate of about 5 knots in calm air.

The strength of the vortices is directly related to the aircraft's weight, wing configuration, and airspeed. The heavier, slower, and cleaner the aircraft, the greater the intensity of the turbulence. Also, the wake turbulence generated by an aircraft on takeoff is significantly stronger than that generated by the same aircraft on landing. The vortices begin at rotation for takeoff. Conversely, they end when the nosewheel touches down after landing.

Takeoff/Landing Encounters

■ An F-16A was landing behind a KC-135 on a touch and go. The spacing was approximately 9,000 feet (45 seconds). Approaching the runway threshold, the F-16 hit the KC-135's wake and rolled first left, then right, and scraped the left horizontal tail on the runway. The effective crosswind was 6 knots.

■ An F-16B was 5,000 feet behind the lead F-16 on a touch and go. Lead landed on the right side of the runway and No. 2 took the left. In the flare approximately 10 feet above the runway, No. 2 experienced severe wake turbulence. The left wing dropped 15 degrees, and a high sink rate developed. During the go-around, the aircraft touched down firmly on the left gear, followed by the right gear, and then became airborne. The left horizontal tail tip and left ventral fin were damaged beyond local repair capability.

■ A C-141B was No. 2 in a four-ship formation landing at one minute intervals. The lead aircraft flew a higher and steeper than normal approach and touched down 1,500 to 2,000 feet down the runway. Number 2 flew a normal approach and landed 1,000 feet down the runway. The pilot encountered lead's wake turbulence on short final, but flew through it with no problems. He again hit the wake in the flare and initiated a go-around, but touched down in a right bank and hit the right aileron on the runway.

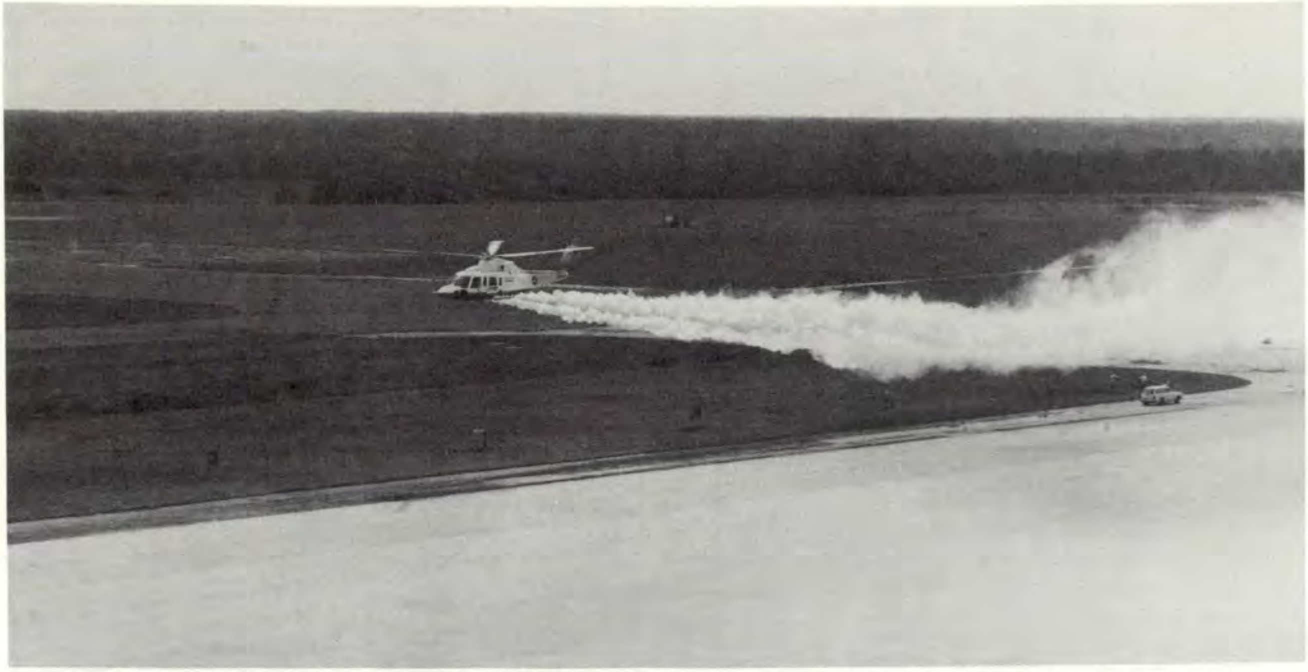
■ A B-52D was No. 2 in a two-ship minimum interval takeoff. At approximately unstick speed, the aircraft hit lead's wake turbulence. The left tip gear and external fuel tank hit the runway just prior to or just after liftoff. The external fuel tank ruptured and began to leak.

■ A T-39 on a transition training mission at a civilian airfield was cleared to land behind a DC-10. At approximately 2 miles on final, the T-39 experienced a rapid roll to the left to about 120 degrees of bank. As soon as the pilot recovered the aircraft, it once again rolled quickly to the left and descended. The pilot was again able to regain level flight, but too late to avoid hitting the ground. The pilots were able to walk away, but the aircraft suffered major damage.

Since vortices dissipate with time, allow as much time as possible when following other aircraft, especially heavy, fixed-wing aircraft.

Helicopters

■ Anyone who has stood close to a helicopter hovering at low altitude is aware of the strong downwash, but what you may not understand is that the helicopter creates the same kind of wake turbulence vortices with its rotors as a fixed wing aircraft. The vortices roll off the tips of the rotors and trail behind the helicopter's flightpath. The difference is in the strength of these vortices. The wake turbulence created by a helicopter is significantly more severe than that created by a fixed wing aircraft. In fact, it may be more powerful than that produced by a four-engine transport. A large helicopter can create an extremely dangerous wake, and you should avoid flying through it.



In July, the FAA used a Sikorsky S-76 fitted with two special smoke generators to mark the vortices for study. The vortices were measured using photographic, video, and laser doppler systems.

■ A CH-53C was landing at a civil airfield for a static display. The pilot had been assured by the tower controller that nearby, light aircraft were tied down. The crew coordinated with the tower to fly a steep, no-hover approach to reduce the amount of turbulence generated. Prior to touchdown, a Cessna 150, located approximately 250 feet to the right and 350 feet behind the helicopter, was blown over.

Key Points

Now for a quick review of what we have learned. Here are some key points to remember.

■ Wake turbulence is usually worst behind a large, slow aircraft in a clean configuration.

■ A crosswind could cause the upwind vortex to remain on the runway and the downwind vortex to move to a parallel runway. The vortices will remain on the field the longest with a 5-knot crosswind.

■ A tailwind may move the vortices of a preceding aircraft forward while a headwind may move them back.

■ The greatest loss of control will occur when an aircraft encounters a wake left by an aircraft on the same heading.

■ The greatest danger is in the takeoff and landing phase where there is little time or altitude available for recovery. This is especially true during landing when the aircraft gets nearer the stall as the airspeed decreases and induced drag increases.

■ A large helicopter will create a wake that is more intense than one created by a large aircraft.

Avoidance

Based on what we know about wake turbulence, the following techniques will help keep you clear of the hazard.

■ Since the vortices descend at about 500 feet per minute, stay on or above the flightpath of any preceding aircraft.

■ When winds are calm or near runway heading, stay on the runway centerline during landings and takeoffs. This will take advantage of the outward spread of vortices near the ground.

■ In crosswind situations, take off on or fly the approach to the upwind side of the runway. (Be careful during light crosswinds — up to 5 knots — that may hold the upwind vortex on the runway for longer than normal.)

■ Since vortices dissipate with time, allow as much time as possible when following other aircraft, especially heavy, fixed-wing aircraft or helicopters.

■ To make flight controls more effective, consider adding a few knots to your approach speed, as you do in gusty conditions, whenever you suspect wake turbulence may be present.

■ Vortex generation begins at rotation, so take off or land prior to the rotation point of preceding aircraft.

■ Vortex generation stops when the nosewheel is lowered to the runway, so take off or land beyond the touchdown point of landing aircraft.

■ Stay above the flightpath of an aircraft taking off or landing on an intersecting runway, especially a heavy aircraft. If the rotation point is beyond the intersection, you're probably safe to continue.

■ In cruise flight, avoid flying behind and below a heavy jet. Fly above or upwind of its flightpath.

As you can see, wake turbulence effects can be extremely dangerous. Be aware of conditions that are conducive to encountering another aircraft's vortices and avoid them. During landing, if in doubt, go around. ■

"Yes, Sir . . ."

MAJOR JAMES S. KASH
34 TTS/Tactical Airlift Instructor School
Little Rock AFB, AR

■ Any instructor who has worked with international students may be familiar with this answer. Due to different cultural factors, the international student is less likely than his American counterpart to ask questions that might "insult" his instructor by saying something was not presented clearly or he does not understand the concept.

Eventually, after enough exposure to international students, instructors become aware of this characteristic and usually it does not present a safety problem with ground training. The following narrative is an example of how this phenomenon can create a safety problem in a flying environment.

The mission had started as an ordinary three ship, tactical low level mission in the C-130 Hercules. The student pilot in the left seat flew a normal departure and rejoin, and the formation proceeded to the combat entry point. The first half of the low level route was uneventful with the student getting used to flying the No. 2 position. As the flight progressed, the student's inputs on the controls appeared to be more erratic, especially in the pitch mode. The IP instructed the student about being smoother on the controls and, of course, received the reply . . . "Yes, Sir."

After completing the airdrop and escape, the student gave the IP the aircraft while he briefed the tactical recovery to be flown. The IP then discovered what may have been causing the student's abrupt pitch control. The IP noticed the airplane would randomly pitch down, then up. The IP initially thought the problem to be runaway trim or the trim tab sticking. Further evaluation of the problem indicated the trim was working normally. The instructor broke out of the formation, declared an emergency, and set up for a straight-in approach. An uneventful approach and landing was flown, and the aircraft was turned over to maintenance. Maintenance investigators found worn seals on the elevator boost pack causing the uncommanded pitch inputs, and the aircraft was returned to service.

Several lessons were learned:

■ The student pilot continued to fly the airplane with a malfunction and not report his problem to the IP. Again, cultural differences and the desire to "save face" may have caused this behavior.

■ The instructor pilot thought the student's inputs were causing the erratic pitch changes en route. Again, the IP's cultural experience led to his expectancy for the student to report control difficulties.

■ Instructors flying with international students must be aware of cultural differences (both the instructor's and student's) interacting and explicitly brief the student to report malfunctions with the aircraft when they cannot be detected by cockpit indications.

The above narrative could have ended in disaster if the uncommanded inputs became excessive at low level. Each person, due to their respective cultural expectations, did not communicate with the other. Instructors must be aware of these cultural barriers to communication and not let them create an unsafe situation. ■

SPATIAL DISORIENTATION

Instrument Cross-check . . . Your Achilles Heel

MAJOR BRITT MARLOWE
Directorate of Aerospace Safety

■ The mishap was a two-ship instrument evaluation mission, in a single-seat aircraft, with the flight examiner as wingman. On the climbout, following an uneventful takeoff, the flight entered IMC, then emerged from the clouds in a steep dive. The examiner, still flying the wing position, crashed with no attempt to eject. The lead aircraft struck some trees during the dive recovery, sustaining extensive damage, and was subsequently recovered.

Good instrument procedures and maintaining situational awareness could have prevented this mishap. This is good advice if you recognize you're disoriented. Our recent single-seat fighter mishap experience (see figure), however, has pointed out that disorientation may go unrecognized, especially when you're busy, pressed, stressed, preoccupied, or distracted. Some fighters fly so smoothly that sensory cues like buffet; wind and engine noise; and aircraft feel (stick, rudder, trim, and throttle feedback) are almost nonexistent.

These diminished indicators of orientation can give you a false feeling of security, and as a result, slow descent and roll rates (in the absence of good visual cues) are not adequately sensed by your internal gyros. Distraction during any phase of flight, coupled with the lack of visual cues in an airplane that doesn't "talk" to you, produces conditions that are perfect for an unrecognized disorientation mishap.

Class A Spatial Disorientation Mishaps
1971 Through 28 July 1985

Acft	No. Class As	Ops Factor (%	SDO Ops Factor)
F-16	57	26 (46%)	9 (35%)
F-15	47	25 (53%)	5 (20%)
F-4	282	138 (49%)	26 (19%)
A-10	45	36 (80%)	4 (11%)
A-7	82	46 (56%)	4 (9%)
F-5	22	13 (59%)	1 (8%)

Types of Disorientation There are three types of spatial disorientation: Incapacitating, recognized, and unrecognized. Incapacitating disorientation can occur when your internal gyros are so severely tumbled that recovery is impossible and the only alternative is to eject. For example, departure from controlled flight where the aircraft executes several uncommanded rolls or severe post stall gyrations in the absence of a good visual cue (night or weather). Fortunately, this type of disorientation is relatively rare.

Recognized disorientation occurs frequently but is usually brief, because the sensory conflict is usually resolved by correct interpretation of a visual cue (instrument

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Instrument Cross-check . . . Your Achilles Heel

cross-check). Recognized and incapacitating disorientation have one thing in common however; the pilot knows it!

The primary concern of the TAF is *unrecognized* disorientation. This is the most common type in Class A mishaps, and its elimination has the highest potential for mishap reduction.

Visual Processing of Information

There are two modes of visual processing: Foveal and ambient. The *foveal* (focal) *mode* generally operates independently from the ambient mode. It is used to identify targets; read instruments, displays, the HUD; and essentially provides your brain with detailed information.

The *ambient* (peripheral) *mode* is extremely responsive to anything that resembles a line (true or false horizon). It distinguishes movement relative to your environment (attitude, airspeed, altitude estimation) as well as your surroundings (terrain texture). The ambient mode provides a means of maintaining overall orientation in space without "thinking" about it. It is a result of a subconscious level of awareness keeping track of various sensory inputs including peripheral visual, tactile, G-forces, hearing, and vestibular inputs to keep us oriented with respect to the horizon.

Information transmission rates are different for each mode, foveal being "slower" than ambient because it requires active thought. This is analogous to the difference in transmission rates between a "dial-up" computer terminal that operates at 300 baud and a "hard-wired" computer terminal that operates at 9,600 baud.

Although faster, the ambient mode is most easily deceived when the visual component (peripheral vision) is lost, such as at night or in the weather. Hence, this mode is functioning on limited information being processed below the level of awareness. Some fighter aircraft may not provide the pilot with adequate cues to alert the remaining components of the ambient mode to an unusual attitude. Unless the pilot overrides the ambient mode by transitioning to basic flight instruments (foveal mode), disorientation may go unrecognized.

A recent fighter mishap highlights this condition. The mission was a night, two-ship, controlled range mission with scattered clouds in the target area. The IP was flight lead, and No. 2 led across the target on

a dry run. During the pulloff, the IP directed a left turn and climb to 5,000 feet. At that point, No. 2 called that he was "IMC." Shortly after that, No. 2 called "standby." A few seconds later, the No. 2 aircraft impacted the ground at 420 KIAS, 150 degrees right wing down, at 1 degree AOA. It was determined the aircraft hit the ground during controlled flight, and the pilot was probably disoriented and distracted by some warning lights that appeared on the left console shortly after he entered IMC conditions. He became preoccupied with the warning lights, stopped his instrument cross-check, didn't recognize his unusual attitude, and crashed.

Your instrument cross-check can easily be interrupted by cockpit distraction such as a warning light or canopy glare. This is detected by your peripheral vision, a component of the ambient mode. *Remember, transmission of visual information is more automatic in ambient than in foveal and can be subconsciously overpowering*! Once your attention is diverted, your instrument cross-check *stops*. Staying away from the gauges too long prevents you from overriding the ambient mode and you return to a subconscious processing of partial information. This can be fatal, especially in an airplane that doesn't "talk" to you.

Disorientation Stress Humans can't tolerate the sensation of being disoriented. We seek to orient ourselves by whatever cues are available, especially visual cues, and accept them without question. Without good valid visual cues ("black hole" or "milk bowl" effect), the internal gyros and other balance senses (ambient mode) can quickly place you in conflict. The ambient inputs can create a powerful expectation of orientation that may very well be inconsistent with reality. The body's basic stress response, the "fight or flight" mechanism, is activated. This may prompt a reversion to heavily learned habit patterns such as procedures you may have learned in previous aircraft (which can be negative transfer). This more automatic or "reflex" behavior generally takes over when "thinking" behavior stops (the conflict between the "will" and the "skill," the "primitive" versus the "rational").

The pilot sees what he expects to see or what he wants to see. There may be a tendency to blame something else, the ADI or flight controls. You may transition back and forth between visual flight and instrument flight, *effectively stopping your instrument cross-check* and increasing your chances of disorientation.

Sleep deprivation and chronic fatigue increase disorientation stress. Time "expands" (temporal distortion). A few seconds seems like minutes and you feel like you have all the time in the world to handle the situation. *You* don't! You are unaware your performance is degraded, and you're flying by the "seat of your pants."

Anticipation Being aware the flight conditions you're about to fly in may lead to disorientation is OK, but it's not enough. Adjust your cockpit lighting appropriately and air/ground check your autopilot (if you have one) in advance. These procedures may assist you in recovery from disorientation should it become necessary.

Cockpit Lighting There are two schools of thought concerning cockpit lighting: Low or bright. You can set your lighting bright and then work it down as you adapt. Low lighting reduces canopy glare that can distract you during an instrument cross-check and provides better outside night vision. However, what you want to see most during disorientation are your instruments. Low lighting may not be adequate for instant interpretation of the gauges. There are a few tradeoffs with this.

Although a fully lit "cocoon" assists your visual cross-check, the head movement required to reach the rheostat may not be wise. In most of our fighters, the lighting controls are disorientation "traps" located in places not easily reached. Head movement, when you're disoriented, is the last thing you need.

Additionally, a bright panel or console increases canopy glare. If the majority of the glare comes from the side console, simple movement within a bright cockpit may result in a reflection which your ambient mode (peripheral vision) perceives as movement. This distraction will break up your cross-check. A bright panel and a dim console may be the best way to go. Keeping in mind the tradeoffs, dim or bright, the light setting that works best for you, *is* best.

Autopilot If disoriented, use of the autopilot (if you have one) while "mentally" flying the airplane can allow you to concentrate on the gauges and get your gyros straight. A flight check of the system in advance should help reduce your reluctance to give up direct control of

continued

Instrument Cross-check . . . Your Achilles Heel

the aircraft and make the decision to select autopilot. Know the roll and pitch limits of your autopilot and make sure the aircraft is within these limits when you engage it. Remember, you may sense autopilot recovery as incorrect. Your ambient mode is operating at full capacity under these circumstances. If your hand is on the stick, you may "tweak-it" subconsciously to offset these sensations, thereby prolonging recovery. Continual cross-check of your gauges, with your hand off the stick, can help you overcome this uncertainty.

Aircrew Training The eyes, internal gyros, and seat of the pants provide orientation. Remove vision and the remaining two systems become unreliable because of the ease at which they acclimate to whatever attitude you're flying, right or wrong. Recognized spatial disorientation, such as the leans, or an increasing pitch sensation during an accelerating climb into the weather, or tumbling gyros, is common. These situations infrequently result in an aircraft mishap. While these have a place in our training programs, the scope should be expanded to include emphasis on *unrecognized* spatial disorientation. Training should focus on mission demands, flight conditions, and aircraft feedback characteristics that could set you up for this type of mishap. Training should include, as a minimum:

- Visual processing of information.
- Factors that upset instrument cross-checks like distraction, preoccupation, task saturation, and fixation (cockpit illusions, canopy glare, and flares).
- Disorientation stress and how it degrades performance.
- Identification of disorientation "traps" (avionics, displays, and switches) and specific cockpit design problems for each aircraft.
- Psychophysiological factors that influence your ability to cope with disorientation like sleep deprivation, poor diet, and fatigue.
- Environmental factors conducive to unrecognized disorientation like night ground attack missions, over water, weather formation, black hole, milk bowl, etc.
- Developing a *highly disciplined* instrument cross-check which should be routinely practiced to obtain and maintain event proficiency.

Corrective Procedures If single ship, at night, and disoriented, adjust the cockpit lighting so you can instantly read your instruments. Keep in mind that head movement can add to your disorientation and that too much light can create distracting canopy glare. Get out of the ambient visual mode by leaning forward and concentrating on your instruments, *not your HUD.* Fly straight and level for 30-60 seconds and concentrate on your ADI to settle your gyros. Use of the autopilot may be helpful. *Cross-check all* your gauges and avoid fixating on any one thing. When flying formation, avoid excessive head movements. "Sneek a peek" at your gauges using your eyes only. If the wingman is disoriented, lead should communicate attitude information at regular intervals. Avoid abrupt accelerations and execute turns and rollouts smoothly and gently. Any unexpected attitude changes can disorient the wingman. Get to VMC if possible. This will give you the horizon and allow your wingman to look around. Remember, lost wingman procedures are to ensure aircraft spacing . . . not to recover a disoriented wingman.

Force yourself to direct your attention to your cross-check. Anticipate — have a plan and be able to execute it. If disoriented, and you're out of control below your minimum uncontrolled ejection altitude, *eject.* That aircraft is going to hit the ground, with or without you.

Instrument flight is a complex skill. It requires time and conscious attention to decode the ADI and other gauges while actively suppressing inputs by the ambient mode. Thirty to sixty seconds of instrument cross-check to settle your gyros can seem like five minutes when you're disoriented. This is partly because of the work required to process information while in the foveal mode, and partly due to the "time expansion" caused by the body's normal stress response. Instrument procedures can be easily interrupted by factors such as distraction, fixation, or task saturation. When this occurs, you *stop* your cross-check and subconsciously process information that is unreliable (ambient mode).

Attention and *concentration* are the key elements of a good instrument cross-check. It takes *practice* to obtain and maintain event proficiency . . . It's your "achilles heel." ■

Photographs courtesy SSgt Paul H. Minert, 63d Organizational Maintenance Squadron, Norton AFB, California

May The Best Man Win . . .
GUNSMOKE '85

PEGGY E. HODGE
Assistant Editor

■ They came from all over the world to prove they are the best the Air Force has to offer. In what some consider the "Olympics" for fighter pilots, Nellis AFB hosted GUNSMOKE '85 from 6-19 October.

As the only competition of its kind in the free world, GUNSMOKE '85 is the USAF's worldwide fighter gunnery meet. Sponsored by the Tactical Air Command (TAC), it happens every 2 years at Nellis AFB, Nevada. The finest fighter pilots and their ground crews, who have been recognized within their own command as the best, are pitted against one another in an intense, fast-paced competition testing their combat skills. They gather to compete against each other where it counts — *in the air*! The competition takes place on the Nellis Range — the only one of its kind.

It was only 4 years ago the shoot-out, now called GUNSMOKE, began anew after a 19-year break. Primarily, wars caused the shoot-out's fallow years. The competition no sooner began in 1949 than it ended in 1950. The tactical fighters were needed in Korea.

Then in 1954, Nellis once again hosted a shoot-out to determine which "fighter jocks" were the surest of the sure shots. The second break in the competition came with

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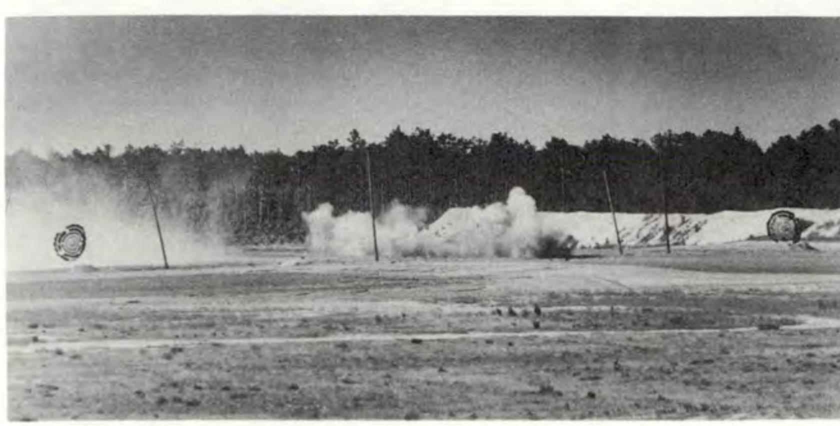


the problems in Southeast Asia.

Finally, GUNSMOKE again got underway in 1981. As in the first competition, the purpose was to exercise USAF tactical fighter weapons systems under realistic conditions. It was also designed to show off weapons delivery techniques that make best use of tactical air versatility and to recognize maintenance and munitions load teams.

Let's take a look at the story behind this intense competition, what it entails today, and why it is important.

In the original competition, known as "William Tell," the dayfighter phase was flown at Nellis and the interceptor phase was flown at Tyndall AFB, Florida. TAC then decided to hold the competition every 2 years and more realistic targets such as pyramid towers and moving darts were used.

Other changes resulted in the Loadeo (a weapons loading exercise TAC had introduced in 1956 where precision, technical expertise, and safety weigh as much as speed) expanding to include special weapons loading, and the competition was moved from June to October to allow flying in cooler temperatures.

Even more realism was added during William Tell 1960. Conventional events were divided into close air support, interdiction, and air-to-air categories. Over-the-shoulder, retard, and laydown events replaced nuclear dive-bombing competition. It was also in 1960 that the George AFB, California team introduced the F-104 Starfighter. (This was the last time a Nellis team competed. Officials decided the advantage of constant training, best instructors, and excellent ranges were unfair to other players.)

In 1962, only one primary and one alternate team from each wing competed in William Tell. Also, all-weather tactical aircraft were included, and F-105 Thunderchiefs entered the competition for the first and only time.

GUNSMOKE '81 was the first competition held since 1962 when the tactical weapons meet was part of the William Tell Program. It brought even more changes. GUNSMOKE '81 saw the return of the 1950's full-team idea to the contest. Scored events included air-to-ground deliveries, navigation, loading competition, and maintenance efficiency. A-7s, A-10s, and F-4s participated in the meet. GUNSMOKE '83 featured F-16s for the first time.

Officials tallied the scores after the strafing competition. GUNSMOKE '85 judged aircrews in three events: Basic weapons delivery, tactical bomb delivery, and navigation/attack.

GUNSMOKE '85 featured 17 teams from the active duty Air Force, the Air Force Reserves, and the Air National Guard. Nellis' Tactical Fighter Weapons Center organized the meet and provided supporting services to competing teams. The teams came from those commands which make up the tactical air forces (TAFs) including US Air Forces in Europe, Pacific Air Forces, Alaskan Air Command, Air National Guard, Air Force Reserve, and TAC's 9th and 12th Air Forces.

GUNSMOKE '85 pitted F-16 Fighting Falcons, A-10 Thunderbolt IIs, F-4 Phantoms, and A-7 Corsair II teams against each other in various air-to-ground scenarios that test combat skills. To get to GUNSMOKE, each of the competing teams had to succeed in its own command's selection process.

GUNSMOKE '85 judged aircrews in three events: Basic weapons delivery, tactical bomb delivery, and navigation/attack.

Weapons delivery consisted of dive bombing, low angle bomb deliveries, and strafing. Tactical bomb delivery comprised such patterns as "pop ups" — flying in below radar, then suddenly increasing altitude to drop ordnance. Low level weapon deliveries were also included in this event. Navigation/attack measured how accurately fighter pilots navigate at low altitudes and attack a target.

GUNSMOKE air and ground crew winners were chosen for each aircraft type including the F-16 Fighting Falcon, F-4 Phantom II, A-10 Thunderbolt, and A-7 Corsair II based on the total number of points scored. Aircrews got two opportunities in each of the three events — basic weapons delivery, tactical bomb delivery, and navigation/attack. The higher of the two scores was used for the final standings.

Aircrews could score a possible 10,000 points in the gunnery and bombing events and maintenance crews competed for a possible 6,000 points. During the Loadeos, muni-

Captain Mark Fredenburgh, an F-16 pilot with the 50 TFW, won the Top Gun Award. The Top Gun Award is given to the highest scoring individual pilot.

An A-10 participates in the strafing competition at GUNSMOKE where F-16s, F-4s, A-10s, and A-7s were pitted against each other in various air-to-ground scenarios.

tions crews attempted to score a maximum 3,000 points. Winners were announced for the air and ground crews supporting each of the types of competing aircraft. Air and ground crews with the highest combined scores were the overall winners.

The competition has changed names several times through the years and also undergone many refinements to increase realism. One thing, however, has remained constant — a desire by all players who get to GUNSMOKE to *win* their categories of competition.

The winners for GUNSMOKE '85 are as follows: The 419th Tactical Fighter Wing (TFW), from Hill AFB, Utah (AFRES), won the GUNSMOKE '85 overall team title. The 50 TFW, from Hahn AB, Germany (USAFE), came in second, and the 23 TFW, from England AFB, Louisiana (9th Air Force), came in third. Captain Mark Fredenburgh, an F-16 pilot with the 50 TFW, was the Top Gun, which is the highest scoring individual pilot. The 442 TFW, from Richards-Gebaur AFB, Missouri (AFRES), won overall maintenance and Loadeo events and was honored as the top A-10 team. Capturing both F-16 maintenance and Loadeo titles was the 419 TFW while the 37 TFW, from George AFB, California (12th Air Force), did the same in the F-4 category. The A-7 winners were the 185th Tactical Fighter Group (TFG), from Sioux City Municipal Airport, Iowa (ANG), in maintenance and the 192 TFG, from Byrd Field, Virginia (ANG), for Loadeo.

The 442 TFW won overall maintenance and Loadeo events and was honored as the top A-10 team.

GUNSMOKE is an exhibition of tactics, training, and technology. This exercise tests air-to-ground capabilities of our tactical aircraft and the people who fly and maintain them. It enhances unit training and encourages esprit de corps. Most importantly, GUNSMOKE sends the message the United States Air Force is one to be reckoned with. It's the best — and has to be! The safety of the free world depends on it. ■

HEARS TO PROTECTION!

PEGGY E. HODGE
Assistant Editor

■ Noise has been associated with powered flight since its beginning. As our aircraft continue to increase in power output, noise levels also continue to increase. We can no longer consider noise just a *nuisance* — it is a hazard presenting a big problem for crewmembers.

The major cause of hearing loss today is loud environmental noises to which an individual is exposed, particularly when the noise is encountered on a *continuing* basis. In an aviation career field and environment, we encounter noise almost *every day*! It is therefore important we are aware of the potential hazards of noise as well as the necessary safety precautions.

First, let's take a look at some of the noise levels we deal with and what sources may be part of our problem. Figure 1 shows us examples of aircraft noise levels and where they range in relation to some of the other familiar sounds we encounter.

The major sources of noise encountered by crewmembers working around and with aircraft include cockpit noise, power plants, noise induced from rotating propellers and helicopter rotor blades, aerodynamic noise, noise due to air flow in the pressurization and air conditioning system, and noise from the communications system.

Consequences of working around aircraft noise levels as well as other sources can affect our performance, our physical well-being, and even safe flight operations.

High noise levels can be detrimental to efficient crew performance. It can cause fatigue, irritation, and lack of concentration. When surrounded by noise on a continuing basis, a crewmember can become less efficient, less alert, and more inclined to be careless. In general, noise is likely to reduce the accuracy of work. It takes a greater toll on complex tasks compared to simpler tasks. When noise is particularly loud, errors in people's observation tend to increase, perception of time may be distorted, and greater effort is required to remain alert. Loud noise can lead to breaks in concentration sometimes followed by changes in work rate.

Noise can also cause us physical problems. *Most importantly, noise may cause permanent hearing loss.* When the noise level exceeds approximately 85 dB(A),*the sensory apparatus of the human ear begins to reach limits where prolonged exposure — a few hours for example — produces changes in the delicate hearing apparatus that can become

Source	Intensity in Decibels dB(A)
Jet Aircraft (Ground Crew)*	101-138
Pneumatic Rock Drill (Operator Position)	118
Discotheque	110-115
Walkman Radio	90-117
Military Pilot (Cockpit)	85-110
Piston Aircraft (Ground Crew)*	84-101
Boiler Room	90
Motorcycles	75- 95
Busy Street	55- 75
Face-to-Face Conversation	68

*Distance in relation to aircraft may cause figures to vary.

Figure 1

*dB(A) is the standard abbreviation for sound levels (decibels) measured with an A-weighting network. This measurement most nearly approximates human ear response and will be used throughout this article.

permanent. (As you can see in Figure 1, there *are* flightline and recreational noise levels exceeding 85 dBA that we need to "watch out for.") These changes may consist of fracture of the tiny noise sensor hairs of the inner ear that detect the various tones of sound. Figure 2 shows the structure of the inner ear, the cochlea, that is used to detect sound frequencies (or pitches).

In the early stages of hearing loss, high frequencies are affected. We most likely will not recognize this early damage as our communication or enjoyment factor (i.e., listening to music, watching TV) are not affected. In the later stages when speech frequencies are affected, it is most likely too late.

If after coming out of a loud environment you experience a dull feeling in your ears or a little bit of ringing — this may be the first sign a problem exists. A good rule to follow according to AFR 161-35, Hazardous Noise Exposure, is if you have to shout at three feet (a loud voice at one foot) to be understood, you are in hazardous noise, and hearing protection must be worn and the time of exposure reduced as much as possible. Use this rule both on and off duty.

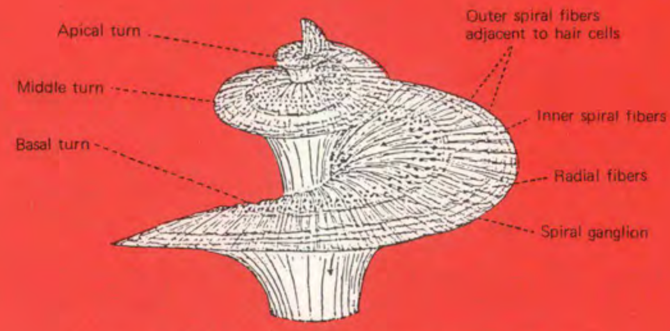
As hearing damage continues, it can become quite significant and handicapping. And there is no cure. Hearing aids do not restore noise-damaged hearing although they can be of limited help to some people.

People with partial deafness from exposure to noise do not necessarily live in a quieter world. The many sounds still audible to them are distorted in loudness, pitch, apparent location, or clarity. Consonants of speech, especially high frequency sounds such as "s" and "ch," are often lost or indistinguishable from other sounds. Speech frequently seems garbled, sounding as if the speaker has his or her "head in a barrel." When exposed to a very loud noise, people with partial hearing loss may experience discomfort and pain. They also frequently suffer from tinnitus — irritating ringing or roaring in the head.

Other physical problems may

continued

THE INNER EAR SENSOR HAIRS OF THE COCHLEA



Adapted from A. Rasmussen, Outlines of Neuro-Anatomy, W.C. Brown Co. Dubuque, Iowa. 1943.

Figure 2

Regular hearing tests are a good indication of how well you're using available hearing protection.

include loss of sleep, increases in blood pressure, faster heart rates, increased adrenalin, heart and circulatory disease, muscular contraction resulting in excessive fatigue, and possibly stress reactions which could have long term results. At very high noise levels, some people may also suffer from other effects such as dizziness, nausea, and vomiting.

Not only can noise create a significant hazard to the crewmember's performance and physical well-being — the sense of hearing is absolutely essential to safe flight operations. Noise can jeopardize the mission through interference with voice communications. Also, interference with effective speech communication is a serious problem which can be brought about by high levels of noise at certain frequencies. This problem can prevent crewmembers from communicating with each other.

It is important to note that hearing protection devices can be effectively used for the preservation of hearing in high noise level environments with minimal effects on speech discrimination. In fact, at high noise levels greater than 85 dBA, headsets actually improve speech discrimination for listeners with normal hearing. Your ability to communicate is actually *better* with hearing devices. Hearing devices screen out noise and allow for clear communication.

Communication is only part of the problem. As we talked about earlier, working in a noisy environment can produce fatigue and irritation. This can also lead to an increased risk of mishaps. Further, noise-induced fatigue or disturbed sleep may mean lower efficiency which has an adverse effect on maintenance standards and may lead to mishaps.

The answer to our problem here is *protection*. Whether on the ground or in the air, we must protect ourselves from noise pollution. "Where air can get in, noise can get in" is an old adage and a reminder to ensure protective gear is well fitted and kept in first-class condition.

On the ground, efforts should be directed toward minimizing the number of people who are exposed to high noise levels and reducing the amount of exposure for those who must work in noise-exposed areas. If you are exposed to high noise levels, be equipped and *use* some form of ear protection. In flight, aircrews are protected from high noise levels in the aircraft by wearing well designed head gear.

Figure 3 shows the limits that have been considered safe for hearing since as early as 1964 at various frequencies and decibel levels. Many believe that for pilot safety and health, the FAA and other government regulatory agencies should require aircraft cockpit noise levels be well within acceptable limits for an eight-hour day, forty-hour week.

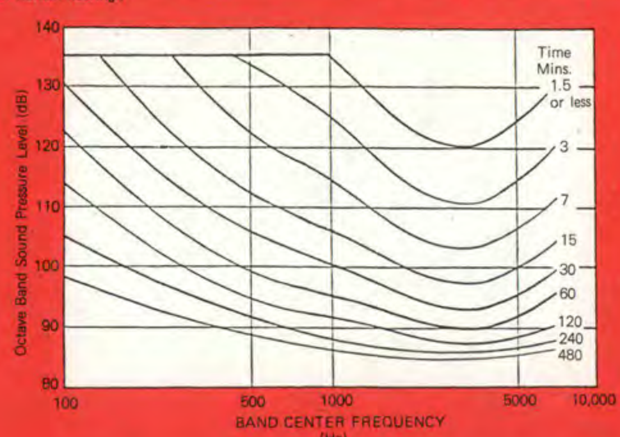
What in the past was referred to as "aging hearing loss" is known to be due primarily to noise damage, or, in some cases, middle ear infections with subsequent permanent hearing loss. Neither of these two prominent causes of hearing loss — noise damage and middle ear infection — need occur today if modern medical science is applied.

The Air Force employs stringent audiometric monitorings of all aircrew members to ensure significant amounts of hearing loss do not develop. Also, the Air Force expends considerable effort to develop personal ear protection devices that provide significant protection against excessive noises found within the aircraft.

If we want long and productive careers, we must plan ahead. We must include in this planning consideration for the preservation of our hearing. It is our responsibility as crewmembers working in a noise-filled environment to be safe — have your ears checked periodically and wear ear protectors. No matter what type of hearing protector is used, the only effective hearing device is one that is used regularly, worn properly, and provides adequate protection. Remember those earplugs — these inexpensive hearing protectors will help prevent irreversible hearing damage. ■

Figure 3
NOISE EXPOSURE LIMITS

(As early as 1964, the U.S. National Academy of Sciences set noise limits for the preservation of human hearing.)



Damage risk contours for one exposure period per day and specific octave bands of noise. (From Committee on Hearing, Bioacoustics and Biomechanics, U.S. National Academy of Sciences, 1964.)

Partially adapted from *Flight Safety Foundation, Inc. Human Factors Bulletin*, July/August 1984.

ONE AIRLIFTER'S PERSPECTIVE

MAJOR J. J. LAWRENCE
Directorate of Aerospace Safety

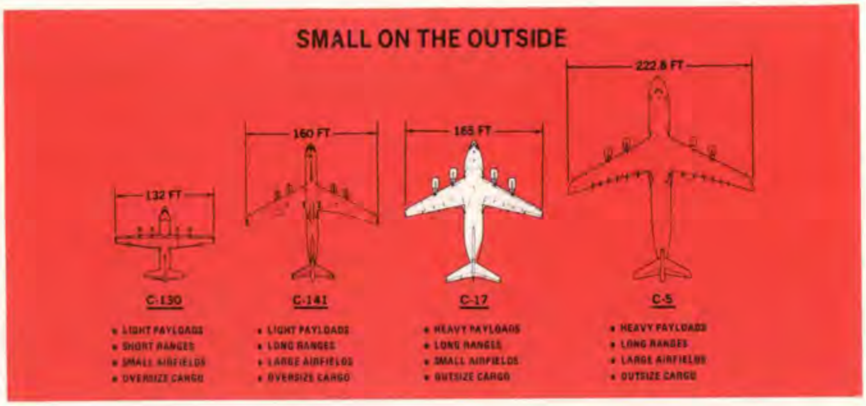
■ Trivia questions seem to be the rage right now. Try this one. What weighs 570,000 pounds at takeoff, flies 6,300 nautical miles (with one aerial refueling), and offloads 172,200 pounds of much needed oversize and outsize material at a 3,000-foot airstrip near the bad guys using only two pilots and one loadmaster? The answer, of course, is that nothing does right now, but as most airlifters out there know, the C-17 is the future answer to this trivia tidbit. The C-17 could be the USAF's remedy to our present shortfalls in big cargo, intratheater airlift.

As the Editor of the *Air Force Safety Journal*, I'm always on the lookout for interesting reasons to escape the confines of the Air Force Inspection and Safety Center. I recently had the opportunity for just such a respite from the regular office routine by "horning in" on a trip to McDonnell Douglas Corporation in Long Beach, California. I accompanied the USAF Director of Aerospace Safety and several of my coworkers on a tour of the C-17 beehive of activity.

This article will chronicle my findings during that visit, hopefully telling the story of why we need this aircraft and what it appears we are doing right from a design safety standpoint.

Any new airplane story has to begin with a statement of need, and few needs have gotten as much attention in recent years as the airlift shortfall problem, particularly intratheater airlift. The C-141, C-5, and the Civil Reserve Air Fleet (CRAF) are performance-constrained to operate between what is considered major airfields. Sixty-seven percent of the cargo delivered to the theater needs to be trans-shipped to other destinations. Fifty percent of this total is outsize and cannot be handled by our C-130 force. The C-X (later becoming the C-17) requirement was to provide a modern, multipurpose airplane to overcome the inefficiency and cost of this

continued



transshipment and surface movement and to deliver combat equipment directly to its final destination from Army bases in the US.

An additional decision was made to provide the theater commander with necessary operational flexibility by placing a 3,000-foot routine runway operation in the Request For Proposal (RFP). The C-X Task Force Airfield Study surveyed the runways available in the free world. The current strategic airlift force, requiring a 150-foot wide paved runway surface, can operate into some 850 free-world facilities. By setting a requirement of regular operations in and out of a 90-foot wide, 3,000-foot long runway, now 10,000 free-world runways would be within direct CONUS to operating location reach.

The McDonnell Douglas answer to the Air Force RFP was the C-17, a 175-foot long, 165-foot wing-spanned aircraft, which has the same basic dimensions as a C-141 but a wide body capable of carrying twice the C-141's cargo payload, plus outsize and oversize equipment.

The aircraft has an 18-foot wide cargo compartment with not only side-by-side pallet loading capability (18 pallets), but also side-by-side onloading of cargo vans and large trucks (oversize equipment). One of the primary advantages of the new airlifter then is that while it can handle outsize equipment, it can also double row oversize vehicles which make up the majority of items to be airlifted in a contingency. This results in a reduced number of sorties to complete the move. If the aircraft was designed specifically to carry only outsize cargo, then it would be limited to a single row of oversize equipment.

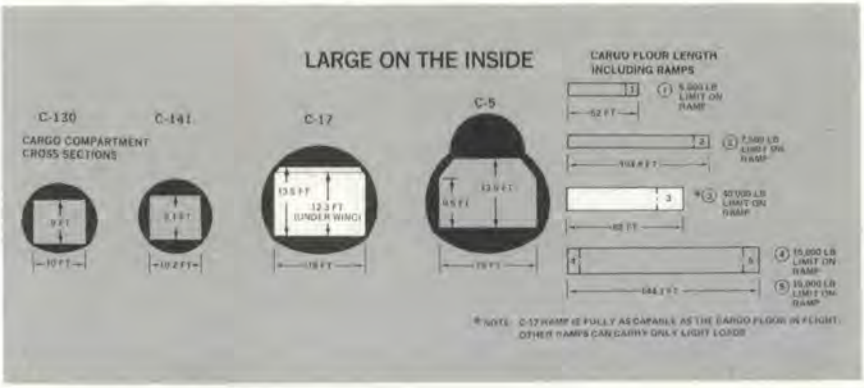
The C-17 also can carry a 40,000-pound load on the cargo ramp (equivalent to the total payload of a C-130) which is big enough to accommodate 4 pallets or two ½ ton trucks. The C-5 ramp is limited to 15,000 pounds and the C-141 to 7,500 pounds. The C-17's ramp is an integral part of the loading floor. Built-in ramp toes provide rapid combat offload capability as well as speedier engines running offload and onload. The design eliminates petal and pressure doors using a simple, single cargo door and thus has no requirement for kneeling of the landing gear. These improvements ensure minimum ground time and improve airdrop capabilities.

The engines also use new technology, tested and proven by the YC-15 earlier test aircraft. The thrust reversers divert exhaust forward and upward so dust and debris are not a problem during landing or rapid ground offload operations. They are designed to operate at zero forward speed without ingestion or overtemperature problems. Semi-prepared surfaces are no problem for these thrust reversers. If you saw a C-130 land on an unprepared surface then watched a YC-15, you would see a remarkable difference in visibility and debris generated by the reverse thrust.

The 4 engines themselves are 37,500 pound thrust Pratt and Whitney PW2037s. This engine is another proven performer, having been in commercial service on the Boeing 757 since December 1984. By the time of C-17 initial operational capability (IOC), the engine will have logged more than six million hours of flight time. As a result, the C-17 will be powered by a proven power plant with a logistics infrastructure established worldwide.

The propulsive powered-life technology of the C-17 was fully tested on the YC-15 when the DOD sponsored the Advanced Medium STOL Transport Technology Prototype Program. The YC-15 accumulated 800 flight hours and proved the concept of powered lift. Basically, engine exhaust is directed onto and through the flaps, thereby increasing the coefficiency of lift on the wing. A powered-lift aircraft can, therefore, fly at much lower landing/approach speeds and can thus operate into much shorter runways. Using a 5-degree glidepath (twice the normal for transports), a head up display (HUD), and final approach airspeeds of 115 knots at max landing weight, you can see that 3,000-foot runways should pose no problems for routine operations.

Inside the cockpit, we find NAVSTAR/GPS backed up by dual INS capability with physical capacity for a third INS and four, full color cathode ray tube (CRT) interchangeable presentations which provide flight, navigation, engine, aircraft subsystem, and mission essential information. Additionally, we see integrated station-keeping data (for IFR airdrops); computer monitoring of engine performance with automatic crew alert; and flexible, mission specific display for-



mats. Currently, efforts are underway with 10 potential suppliers to assure the aircraft has the latest proven avionics attention. And get this, you heavy drivers with aspirations of being fighter pilots, a stick replaces the yoke to go along with the two fully-capable HUDS.

Also of importance is the fact that for the first time in the military aircraft business, we are requiring warranties on the reliability and maintainability of the aircraft. If warranted items and goals are not met, they will be corrected at no increase in cost to the Air Force. Warranties are included for fleet reliability, maintainability, and availability as determined by an Air Force ORE; system performance determined by specifications; structural life with basic aircraft structure warranted for 10 years after delivery; and engine warranties and service policies will be at least as favorable to the government as to "most favored" commercial customers.

The C-17 conceivers and testers have put safety up front in the design of the aircraft and in all its subsystems. Flight controls will use fly-by-wire technology with mechanical backup. There will be four independent hydraulic systems with two engine-driven hydraulic pumps for each of these systems. Also included will be multiple hydraulic actuators. All are designed for maximum redundancy and, thus, greater combat survivability. The supercritical wings will be swept 25 degrees and use winglet technology. These characteristics reduce drag, weight, and fuel consumption.

The electronic engine controllers will provide full-throttle operation without overboosts, auto trimming capability, and engine-out detection prior to normal engine-out indications. All four thrust reversers will be in-flight operable as well as operable on the ground, with upward and forward thrust vectors for safe operation during ground activation. The engines also offer a dual loop fire detection system. This should reduce the number of false fire warnings and, thus, needless inflight engine shutdowns.

The caution and warning system features a continuous monitoring of critical aircraft systems with aircrew alerts in the event of system failure. Also incorporated into the interphone system will be aural tones and voice warnings of critical flight conditions. The aircraft also will use wireless intercom communications and hard wired backup communication control.

The aircraft is designed emphasizing minimization of crew fatigue with reduced engine noise and efficient acoustic insulation which should allow off-headset voice communication between pilots. A self contained avionics cooling system will decrease engine bleed air required. The cargo area and flight deck are designed to be much more comfortable and quieter than what our airlift aircrews are used to today.

The landing gear system contains thermally-sensitive relief plugs to relieve tire pressure from overheated brakes. Wheel well components are limited to only essential gear parts thus lessening the chance of damage from a blown tire. The RFP calls for operation with one flat main landing gear tire. Manual gear lowering sequencing and free fall are also offered as backups to the normal gear extension system.

So what do we have here? A modern airlifter that appears to be a reliable and maintainable aircraft using proven technology with safety built in up front, and a new approach to contractor warranties for government purchases. An aircraft which will help solve both our airlift shortfall concerns and our intratheater materiel movement problems. It should operate into short, semi-prepared airfields and give theater commanders greater flexibility on resupply options as well as hamper enemy interdiction plans. We can have a solid airdrop performer and a follow-on to our aging C-141 and C-130 fleet.

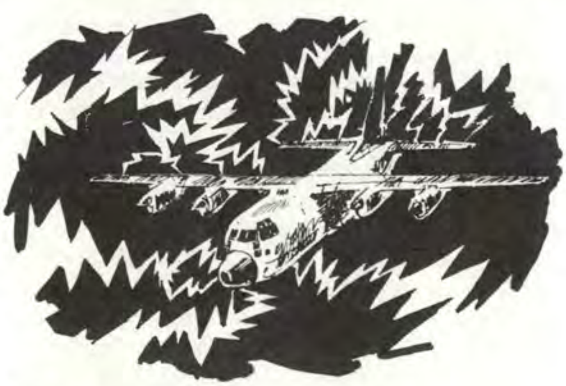
The IOC for the C-17 is now Fiscal Year 1992, based on the current DOD-funded contract, with the first flight in 1989. The 1983 SECAF Airlift Master Plan submitted to Congress calls for a total buy of 210 aircraft using the C-17 as the long term airlift solution to future shortfall considerations. In February 1985, the Secretary of Defense signed the Defense System Acquisition Review Council II approval. ■

This visit to McDonnell Douglas Corporation was a rewarding one, especially for a lifelong airlifter who flies C-141s which rolled off the line over 25 years ago. I see lots of solutions to the everyday problems we now encounter and a healthy long term solution to a critical military airlift requirement. I'd like to thank the McDonnell Douglas personnel for their hospitality and efforts to answer all questions, big and small. I'd like to particularly recognize Mr. Nicholas Gaspar of the System Safety Division for the time and expertise he shared with us during this visit.

OPS TOPICS

Afterburner?

■ Two F-4Es had just returned from a night sortie and were awaiting dearming prior to taxiing to the ramp. A transient alert crew picking up drag chutes about 200 feet to the rear and left of the aircraft noticed a fire in the left tailpipe of the Number Two phantom. They notified the tower who notified the flight lead. The wingman promptly shut down and both crewmen rapidly exited the aircraft. The fire went out after the engine was shut down. The cause was an unusual fuel leak that sprayed a mist near the torch igniter.



An EnLIGHTNING Experience

A C-130 was cruising at FL 190 in IMC and heavy precipitation. The heavy precipitation rendered the weather radar ineffective with a 1 to 2 NM usable range. The crew asked the center if there were any thunderstorms nearby. The center stated there was one storm at the aircraft's 2 o'clock position at 10 miles, and their current heading seemed safe enough. Just as the crew was requesting a lower altitude, they saw two flashes of lightning and felt a heavy thud as a third bolt they didn't see hit the aircraft. No avionics were lost, and the crew continued on to their destination. Upon arrival, they inspected the Hercules and determined no significant damage had occurred, so they continued their mission to home base.

At home base, maintenance discovered the lightning had struck and damaged both the nose and SKE radomes. Inspection revealed numerous white burn spots on the aircraft: 20 on the inside of the cargo door, 6 inside the aircraft aft of the cargo door, 6 on the inside of the ramp, 4 on the right wing, and 1 on the right aileron.

Blocked Escape Slide

An EC-135 was delivered for Class II modifications. Inspection of life support equipment disclosed a trash can secured to the emergency escape slide container near the aft escape hatch. The trash can was held in place by a tiedown strap wrapped around the can and the escape slide container. With the strap in place, the container couldn't be opened, and the strap would have to be removed before the slide could be deployed. This could be a real hazard during an emergency, especially for crewmembers who seldom work with tiedown straps. The time lost in removing the strap could well be the difference between a successful emergency evacuation of the aircraft and an unsuccessful one.

There's The Beef

A C-141B was making a PAR approach at an overseas base at dusk and had received clearance to land from GCA. Just prior to decision height, the command post advised the aircraft there were cows on the runway. The crew flew a missed approach, but couldn't see the cows until passing directly over them. Tower controllers didn't see the black-and-white cows because of darkness until the aircraft executed the missed approach. The cows had been spotted by the vice wing commander who was making a routine visit to the flight line. He called the command post who then called the aircraft. The cows had pushed through the perimeter fence.

Autopilot Failure

The FB-111A flew in pitch autopilot altitude hold submode at 19,000 feet for one and one-half hours without incident. The pilot disengaged the altitude hold, descended to 11,000 feet, and re-engaged altitude hold. The aircraft immediately pitched over 20 to 30 degrees into a negative 2 to 3-G descent and lost 700 feet before the pilot could depress the autopilot release lever to recover control. The pilot turned off the pitch damper and landed the aircraft without further incident. After landing, the pilot re-engaged altitude hold for the auto flight control specialist, and the horizontal stabs drove down rapidly for two engagements, but thereafter, performed normally. Intensive troubleshooting failed to duplicate the malfunction or indicate any failures. The pitch and yaw computers and CADC were replaced, and the aircraft was flown successfully.

New Bird Strike-Resistant F-4 Windshield

Aeronautical Systems Division (ASD) is flight testing an inproved, bird strike-resistant windshield for F-4 aircraft. The new windshield is on the left in the above picture, and the old windshield is on the right.

Developed by the Flight Dynamics Laboratory in ASD's Air Force Wright Aeronautical Laboratories, the new windshield is designed to withstand strikes by birds weighing up to 4 pounds with the aircraft traveling at speeds up to 500 knots. Current F-4 windshields resist bird strikes only to about 200 knots.

Aircraft such as the F-4 are flying more low-altitude (bird territory) missions at higher speeds. Therefore, they are colliding with more birds, thus prompting the need for the improved windshields.

Redesign of the F-4 windshield resulted in eliminating a horseshoe-shaped frame which connected the three pieces of the old windshield. This change improves visibility, reduces weight, reduces the number of parts necessary for spares support, and reduces maintenance hours

The windshield is being flown for operational test and evaluation on an F-4 by the 131st Tactical Fighter Wing (TFW) of the Air National Guard in St. Louis. The 131st TFW will test three F-4s fitted with the new windshield for one year.

Laboratory engineers also are working on improving bird strike resistance for other aircraft including the F-16, A-7, and T-38.

Whoops!

After the T-38 FCF pilot rolled the aircraft inverted, the ejection seat lap belt disconnected at the right seat mount allowing the pilot to fall onto the canopy. The pilot was able to right the aircraft and returned to the base for an uneventful landing. Investigation revealed improper installation of the seat belt by maintenance technicians. ■

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.

(L to R) TSgt David M. Rech, MSgt Robert W. Hall, Capt David M. Harris, Capt John F. Kelly, SSgt Jerry A. Price, and SSgt Roger A. Sather

20th Special Operations Squadron
Hurlburt Field, Florida

■ On 14 November 1984, an HH-53H Pave Low III helicopter commanded by Captain Kelly experienced catastrophic failure of the tail rotor drive system. The crew, along with eight passengers, had just completed a low-level navigation route and were climbing up to air refueling altitude. As the helicopter passed through 800 feet AGL, a radio call was received from the flight engineer of their wingman stating he had seen something fly off the tail rotor of Captain Kelly's aircraft. About the same time, Sergeant Price called out from the ramp that the tail rotor assembly was coming apart. The cockpit crew quickly analyzed the situation and accomplished the bold face emergency procedures. The cabin crew ensured all passengers were secured for landing, then helped locate a suitable landing site. No parachutes were available, and low altitude would have precluded their use; therefore, the crew took the only other course of action available and entered autorotation. Sergeant Sather quickly shut off the throttles thereby giving the pilots directional control, then lowered the landing gear. A clear area was located beyond a stand of trees, and Captains Kelly and Harris executed a "controlled" crash landing. Timely, accurate decisions on the part of the entire crew, coupled with precise control by the pilots, allowed the aircraft to land upright and all but two aboard to walk off unharmed. Captain Kelly was seriously injured in the mishap. Had it not been for the professionalism and airmanship of this crew, all 15 people might have died. WELL DONE! ■

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UNITED STATES AIR FORCE

Well Done Award

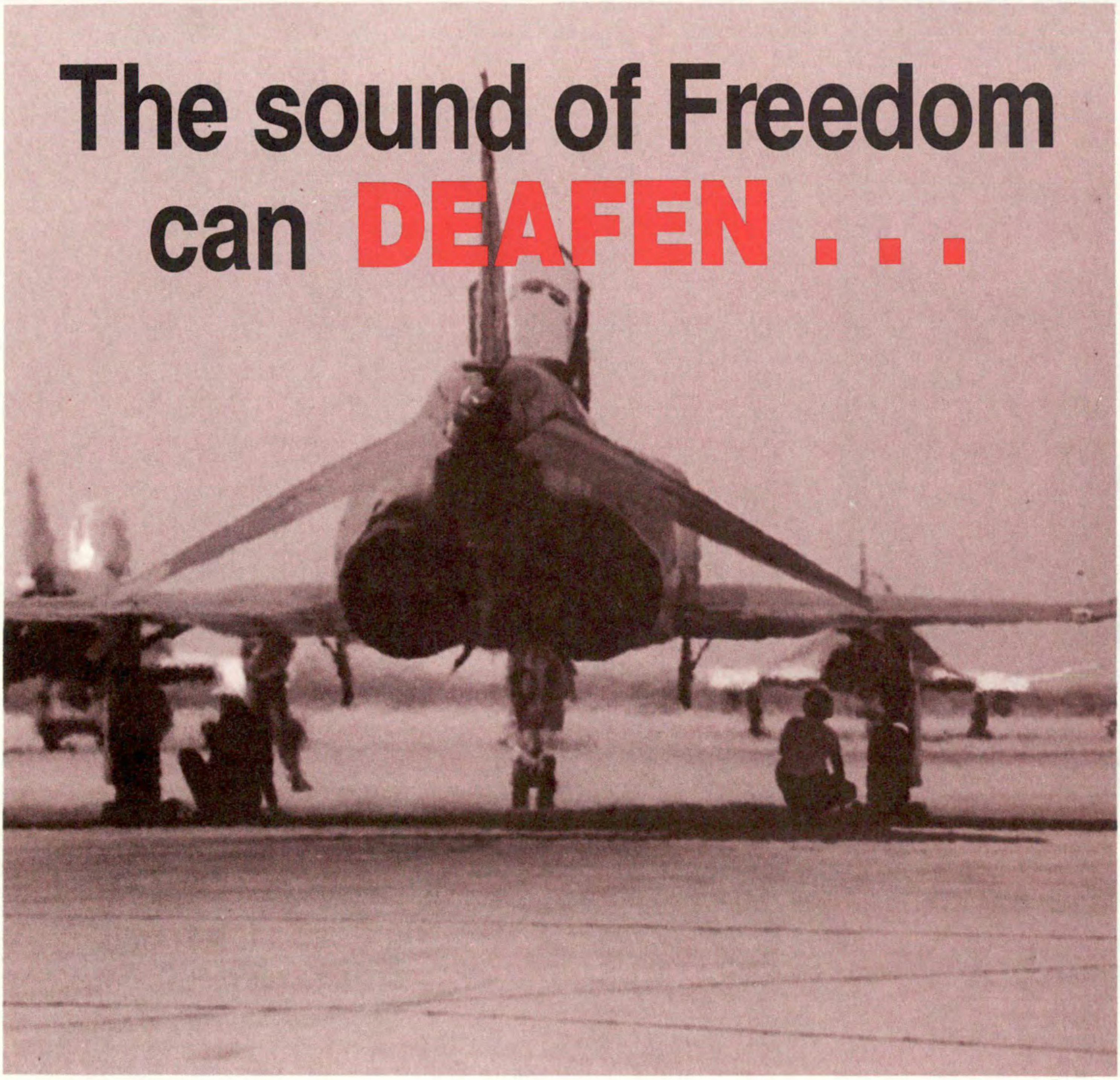
Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.

MAJOR

Conrad Juneau

917th Tactical Fighter Group
Barksdale Air Force Base, Louisiana

■ On 27 November 1984, Major Juneau was leading a flight of two A-10 aircraft in a formation takeoff. The cockpit temperature of his aircraft began to increase after lift-off. He signaled for gear and flaps up, and after properly configuring his flight, selected a lower temperature by using the temperature level control. He then selected manual cold on the control panel when the temperature level controller failed to lower the cockpit temperature. Rather than risk a cockpit overtemperature emergency, he selected RAM air on the control panel of his aircraft and simultaneously signaled his wingman to loosen his formation position. He had begun a turn back toward the airfield when a sudden, deafening blast of hot air in excess of 500 degrees F. blew the louvers from the left air conditioning duct into his lap. The volume of air was such that it prevented him from hearing the aircraft radios, and the temperature of the in-rushing air caused second degree burns through his flight suit to his left arm and thigh. He immediately accomplished the bold face procedures for cockpit overtemperature. With the large volume of super-heated air still trapped in the cockpit burning his face and a delay in the bleed air valves closing, he jettisoned his canopy, maneuvering for an emergency landing against traffic. While turning onto final, the bleed air valve closed, and he was able to hear the clearance to land. After an uneventful landing, he was treated by the base flight surgeon for first and second degree burns. Major Juneau's exceptional airmanship and presence of mind were instrumental in the safe recovery of this aircraft. WELL DONE! ■



Wear Hearing Protection

Courtesy 54FTS Squadron Safety Office