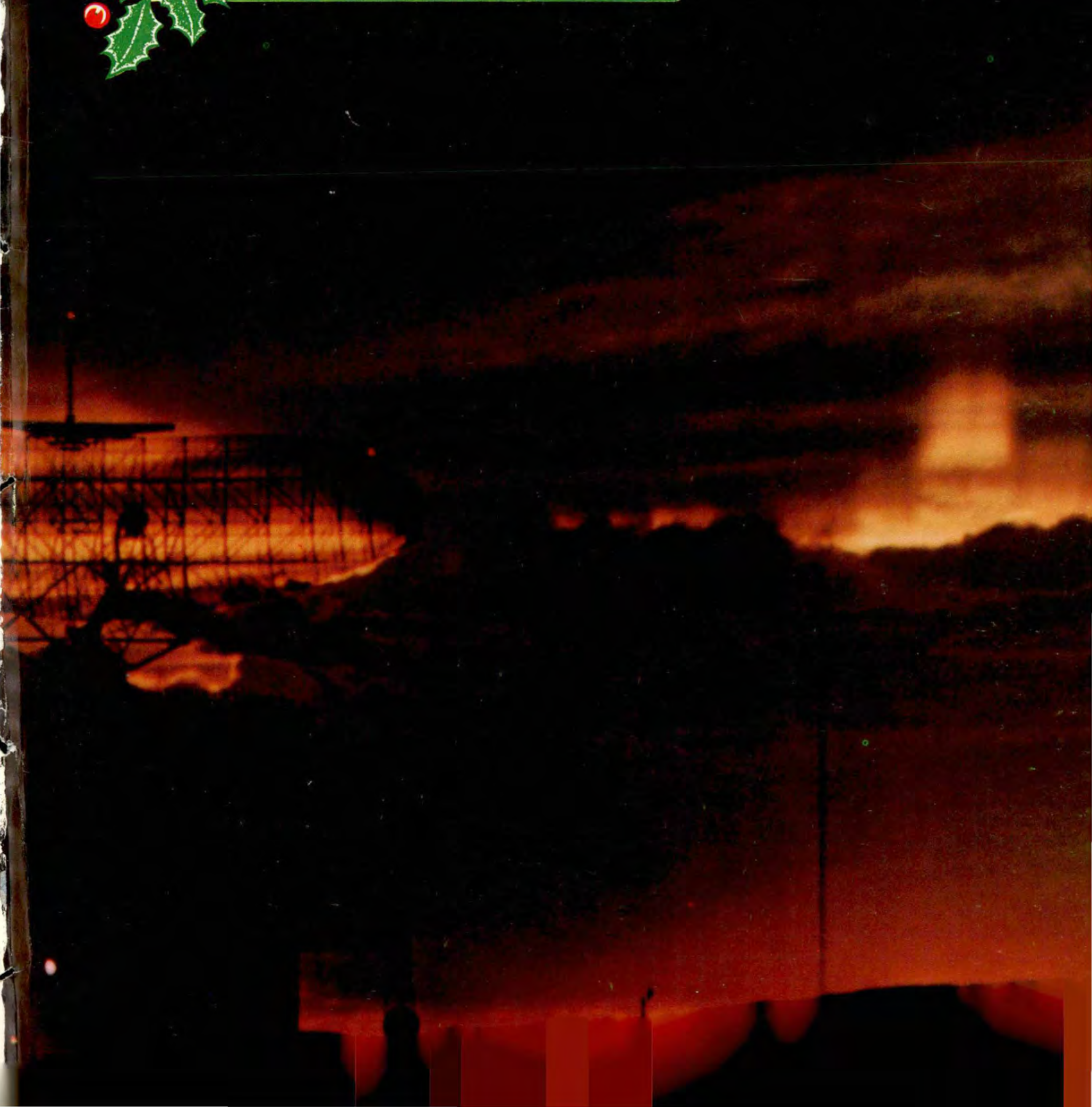
UNITED STATES AIR FORCE • DECEMBER 1971

Aerospace SAFETY



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UNITED STATES AIR FORCE DECEMBER 1971

Aerospace SAFETY

FOR AIRCREWS, MAINTENANCE & SUPPORT TECHNICIANS

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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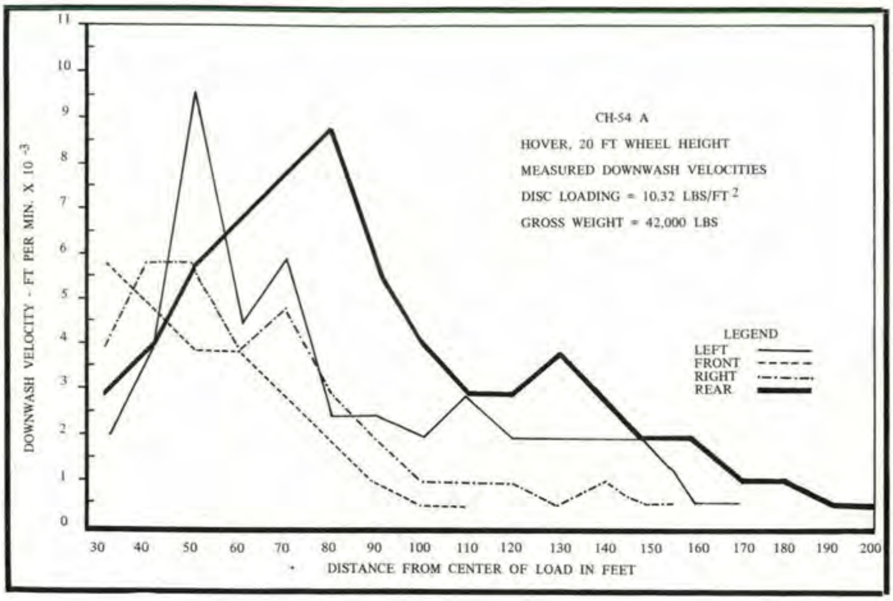
DECEMBER 1971 AFRP 127-2 VOLUME 27 NUMBER 12

Merry Christmas
and a
Happy New Year



HELICOPTER WAKE

VERNET V. POUPITCH
Directorate of Aerospace Safety

Pilots are well aware of fixed-wing aircraft wake turbulence and the hurricane velocity of wingtip vortices generated in flight. Standards for separation have been established by FAA and more conservatively by USAF to minimize the adverse effect on control of the exposed aircraft.

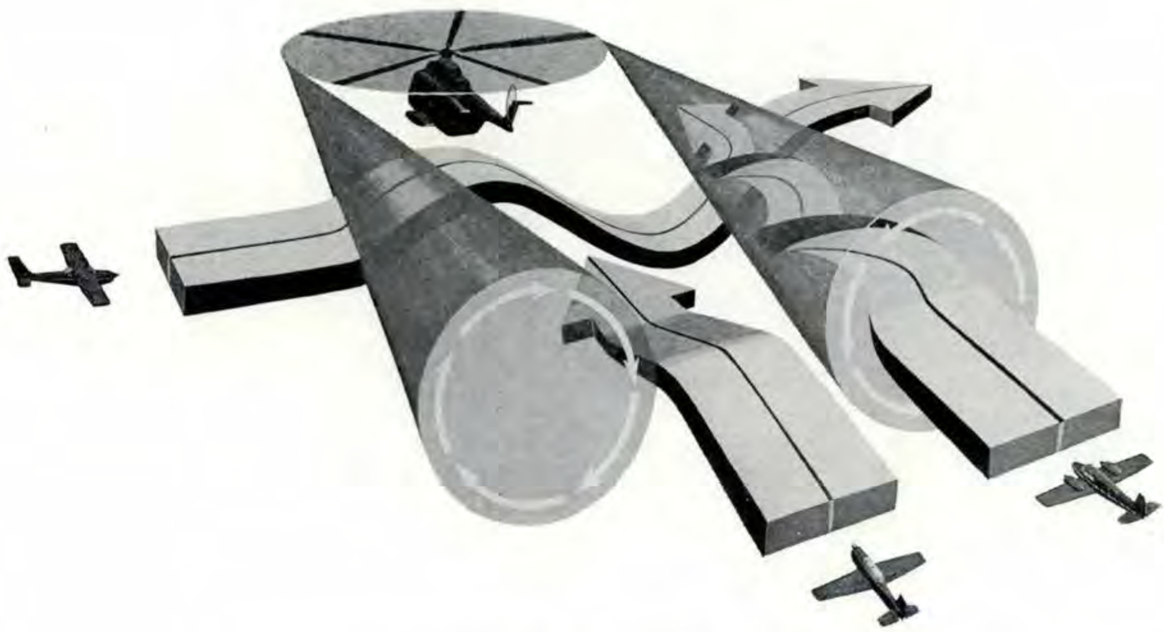
Unfortunately, light aircraft pilots and control tower operators don't appreciate the high dynamic pressures generated by heavy helicopters. A study by NASA has determined that the average velocity and the total energy of the downwash in a helicopter wake are similar to those for an airplane of the same weight and span and flying at the same speed.

Recently in SEA, a pilot was conducting transition training in an HH-53 and was cleared to make an approach to the last 2000 feet of the runway. The pilot elected to make his spot approach to a runway/taxiway intersection, which was clear at the time the approach was started. As the helicopter completed the final phase of the approach, the IP advised him an O-1 aircraft had taxied up to the intersection and their rotor wash was rocking the light plane. The helicopter pilot broke left and made a go-around and the O-1 taxied back to his ramp.

The tower operator had cleared the O-1 to taxi and unwittingly to exposure to possible damage. Had he understood the hazards and problems associated with rotor downwash from a heavy lift helicopter, he would have held the O-1 away from the approach spot.

Since all services operate light aircraft, it is imperative that all personnel involved be familiar with the extent of heavy lift helicopter rotor downwash, the energy of which is strong enough to upset small aircraft and damage larger aircraft. Based upon studies published by Dr. William P. Schane of the Aviation Medical Research Division, US Army Aeromedical Research Unit, the following is a summary of findings.

Aircraft with a disc loading of



Penetration modes: cross track, along track between vortices, along track through vortex center. Each mode presents certain hazards to penetrating aircraft.

TURBULENCE

4.35 lbs/ft², such as the UH-1 class, can generate a resultant wind as high as 3000 ft/min or 29 knots.

In larger aircraft such as the H-3, with a disc loading of 7.6 lbs/ft², a resultant wind of 5200 ft/min or 51 knots has been measured.

Similarly, disc loading for the H-53 of 10 lbs/ft² has generated a hurricane velocity greater than 10,000 ft/min (98 knots).

Maximum wind velocities generally are recorded in a circle of radius 1 to 1.5 disc diameters from the center of impingement. (A Sikorsky Aircraft Company study of downwash velocity of the CH-54A whose disc loading was 10.32 lbs/ft² is shown graphically. Note the velocities in front, left, rear and right sides of helicopter are depicted and the left side and rear side downwash velocity was nearly 40 percent higher than at the other two sides.)

The magnitude of the resultant wind is proportional to the square of the disc loading and varies with height above the ground.

When a helicopter is within "ground effect," generally at a hover altitude of less than 100 feet or when the rotor is at 1.0 disc diameter or less above the deflecting surface, the resultant winds are horizontal and the magnitude inversely proportional to the height above the ground.

The height above the ground of maximum winds is directly proportional to the effective disc diameter and to the height above the ground of the helicopter.

These findings should make clear to all pilots and control tower operators that adequate separation must be provided between helicopters and other aircraft. FAA standards and control for fixed-wing and rotary-wing aircraft published in Terminal Air Traffic Control Handbook 7110.8B are a controller's guide for minimum safe separation. Yet, controllers and pilots are sometimes lulled from a vigilant to a complacent state, and unwittingly and needlessly permit hazardous exposure of aircraft and crews. The latest advice is to allow at least one minute separation between helicopters and approaching aircraft. ★

THE I.P.I.S. APPROACH

By the USAF Instrument Pilot Instructor School, (ATC) Randolph AFB, Texas

LOW ALTITUDE INSTRUMENT APPROACH PROCEDURES

A pilot glancing through any of the FLIP Low Altitude Instrument Approach Procedure booklets is confronted with many different procedure depictions. Procedures are shown with barb symbols, holding patterns, teardrops, and procedural tracks. Three different depictions for holding patterns are in use. It is only natural that a certain amount of confusion exists as to how to fly certain approaches. A general discussion of low altitude procedures is in order and should alleviate at least some of this confusion.

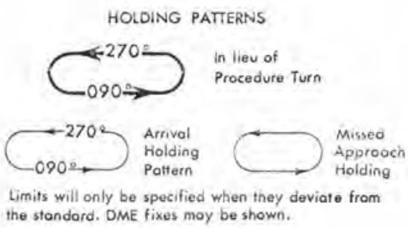
PROCEDURE TURNS

In years past and until all procedure turns could be converted to the barb symbology, AFM 51-37 authorized the use of "procedure turn" procedures with any of the three depictions then in use. These depictions were the barb symbol, the teardrop, and the holding pattern. This is no longer true today. The new AFM 51-37, dated 1 November 1971, recognizes only the barb symbol as the proper depiction for a procedure turn. Use the pilot procedures contained in AFM 51-37 to fly all approaches depicted with the barb symbol.

HOLDING PATTERNS

A recent change to the Inter-Agency Air Cartographic Committee (IACC) specifications for low altitude instrument approach procedures establishes three distinct types of holding patterns. This section of the legend page is reproduced here.

Where descent is depicted prior to the holding fix, you must be on course inbound prior to beginning that descent. In the first example above, you must be on the 307 degree course inbound prior to leaving 1600 feet for 800 feet. In the second example you must maintain a minimum of 1600 feet until past the final approach fix.

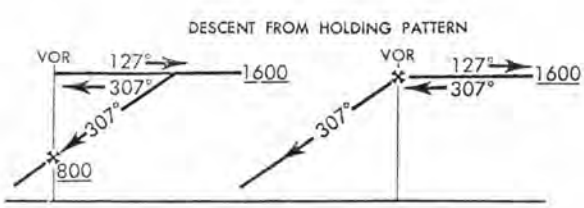


Arrival holding patterns and missed approach holding patterns are self-explanatory. Use the pilot procedures contained in FLIP Section II and AFM 51-37 to fly these holding patterns.

The third type of holding pattern is depicted with a heavy blue holding pattern symbol. Note the words, "In Lieu of Procedure Turn" adjacent to the symbol. Use holding procedures and not "procedure turn" procedures to fly all approaches depicted with the heavy blue holding pattern symbol.

All maneuvering depicted with a heavy blue line is considered an integral part of the approach procedure. This applies to the heavy blue holding pattern depiction and differentiates it from an arrival holding pattern which is not part of the approach procedure.

Descent from the minimum holding altitude is depicted in two ways—descent at the holding fix and descent on the inbound leg.



PROCEDURAL TRACKS

A procedural track is used to depict a specific route of flight from an initial approach fix to a final approach fix. Procedural tracks assume many different forms. Because the only authorized depiction for a procedure turn is the barb symbol, a "tear drop" depiction must now be considered to be a procedural track. Fly all procedural tracks exactly as they are depicted.

USAF IPIS GREETINGS

December 1971 marks the seventh year of continuous monthly "IPIS Approach" articles published in this magazine. These articles are but one service that the USAF IPIS provides to the Air Force. While these articles cannot be directive in any way, they can explain new procedures, new techniques, and answer questions of general interest concerning instrument flight. As always, the well-informed pilot will tend to be a safer pilot. We hope that the information provided in the "IPIS Approach" contributes to safety in this manner.

Most of the material in the articles is prompted by questions posed to the USAF IPIS by individuals throughout the Air Force and the other services. Please do not wait to see if your pet problem or question will one day appear "as if by magic" in these articles. Ask it! Ask it now!! Address your inquiries to USAF IPIS/DOYI, Randolph AFB, Texas 78148, or call AUTOVON 487-4884/3092.

The USAF IPIS extends best wishes to you and your family for a Merry Christmas season and a safe and prosperous new year.

Donald M. Condra

DONALD M. CONDRA, Lt Col, USAF
Commander, USAF IPIS

PILOT'S

The title of this article is wrong. It should be spatial disorientation. That's what we flight surgeons call it. Pilots seem to prefer the term vertigo. What is important is that we know this subject—what we call it is secondary.

The subject of spatial disorientation is not a new one. It is part of the pilot's academic training, it is often discussed at flying safety meetings and squadron briefings, and it frequently is the subject of articles in Air Force safety publications. It is reviewed so often because of its importance; pilots must always be reminded about spatial disorientation.

This was underscored in a study done by flight surgeons who found in a USAF major command that *spatial disorientation was the cause of four percent of all flying accidents and 14 percent of all fatal accidents.* Furthermore, 100 percent of the pilots in that command admitted experiencing spatial disorientation at least once. Therefore, it is reasonable to state that spatial disorientation commonly occurs among pilots, and that it is a factor in a significant number of aircraft accidents.

Although this subject can be quite complex, only a simplified overview is necessary for understanding. In order for human beings to be oriented in relation to the earth's surface, three special senses relay information to the central nervous system where it is integrated and interpreted by the brain. These three special senses of orientation are visual, vestibular, and proprioceptive.

THE VISUAL SENSE allows us to see. We know if we are sitting, standing, or lying by reference to other objects around us. Of the three senses necessary for orientation, vision is the most important. Even if we are denied normal vestibular-proprioceptive function (for example, due to some disease process), we can still properly orient ourselves by visual reference alone.

THE SECOND SPECIAL SENSE is vestibular. It comprises an organ (called the semicircular canals) located in the inner ear. The semicircular canals are complex, delicate tubular structures lined with nerve tissue and filled with fluid; there is one set of these canals in each ear. When the head is tilted or moved, an eddy or current of the semicircular canal fluid is created. The current, in turn, stimulates the nerve cells (microscopic hair cells) which line the interior of the canals; the hair cells then relay this information to the brain via nerve pathways. Subsequently, the brain interprets this nerve impulse and tells us in which direction the head is being

VÉRTIGO

Lt Col RUSSELL B. RAYMAN, USAF, MC, Directorate of Aerospace Safety

tilted or accelerated. This sequence allows one to know, even without the aid of vision, his position in relation to the earth's surface. For example, if you close your eyes and lean far to the left, you will know your position only because of the above vestibular apparatus.

THE THIRD SPECIAL SENSE is proprioception which is made up of special cells located in the muscles, tendons, and joints. These cells are stimulated by pressure and can relay, via nerve connections to the brain, information regarding the body's orientation. It is commonly referred to as "seat of the pants" information. As an example, when we go up in an airplane, the forces of acceleration act upon the buttocks. Within the buttocks, the cells of proprioception are stimulated by the upward force of the airplane. Next, a nerve impulse goes to the brain telling us that we are in a climb. With the eyes closed, we still know we are going up because of proprioception. Under normal conditions, we use visual information in conjunction with the vestibular apparatus and proprioception to know our orientation with the earth's surface.

Assuming a man has normal function of the three senses described above, he would have no difficulty knowing his orientation as long as he is *on the ground*. On the ground, the three special senses can be relied upon to give accurate information as to one's position. However, once one is taken from a ground environment to an unnatural airborne environment, the three special senses do not function as well. As a result, spatial disorientation may occur, due primarily to the brain misinterpreting the information received from the three senses (visual, vestibular, or proprioceptive). Under certain conditions (to be discussed below), such misinterpretation can happen to any pilot. When spatial disorientation occurs, the pilot will not know his position in relation to the earth. The possible consequences of this condition are obvious.

Spatial disorientation is most likely to occur when a pilot is denied outside visual reference. Therefore, he is most vulnerable flying at night, in clouds, or in poor visibility weather. Under these conditions, when vision (the most important of the three senses of orientation) is denied, the pilot has only the vestibular apparatus and proprioception to tell him where he is. But without visual reference, the latter two senses may relay information to the

brain where it could be misinterpreted, making a pilot think he is going one way in relation to the earth when he is really going in another direction. How many pilots, while flying in clouds, with zero visibility, have felt the sensation of being in a dive, climb, or bank only to find, upon checking the instruments, that the aircraft is really flying straight and level? This is a classic example of the brain misinterpreting signals sent by the vestibular or proprioceptive senses. Once the aircraft breaks out of the clouds into VFR weather, the pilot's outside vision is restored and the three senses again accurately display their signals—the pilot then becomes oriented.

Another example of such an illusion may occur just after takeoff climbing through clouds. The pilot may suddenly experience the sensation of a steep climb when he is actually in a normal climb. In order to "correct," he pushes the stick forward; at low altitude just after takeoff, recovery may be impossible. This is called the oculogravic illusion and has been responsible for a number of aircraft fatalities.

Spatial disorientation can also occur on dark nights when the horizon cannot be discerned. Stars and ground lights appear to merge making orientation with the ground very confusing. Only instruments can tell the pilot exactly where he is.

Probably the most spectacular and most dangerous illusion is the notorious Coriolis illusion. Its effect is a sudden, severe disorientation which usually occurs when the aircraft is in a turn and the pilot rotates his head in a plane other than the turn of the aircraft. This classically occurs during a penetration turn if the pilot simultaneously rotates his head backwards to find the switch to make a radio frequency change. The vestibular organ is particularly sensitive to this maneuver and reacts violently. This phenomenon is particularly dangerous at low altitude. The pilot may suddenly become so disoriented that recovery becomes impossible.

These are only a few illustrations of spatial disorientation; many more could be cited. Pilots must be aware that spatial disorientation is always a threat and, given the right set of circumstances, can happen to anybody. The flight surgeon cannot treat this physiological illness with "pills and shots." The pilot must treat himself by looking at his instruments and believing in them. They seldom lie, but his three special senses might.

In conclusion, the following summarizes the highlights of spatial disorientation:

- Pilots of jet aircraft have an incidence of spatial disorientation five times that of pilots flying propeller aircraft.

- Pilots with little instrument experience are more susceptible than those with a lot of instrument time.

- Spatial disorientation is most likely to occur when outside visual reference is gone such as in weather, clouds, or darkness.

- The oculogravic illusion usually occurs shortly after takeoff and has been implicated in accidents.

- The Coriolis illusion is particularly dangerous and can occur during penetration turns.

- Be aware of spatial disorientation—use your instruments. ★

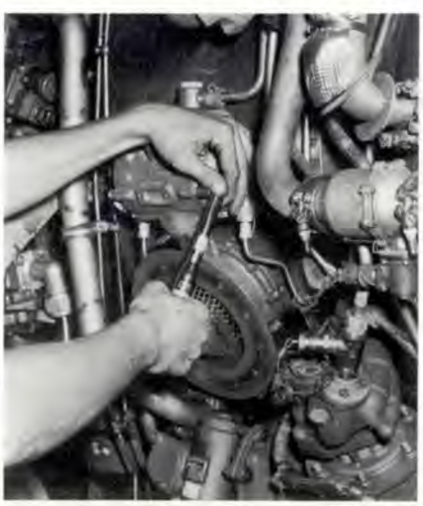
PILOT'S VERTIGO

The Simple Task of Torquing Aircraft Hardware

People are killed and other lives jeopardized, many millions of dollars worth of equipment is lost, and untold manhours are futilely expended. Why? **Because a simple procedure that comes with adequate guidance is ignored.** We're talking about **torquing** aircraft hardware.

The bare statistics might indicate that very little progress has been made in this area over the years. However, a great deal has been accomplished. Standard, easy-to-use torque wrenches have been procured and distributed. Simple, easy-to-operate calibration equipment has been made available. Technical orders containing calibration and repair procedures are readily available. Our education programs continue to emphasize the importance of properly torquing aircraft nuts and bolts.

Statistics, however, clearly point to the sadder side of the picture. The truth is, many items are just not being properly torqued. For example:



C-130—Gear would not extend. Aircraft landed on foamed runway. Cause: Personnel overtorqued locknut, causing failure.

A-1E—Strong fumes in the cockpit. A rapid series of explosions during landing rollout. Fire, both crewmembers lost. Cause: Contractor failed to torque a B nut on the engine driven fuel pump.

EC-121D—Explosion occurred during engine run. Cause: Fuel system B nut not torqued during installation.

RF-4—Bump felt by both crewmen in flight, followed by number one fire light and flameout. During number one airstart attempt, number two fire light came on. Cause: Left engine fuel pump base plate not torqued.

F-106—Secondary hydraulic system pressure dropped to zero just after takeoff. Cause: System failure because of an overtorqued return line.

T-41—Fuel streaming from the engine cowling on takeoff roll. Mission aborted. Cause: Fuel pump supply line only finger tight.

The list is much longer. The question is, why do these things happen? One reason is that supervisors do not ensure that the proper torque equipment is available and properly used. By supervisor we mean those at all levels, from the crew chief who has an assistant to the Chief of Maintenance. The supervisor must make sure that adequate procedures are established, that each and every torque tool is calibrated on schedule and readily available when needed.

A thorough review of this critical problem area is needed. Each organization, field and depot maintenance activity would do well to review its torquing procedures to make sure that the applicable system and engine technical orders are strictly followed by all maintenance personnel. All the expensive efforts that can be pumped into this most critical area of maintenance can be diluted by the unthinking, uncooperative mechanic or supervisor who still believes that old saying, "turn 'er down tight and another half turn," will keep our high speed, close tolerance birds in the air. This type of thinking is completely unsatisfactory. The only way is the technical order way. ★

don't • miss • this

True professionals pride themselves on the accuracy of their efforts. Surgeons derive a great deal of satisfaction in performing a successful operation; a nurse when she is able to relieve some suffering by a patient; the architect when he designs a house that pleases the owner; the lawyer when he successfully defends a client. Pilots are no different. One of the talents that a professional can demonstrate is his proficiency in instrument work or in the traffic pattern. Since all aircraft TOs have best airspeeds and altitudes for certain maneuvers, the professional pilot strives to be precise in his flying and adheres as closely as possible to the published word.

The Stan Board pilot nodded and smiled approvingly as the examinee flew the precision pattern without losing or gaining a foot of altitude or a knot of airspeed. Both the pilot and flight examiner were pleased with the mission until the Cessna locked wings with their T-Bird. The functional check of the ejection systems in the T-33 met with success and the two military pilots survived.

The light aircraft was demolished and its pilot was killed. Cause: failure of the pilots of both aircraft to adequately clear the area.

Both aircraft were operating under the see and be seen concept, yet neither saw the other. It's a safe bet that neither of the survivors will ever find himself preoccupied with the instrument panel again, unless in instrument conditions. It's a hard way to learn but the most unfortunate part is that there are many more pilots who will have to learn this lesson . . . perhaps they will not be so lucky.

The likelihood of a midair collision is difficult to sell. After all, the sky always seems so clear and solid objects, such as other aircraft, are difficult to visualize at thirty thousand. Yes, they are there. If you don't believe our skies are crowded, pay a visit to an FAA control center sometime and get a feel for the amount of traffic they control on an average day. Even better and more impressive is the time lapse photography film that some centers have available. You can't help but be impressed.

A lot of ink has flowed over the presses recently attesting to the critical nature of the midair collision but we still have them. We've told you how to focus your eyes, how to avoid another aircraft in close proximity, but we just can't seem to eliminate this as one of our major hazards. The example of the IP on an instrument check, so engrossed in the precision flying of his examinee that he forgot to look out, describes just one problem. But we're willing to bet that this is not an isolated case. Our position is that if you can't adequately clear the area and keep an eye on the performance of the pilot you're checking, we suggest you ignore the few knots of airspeed or a hundred feet or so of altitude in exchange for a collision-free mission.

We have presented one way in which the individual can help prevent midairs. There are other ways, some involving more people. An example is the action taken by the 3510th Flying Training Wing at Randolph AFB. There are several reasons why Randolph led ATC in reported near misses. To begin with, the San Antonio air traffic volume is greater than the combined totals of O'Hare and JFK International airports. Just considering Randolph alone, we can count 371,000 annual aircraft movements, which ties Atlanta International for the fourth busiest U.S. airport. A major factor in the near miss potential is that two "concrete airways," Interstate 35 and 10, lie directly in Randolph's traffic pattern. They are used extensively by VFR traffic.

The first cut that was taken to reduce the exposure was a program called "Heads Up" which began in 1965. This was a series of regularly scheduled briefings aimed at alerting aircraft executives including FAA officials, airport managers, and airlines representatives of the problem. Unfortunately, a survey indicated that the "word" still wasn't being passed to the light aircraft pilots. To get better coverage it was decided that television would provide one solution. The Base Information and Flying Safety officers helped a local television station in producing a three-minute news feature in which an Air Force T-41 and a T-37 jet trainer flew a simulated near miss. The film later won an award for reporting excellence.

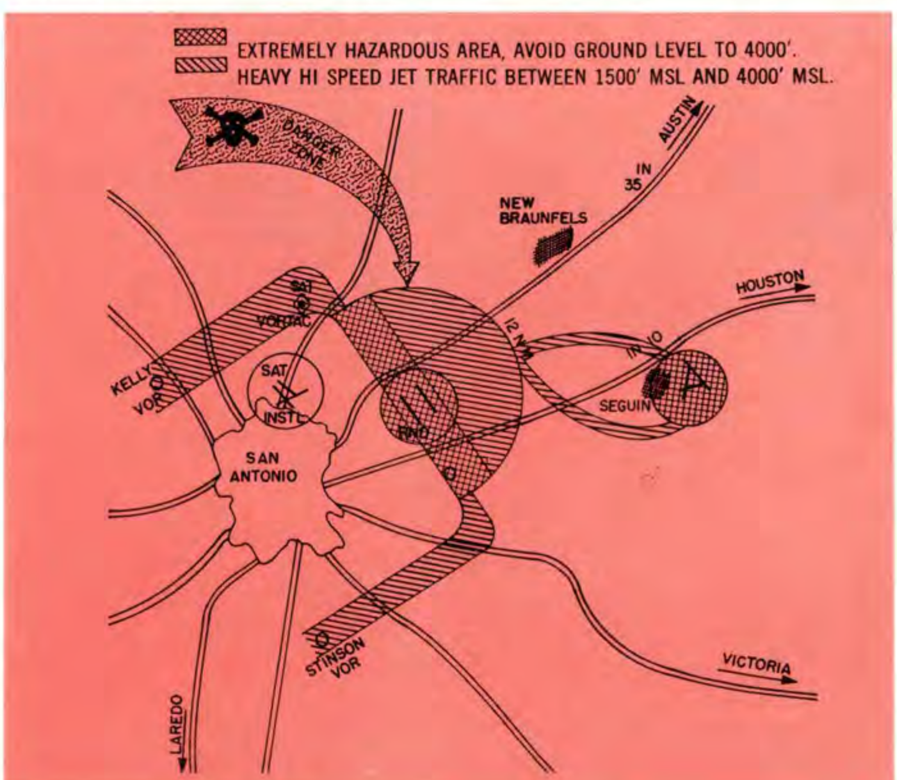
To reinforce the program the safety office began to keep track of the near misses by plotting them on a map of the area near Randolph. After pinpointing numerous close calls and analyzing them, they were able to determine the most dangerous area. From this data they constructed illustrations and charts, combining them into a detailed briefing. To insure that the leaders of the community realized the seriousness of the problem, the wing commander hosted a "Heads Up" luncheon for the Greater San Antonio Chamber of Commerce general aviation committee. During this luncheon Colonel Vandenberg, the wing commander, outlined the person-to-person effort necessary to educate all civilian pilots in the area.

To back up his premise that person-to-person contact was the major tool in education of pilots to the hazard of midair collisions, Colonel Vandenberg's safety people began making visits to small airports within a 200 mile radius. Specifically, the safety officials briefed owners and pilots of light aircraft on Randolph's "hot spots."

In addition to this, the wing commander personally wrote to more than 1500 owners and pilots of light aircraft explaining his concern over the increase in near miss incidents. He asked their assistance and pledged the cooperation of his pilots in dealing with the problem.

These are but the highlights of a program one wing was willing to pursue in an effort to reduce the growing danger of midair collisions. We do not mean to say that this is the only way to do it—just that some responsible individuals are making a real effort toward saving lives and airplanes through education. What are you doing in your organization? ★

Our thanks to TSgt M. J. McLemore, Randolph AFB, Texas, for supplying much of the information for this article.



Suddenly it's

Winter in cold climates brings its own set of problems for helicopter operators. The most serious are those associated with preparation for flight, "white-out" from blowing snow during takeoff and landing, and the effects of low temperatures on materials and people.

How the 5040th Helicopter Squadron at Elmendorf, Alaska, handled these problems with a new helo, the H-3, is related by Major Richard C. Ground, Squadron Stan/Eval officer.

The H-3, which has proven itself in tropical and sub-tropical climates, has completed its first year of sustained cold weather operations. We have used our HH-3Es on a wide variety of missions in the arctic environment during 1970-71. To our knowledge this has been the first extensive and sustained operation of the H-3 during severe cold weather conditions. Missions have been conducted in temperatures as low as −65 degrees and chill factors down to −105 degrees.

Our experience has uncovered some significant difficulties and problems that occur in flight operations and in maintenance. Some of these problems are not peculiar to the H-3 in Alaska but could be encountered in any cold weather operation. In general, a significant increase in manhours is required to complete all cold weather related tasks. Flight planning may take considerably longer, while the normally simple task of crew transportation to the aircraft is complicated by survival gear which must be carried.

In maintenance, enforced scheduled breaks have proven invaluable. A few persons may spend much of their time in heated areas, leaving a larger workload on those remaining. By the same token, a few men will try to remain on the job beyond their endurance and become a hazard to themselves and the entire operation.

Line supervisors should be on hand at all times when frostbite is a danger. During winter months in Alaska, metal freezes to a bare hand, while cuts and scrapes are sometimes not noticed until one moves to a warm area. Ramps and aircraft surfaces become skating rinks to the unwary. The same problems may be found at some northern bases in the Lower Forty-eight.

Moving an aircraft from a warm hangar into freezing temperatures has caused the entire aircraft to ice-over when the humidity was right, and struts, tires, APU accumulators and landing gear blowdown bottles to lose pressure. Tubeless tires, having lost pressure due to temperature change, come loose from the rim when supporting the aircraft on uneven terrain. Struts that deflated in −65 degree temperatures, when no servicing facilities were available, were protected from bottoming by jacking up the aircraft and wrapping rope around the lower strut. Seals were ruined in those struts that were allowed to bottom. Rotor head covers that came with the H-3 became stiff and unmanageable in low temperatures. No acceptable replacement covers are yet available.

Moisture problems in pressure systems were alleviated by reservicing the system with nitrogen. Pulling landing gear and fuel tank pins after APU start and before rotor engagement, as is now authorized in the latest H-3 Flight Handbook, has allowed a much safer operation for ground handling personnel.

Aircraft commanders have the responsibility of insuring that all crewmembers and passengers have sufficient cold weather gear to survive if the need arises. Sometimes this is a pretty big order: Several newsmen who were taken onto the Ice Cap to observe a joint Army/Air Force landing picked up more severe frostbite in the few hours than all of the military personnel involved in the maneuver. This was not an Air Force helicopter involved and the crew had little choice in the matter of passenger clothing being worn.

Leather boots provide little protection from the cold; however, if that's all you have in a walking situation, plastic bags slipped over the sock inside the boot will help keep the foot dry and warm. Insulation from the aircraft works well on humans if the need arises, but

... WINTER

HELICOPTER IN THE COLD

improvisation seldom beats proper equipment.

Flight crews should fly the routes filed unless assured that any deviations are recorded by flight service. Many an hour has been spent searching for a pilot who changed his route without informing anyone. Winter IFR flights are more difficult over mountains with high MEAs. The "D" factor in Alaska was as great as −3000 feet at times during the past winter. With a 10,000 foot MEA this puts you down among the mountains at MEA or above the oxygen required altitude if the "D" factor is corrected for in filing IFR.

Icing conditions have limited instrument helicopter flights, resulting in much lower airspeeds and descent due to insufficient power to maintain level flight with the load of ice and disrupted airfoils. Ice has formed on helicopter blades during taxi in a light fog. This winter we are using blade anti-icing tape which may make a difference.

Another major winter hazard has proven to be whiteouts from the snow cloud created by rotor wash during takeoffs and landings. If the mission is such that a landing in loose or unbroken snow is required, a few precautions will reduce, but not eliminate, the hazard. The best way to land in loose snow is to touch down ahead of the snow cloud caused by the rotor wash. This is only safe when the depth of the snow and terrain underneath is known.

If a landing from a hover will be required, figure that blowing snow will obliterate all but the most contrasting colored objects close at hand. This unit produced bright colored stringers about six feet long with a small weight at one end. These stringers are rolled up and carried aboard the aircraft to be dropped when natural references are not available, on a frozen lake for example. If small bushes are visible, they make excellent hover references provided the approach terminates with the bushes as close to the pilot as safely possible. If the landing area is near open water, an approach to the water's edge will provide a hover reference for touchdown. If power is sufficient, a hover above the snowcloud may be established in an attempt to move the loose snow and uncover a hover reference.

Smoke bombs are good if the snow is not too deep. Beware of loose objects used as references that may blow away in the rotor wash when you need them. We have learned not to make a low turnout over a frozen lake from a wooded shore line. If weather will not allow a climb, ease out from the shore until a safe turn may be made back in the direction of the shore. A tight turn with a good reference is much safer than a gradual turn with marginal visual references.

Finally, when you arrive back at the barn and are ready to escape to the warm ops building, don't forget to complete the 781 correctly with all the discrepancies, allowing maintenance control to plan necessary work on the aircraft and, thereby, assuring yourself of a safe aircraft next flight. And don't slip getting out of the bird! ★

this class is a drag, when do

Any doubts about these long, boring academic hours that teach you things you "don't need to know"?

Flight level 180, 300 KIAS, solo lead, formation. Cold flashes, dull reactions—I think I should select 100 percent oxygen. My wing aircraft is out in trail somewhere about a mile behind me. I'd better rejoin them and tell them I am having problems.

It was a beautiful afternoon to go flying. My instructor and one of my friends would fly wing while I was to fly solo lead in the T-38 formation ride. After our pre-departure briefing, we set out for the two aircraft we would fly on this mission. There was a small mix-up as to who was to fly which aircraft, but we finally decided which one each of us would take. We then proceeded with a thorough preflight, and all systems indicated another routine student formation ride.

Taxi into position and hold, cleared for takeoff. Gear up, flaps up, after-takeoff checkist. Our flight was cleared on the assigned departure to an altitude block of FL 250-FL 310 for some high altitude maneuvers. While climbing through 12,000 feet, the cabin pressurization started to fluctuate causing my ears to pop. This continued as we passed through 17,000 feet. I informed my IP in the Nr 2 aircraft of the problem and I suggested we remain in a low altitude block from 10,000 feet to 22,000 feet for some other airwork. I felt that this would not affect my flying, as in the T-37 we flew unpressurized and I never experienced any problems, and also the mission would not be a total loss from a training standpoint.

Our flight requested and received a low altitude block to practice close and extended trail. I did not feel the pressurization fluctuating as much as before, and it didn't seem to bother me. After about five minutes of extended trail, I started to feel cold flashes and my judgment was starting to become impaired. I was performing maneuvers which were not normal.

I started to think back to the training we were given several months ago, remembering about hypoxia and how it can be such a silent and unsuspecting killer. I re-

membered the symptoms I had experienced under the controlled atmosphere of the altitude chamber ride and related them to what I was experiencing now. The two instances seemed to be exactly alike. I switched to 100 percent oxygen to help get more oxygen into my blood. Then I remembered that a descent should be made below 10,000 feet, but I was at FL 180 and somewhere behind in trail was my IP and the other student. I wagged the wings and called for a rejoin, thinking it would be better to have someone assist me rather than try to make it home on my own. It seemed like an eternity but finally they were on my wing. I never thought anything could be so beautiful.

I tried to explain the problem and after several minutes of confusion (mainly because I was incoherent) I managed to explain that I thought I was hypoxic and that we had better head home and land as soon as possible. By this time, I was so incoherent I could not remember which direction to fly to get home. In our pre-departure briefing the IP had said that anyone with hypoxia or similar problems would lead home so that the other aircraft could monitor the progress of the distressed aircraft. The only problem was that I didn't have the mental capability at the time to do anything but follow, so I signaled the other aircraft to take the lead and I would fly his wing home. I didn't see any problem with this as the other aircraft was dual. The student could monitor my flying and inform the IP if something didn't look right. My state at this time was utter confusion, I made radio channel changes at the wrong time and didn't wait for Lead to tell me what to do. All I could do was fly by instinct instilled by my previous training, and that was to fly so as to keep the wingtip of the lead aircraft in the center of the star.

We reached initial for the landing, and I knew that soon I would be on my own as there was no one else in the aircraft to assist me in landing. By instinct I pitched out, flew downwind, put the gear down, flaps down, and started my turn to final approach. I was almost home free—all I had to do was land. I was high and hot on final, but the controller was able to talk me down the last part of the final approach. Then I saw all the crash trucks, the ambulance, and good old "Pedro" ready for any unexpected event. It made me feel so good.

After turning off the active runway I was surrounded by the ambulance and many trucks. I started to shut down the aircraft and was going to follow the checklist, but the flight surgeon was more interested in me than the aircraft. I told the doc that I was sorry to interrupt a peaceful afternoon but he said "no sweat."

One point I learned most was that no matter what may be said before something happens, the best results are attained by using sound judgment and common sense at the time of the problem. The most important point that impressed me was that training saved my life—training, which at the time seemed so dull and useless. But you never realize how important that training is until it saves your life. ★

we get to fly ?

Not too long ago, a pilot of a twin engine jet, unable to start the second engine and confident of its excellent single-engine performance, attempted a single-engine takeoff. Rotation and liftoff were a little premature for single-engine flight. The climb was established, and the landing gear handle raised. As the landing gear doors opened, the aircraft began to settle. A few moments later, the jet touched down beyond the overrun and began to shed parts. Fortunately, the pilot was thrown clear and sustained only minor injuries.

It is possible to fly an aircraft a few feet above the ground at a slightly slower indicated airspeed than that required to sustain level flight at a little higher altitude. This is the result of a phenomenon called *ground effect* which is better known than understood by many pilots.

When an airfoil such as an aircraft wing is producing a lifting force within a wing span of the runway, the downwash characteristics are altered, resulting in a considerable reduction in induced drag. This ground effect is due to the interference of the ground surface with the airflow patterns about a wing in flight. The compression of air between the wing and the ground is a factor. However, this does not completely explain the effect.

As the airfoil approaches the ground, the wingtip vortices and downwash velocities are increasingly reduced, and at touchdown they are almost completely cancelled out. The reduction in wingtip vortices and downwash velocity is primarily due to the stopping of the vertical air component by the surface of ground. As a general rule, the results of ground effect can be detected and measured up to an altitude equal to about one wing span above the ground.

This can be illustrated by the "image system" of placing a hypothetical upside-down wing the same distance below the ground as the actual wing is above the ground. Any downwash velocity components of the aircraft wing are then offset by the equal upward components from the image wing, establishing a condition of zero velocity in the ground plane.

As the aircraft wing nears the ground, the strength of the wingtip vortices and the downwash angle are decreased for a particular amount of lift being generated. This reduction in downwash near the ground is reflected in a lowering of the induced drag and an increase in lift for the same angle of attack. What this means to the F-5 pilot is that he is obtaining the same lift at a smaller angle of attack and less induced drag, all illustarted in Fig. 1.

For example, with an airplane weight of 14,000 pounds, at takeoff velocity, the reduction in angle of attack required is approximately 30 percent due to ground effect. As you recall, about two-thirds of the drag on the F-5 during minimum speed operation in free air is induced drag produced by the high angle of attack required to sustain flight at this slow speed. However, when the F-5 descends to a point very close to the runway, the induced drag will reduce from 67 percent to 59 percent of the total drag. This factor increases the effective lift-to-drag ratio by about 35 percent, making possible the flattening of the glide path and extending the glide distance following the flare to landing.

Ground effect also assists in cushioning stall-type landings and in operating from soft or rough airfields. The procedure for operating from the latter is to place as much of the aircraft weight on the wings as possible during ground run, and lift off with the aid of ground effect before true flying speed is attained. It is then necessary to reduce the angle of attack gradually until normal flying speed is attained before attempting to climb above the

C. H. VANCE, Senior Performance Engineer, Northrop Corp.

ground

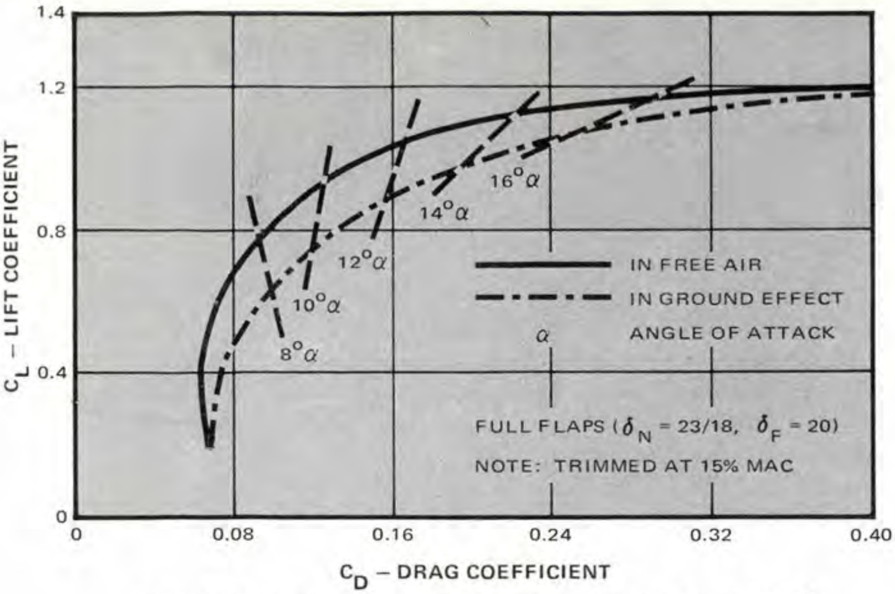


Figure 1. Lift and Drag Characteristics with Landing Gear Down (F-5)

ground effect area. You should keep in mind that the aircraft must have excess thrust available to climb out after it becomes airborne. If the aircraft is airborne at too low a velocity it may be so far back in the area of reversed command that no excess thrust will exist upon leaving the ground effect benefits.

An airspeed indicator is not fully reliable in ground effect. It indicates a slightly higher airspeed as you are leaving the ground effect area and a slightly lower airspeed as you enter the ground effect area.

Ground effect also changes the horizontal tail effectiveness and therefore becomes a major factor in establishing the forward center of gravity (CG) limits of any aircraft. (The lower the percent MAC value, the farther forward the CG is located.) More horizontal tail deflection is required to obtain a certain value of lift coefficient as the CG is moved forward. More horizontal tail up deflection is required in ground effect because the wing downwash angle is decreased and partially deflected upward against the horizontal tail by the ground surface. It will require several more degrees of horizontal tail up deflection to obtain maximum angle of attack just prior to touchdown as compared to free air flight.

Another thought to keep in mind: If your aircraft (any type) has sustained inflight structural damage, and you have satisfactorily accomplished a simulated landing in free air, remember that ground effect reduces the elevator or horizontal tail effectiveness. Plan your approach and flare maneuver so as to use less horizontal tail than that required during the free air check.

Floating following your landing flare is in part a result of ground effect. The aircraft will continue to remain airborne just above the surface at a speed which would have resulted in an immediate stall at a higher altitude. A pilot's misunderstanding of ground effect has no doubt contributed to a number of barrier engagements. The ground effect is always there; it will help cushion your landing, prolong your glide, and permit additional time to improve your landing attitude, but seldom allows enough time to recover from a "balloon effect." The most serious of these effects is that it is possible to get an aircraft airborne with insufficient excess power to sustain flight outside the area of ground effect. ★

EFFECT

Reprinted from Northrop **F-5 Service News**

NUCLEAR SAFETY AID STATION

UNDERGROUND TRAFFIC JAM

At a missile base a launch facility (LF) was called off alert for loss of status accompanied by a missile away indication which reset. A maintenance team was dispatched and replaced the A-4 through A-7 drawers in the status and command message processing group; however, this failed to restore status. The team then performed a power supply check of the power supply group without any defects being detected.

Thinking that something was wrong with the A-4 through A-7 drawers, they returned them to the Electronics Lab for checkout. Since no malfunction could be found in the drawers, they were returned the next day to the LF and reinstalled, but the LF still failed to report status.

After more trouble-shooting by Technical Analysis Division (TAD) personnel, it was determined that the facility was not receiving interrogation signals and that the lack of these signals prevented the transmission of status signals from the LF back to the launch control facility (LCF). A communication team was then dispatched to look for a break in the cable. A break was found and repaired and the LF was returned to alert status. The telephone company had cut the cable with a backhoe while working on a project unrelated to the Air Force.

This incident points out the importance of insuring that service companies which perform underground trenching coordinate their activities with Wing agencies when working in the proximity of Air Force cables.

BEWARE OF CRITICAL COMPONENTS

During crew changeover at a strategic missile base, the new crew discovered that the seal on a critical component was broken. The critical component was an access panel located at the bottom of an equipment rack. The oncoming missile combat crew commander (MCCC) immediately notified the appropriate authorities and initiated an investigation of a possible rules violation. A suitable two-man team checked the status and verified the integrity of the critical components.

It was determined that the critical component located behind the sealed access panel was locked throughout the suspect period, and the on-duty MCCC and the Deputy Missile Combat Crew Commander (DMCCC) controlled the keys at all times. The investigating team also determined that no one entered, tampered with, or had access to the critical component, and the two-man policy had been in effect and complied with at all times. In addition, the integrity of the seal had been checked approximately 24 hours earlier during the previous crew changeover. A maintenance control officer resealed the access panel.

The exact cause of the deficiency was not determined; however, it is suspected that the seal was accidentally broken by the crew during routine alert duties or while the floor was being cleaned and buffed. This incident highlights the importance of all personnel using extreme caution and care when performing routine alert duties and housekeeping chores in the vicinity of critical components. We cannot afford to fall into complacency when it comes to nuclear safety. Your job depends on it! ★

REX RILEY'S
CROSS COUNTRY NOTES

TAQ: On recent inspections Rex has been paying particular attention to the Transient Airman Quarters. Nothing is more frustrating to a crew chief, load chief, or flight engineer than to have to sleep in a noisy, hot, crowded room after spending several hours with his bird, making sure everything is ready for the next day's launch. Or equally bad, to finish your task at 2300 hours, hungry and tired, and find that the snack bar as well as the NCO club stopped serving hours ago. Rex thinks we owe it to our fine traveling airmen to see that the treatment they get is as good as possible. How well they perform cannot help but be a factor in the success of the mission.

ATTITUDE AGAIN: We are beginning to wonder if the remarks section of the flight plan gets attention from anyone. Several recent incidents have led us to believe that if someone is reading the request by the pilot, they are neglecting to pass the information on to the troops who must get the job done. For example, a C-118 aircraft commander requested steps for his passengers to deboard the aircraft. Despite the fact that the base had the time of arrival of the bird, the steps never came and the crew ladder was used to deplane.

MAIL CALL: Our response from the overseas traveling air force has been quite good. We were happy to forward kudos to USAFE after a DO sent a favorable letter to us about one of the European bases. We hope you will keep us up to date and tell us what you think about the service you get. The more mail we get, the better picture we can formulate about how we are progressing.

SNACK BAR: We have heard a few of our troops grumbling about the automatic snack bars found at many of our bases. I really don't think this is too bad, if an electronic oven is available to warm up the chow. At least it beats going to bed hungry. Budget limitations being what they are, this seems to be one solution. Anyone have a better one?

QUICK RESPONSE: If you just can't spare the time to drop us a note concerning the service you have received at various bases, pick up the phone and dial AUTOVON 876-2633 and ask for Rex. We'll have a steno on the extension to take down your comments.

Merry Christmas and Happy New Year.

Rex

THE

REX RILEY
Transient Services Award

LORING AFB	Limestone, Me.
McCLELLAN AFB	Sacramento, Calif.
MAXWELL AFB	Montgomery, Ala.
HAMILTON AFB	Ignacio, Calif.
SCOTT AFB	Belleville, Ill.
RAMEY AFB	Puerto Rico
McCHORD AFB	Tacoma, Wash.
MYRTLE BEACH AFB	Myrtle Beach, S.C.
EGLIN AFB	Valparaiso, Fla.
FORBES AFB	Topeka, Kans.
MATHER AFB	Sacramento, Calif.
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, Tex.
MARCH AFB	Riverside, Calif.
GRISSOM AFB	Peru, Ind.
CANNON AFB	Clovis, N.M.
LUKE AFB	Phoenix, Ariz.
RANDOLPH AFB	San Antonio, Tex.
ROBINS AFB	Warner Robins, Ga.
TINKER AFB	Oklahoma City, Okla.
HILL AFB	Ogden, Utah
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, N.C.
ENGLAND AFB	Alexandria, La.
MISAWA AB	Japan
KADENA AB	Okinawa
ELMENDORF AFB	Alaska
PETERSON FIELD	Colorado Springs, Colo.
RAMSTEIN AB	Germany
SHAW AFB	Sumter, S.C.
LITTLE ROCK AFB	Jacksonville, Ark.
TORREJON AB	Spain
TYNDALL AFB	Panama City, Fla.
OFFUTT AFB	Omaha, Nebr.
ITAZUKE AB	Japan
McCONNELL AFB	Wichita, Kans.
NORTON AFB	San Bernardino, Calif.
BARKSDALE AFB	Shreveport, La.
KIRTLAND AFB	Albuquerque, N.M.
BUCKLEY ANG BASE	Aurora, Colo.
RICHARDS-GEBAUR AFB	Grandview, Mo.

THE CREW CHIEF

Capt WILLIAM V. WOODWARD, HQ 7th Air Force
APO San Francisco 96307

... NOTHING MISSED.

The F-4 Phantom is on its final approach, a hot white pinpoint of light on the horizon—a puff of smoke as the tires hit the runway. A turn down the taxiway, and it's back home again in its heat-scarred revetment.

Sgt James W. (Bull) Cunningham watches the plane land. Parking his bike, he then walks down the ramp to his own Phantom—number 303. At six in the evening another 12-hour work-day is about to begin. In the morning the bird will be airborne. But now it sits there silently, waiting for him.

Sgt Cunningham is a crew chief. He is 21 years old, six feet one inch tall, and well aware of the responsibility he has for the aircrews who fly his aircraft. Facing him is a complex machine of steel, aluminum, and wire—an aircraft as complicated as a Bluegrass filly and twice as temperamental.

He takes up a two-inch-thick checklist. "Bull" runs through those items that mean potential trouble on the ground but life or death in the air. He then checks the pins inserted in the F-4 ejection seats, canopies, downlocks, and finally the pylons.

The work begins . . . a hundred little things on paper. Screws fussed over, rivets pecked, dials tapped, connections checked and rechecked. Shoeless and armed with a flashlight, he injects himself up into the narrow cave of aluminum, the intake. On the way he stops to check a pencil-sized tube that measures air pressure to the engine.

He crawls farther, looking for foreign objects that could damage

NON-STOP . . . WORKING THROUGH THE NIGHT.

gets it all together...

CHECKLIST—CREW CHIEF'S BEST FRIEND.

an engine. Then he checks for foreign-object damage on each of the delicate blades of the compressor. Clean. He backs out slowly, emerging into the night feet first.

He picks up the checklist and continues. So far, everything is okay. And then he sees the cut on the tire. It is a narrow cut, barely perceptible, on the side. Unchanged, it could mean a blowout as the aircraft races down the runway at 175 knots. Out come the hydraulic jacks. As the aircraft is raised, a sweat builds in the sticky heat of the night.

It's 2 a.m., time to switch fuel tanks from the center line to the wings for a different mission. "Bull" and a helper wait while the munitions men dearm the pylons, removing the explosive charges that enable the tanks to be jettisoned in flight.

The tank is lowered carefully on to a dolly, then wheeled away. In its place, from the "tank farm," come a set of wing tanks. These are mated separately beneath the wing of the F-4. Then the "fun" begins, as each is jockeyed on its dolly to match the tank pylons and wing attachment points . . . the locking mechanism is actuated and locked.

Now it's 0440, time to catch a breather, time for a duck beneath the wing with a cup of coffee and a letter from his wife. Down the line the beams from a half-dozen flashlights are cutting the night as other crews labor to ready their birds for the morning mission.

At 0500, a crew truck pulls up and the pilot and navigator climb out. Sgt Cunningham gets up to meet them and gets poked in the ribs and kidded about putting on weight.

The crew chief and the crew go over the preflight checklist and the aircrew perform their walk-around inspection. The two-man F-4 crew climbs up the ladder and into the cockpit. Sgt Cunningham buckles them in. The small air turbine used as a starter brings number two engine whining to life. The engine instruments are checked within limits. Nr 1 comes to life and, again, all engine instruments are checked. The pilot swings the flight controls through their arcs—all okay.

"Bull" gives them the thumbs up signal, and 303 rolls down the taxiway, turns toward the runway, and waits for takeoff clearance. Thunder assaults the ground and the air ripples in a long, broken wave of heat. The F-4 moves down the strip, climbs away from the rising sun, and fades to a burning dot on the horizon.

A tired crew chief watches the dot, arches his back in a stretch, and then heads for the crew shack.

There are thousands of "Bull" Cunninghams—crew chiefs on all kinds of aircraft. Most are not quite six feet one inch tall, but they all have one thing in common. From liftoff to landing, each one of them is the most important man in an aircrew's life. ★

tech TOPICS

BRIEFS FOR MAINTENANCE TECHS

• failure to fill forms

During preflight of a T-29 the crew chief found the main hydraulic accumulator pressure low. A servicing cart was requested and delivered, and the crew chief proceeded with the servicing operation.

The crew chief finished servicing the accumulator and then was called away to perform maintenance on another aircraft. He returned a few minutes later, completed the preflight, and requested an engine specialist to ops check Nr 2 engine. The crew chief went off duty before the engine crew arrived at the aircraft.

The two engine specialists arrived and performed the pre-engine start inspection. A fire guard was posted and a normal start accomplished. Shortly thereafter, the engine stabilized at 1000 rpm. At this time the accumulator servicing fairing fell from the aircraft and was picked up by number two propeller. The fairing was thrown into number one engine cowling cutting a four-inch gash. The fairing was damaged beyond repair.

The cause of this mishap was failure of the crew chief to properly reinstall the fairing. Granted the crew chief was called off the job just as he was starting to install the fairing but had a form entry been accomplished, even though the crew chief had gone off duty, the engine specialist would have known the status of the aircraft prior to engine start.

• torque

After leveloff at 15,000 feet, the loadmaster of a C-130 noted oil leaking from the Nr 3 engine nacelle. All engine instruments were normal and there was no noticeable decrease in oil quantity.

The cause was maintenance. The reduction gear box magnetic drain plug had been improperly torqued during maintenance. The plug was loose even though the safety wire was in place.

An A-37B pilot shut down Nr 1 engine in flight because the fire warning light illuminated. Cause: improper torquing of the tail pipe clamp during installation.

Who is not properly torquing the nuts and bolts? The answer is people at various levels of maintenance from the depot to the line mechanic. Supervisors at all levels must insure that proper torque tools are readily available and properly used.

• that smarts!

The injury of a sergeant whose foot was crushed between the cargo ramp and fuselage of a C-123 underscores the need for strict attention to the job being performed.

The injured man, a passenger, was headed for a seat when he walked onto the ramp. At that moment the loadmaster started to close the cargo ramp and it caught the man's foot.

Most injuries follow this pattern. A moment's inattention and the damage is done.

• cotter pin –lack of

During a GCA the number three throttle of the KC-135 disconnected, leaving the pilot with no control over the engine. The engine was shut down using the fire switch and an uneventful three-engine landing accomplished.

Maintenance found that the bolt, nut, and cotter key were missing from the throttle linkage where it attaches to the fuel control. A review of the records showed that maintenance had been performed in that area seven days prior to the incident.

It is believed that the cotter key was not installed at that time and that the nut vibrated loose in flight, allowing the linkage to disconnect.

• two wrongs make an accident

The F-102 pilot was closing on the target when the radar scope went blank and the aircraft yawed to the left. A quick glance at engine instruments confirmed engine flameout. After all attempts failed to restart the engine, the pilot flew to the closest airport; however, the field was obscured by clouds so the pilot elected to eject, which was successful.

The primary cause of the accident was maintenance. Improper stacking of the accessory drive (bull) gear with insufficient clearance (backlash) between the accessory drive gear and the mating bevel gear shaft caused an overload condition leading to progressive wear, metal fatigue, and subsequent failure, as pictured above.

Contributing cause was supervisory factor. Personnel associated with the spectrometric oil analysis program failed to detect a consistent pattern of abnormal buildup of iron wear contamination in the oil samples taken over a period of several months prior to this accident.

• cooperation??

The T-37 had an overheat light illuminate on initial takeoff at 150 knots, 300 feet AGL. The throttle was retarded but the light remained on and the engine was shut down.

Inspection revealed the charred remains of 1T-37B-6WC-1 (Preflight/Basic Postflight Inspection Workcards) in the engine compartment.

This bird had just returned from cross-country, and it is believed that the workcards were left in the engine compartment by transient alert. Regardless of the source of the error, no pilot should be subjected to such careless actions on the part of maintenance personnel.

tech TOPICS

• attention C-130 flight control instrument technicians

This item came to us from SSgt Giles R. Honse, NCOIC of the Flight Control Section, 7406 Support Squadron (6MAV), APO New York 09057.

"Have you noticed your Standby Compass out of tolerance more than usual? The 7406th Support Squadron Auto Pilot Shop has discovered an error of up to ten degrees in the Pilot's Standby Compass (B-21).

"While following the 1C-130A-2-6 Compass Swing Procedures, the 7406th Auto Pilot Shop ground swung and operationally checked the Standby Compass 'A-OK.' However, after an inflight air check, the compass had an error of ten degrees.

"After an extensive search, I found that the Pilot's Repeater Indicator (Type V-7A), was magnetized. I also discovered that by manually turning the Pilot's V-7A Compass Card, the standby compass would deflect ten degrees off the original heading. Replacing the V-7A indicator corrected this problem. A fleet-wide check revealed one more instance of this.

"To answer the question, 'Why did the Standby Compass ground check OK, but not air check?', the Heading Reference is read directly off the N-1 Compass Master Indicator during ground swing procedures. The Pilot's V-7A indicator is not used. This means that the error caused by the magnetized V-7A indicator remains constant and is compensated for during the ground swing. However, during inflight operation, the pilot manually adjusts the V-7A indicator's compass card to read the aircraft heading and in so doing, causes the unwanted error in the Standby Compass.

"It would pay to check your aircraft by simply rotating the V-7A indicator card slowly through 360 degrees while watching the Standby Compass for any deviation."

• T-38 flameouts

T-38 engine flameouts continue to be a front-runner among the incident reports received, and improper rigging is a prime contributor. Here are three examples:

• During an instrument check ride, at 10,000 feet and 300 knots, the left engine began running rough in the 70- to 80-percent range. The engine flamed out when the throttle was retarded to idle.

Cause: Maintenance factor. Minimum rigging of the bleed valves, combined with rust lick buildup, caused the bleed valves to schedule out of the lower limits.

• Another T-38 was at 45,000 feet. When the throttles were advanced from military to A/B range, the right engine popped twice, fluctuated, and flamed out.

Cause: A-8 cable out of rig. No maintenance had been performed on this engine since PE.

• The third aircraft was at 43,-000 feet. As the throttles were advanced for an altitude change, the right engine flamed out.

Cause: Improper rigging of the A-8 cable.

In all three cases, maintenance was at fault. Strict compliance with available tech data, coupled with a sound quality assurance program, will eliminate these J85 engine rigging problems.

• torque trouble

After level-off at 2500 feet, while the O2-B pilot was establishing cruise power settings, he noticed a discrepancy between front and rear engine fuel flow. The front engine indicated 12 gph, the rear engine the normal 14 gph.

Several minutes later the front engine fuel flow started fluctuating between 10 and 12 gph. The front auxiliary boost pump was turned on and the fluctuation stopped, with fuel flow at 14 gph. Shortly thereafter the pilot noted fuel fumes in the cockpit. An emergency was declared, 200 pounds of cargo was jettisoned, the front engine was shut down and the bird returned to base without further difficulty.

The fuel supply line to the front engine fuel pump was found loose. The fuel pump had been changed the night before by the crew chief, who failed to properly torque the supply line during installation.

• Aero-7A missile launcher maintenance

A recent mishap report revealed that the hazard associated with Sparrow (AIM-7) missiles hitting launch aircraft continues to be a problem. Inadequate Aero-7A missile launcher maintenance within F-4 units has been the cause indicated for these mishaps.

Disassembly inspection of the Aero-7A launcher involved in the above incident revealed the malfunction was caused by **rust** and **residue** from fired cartridges. Performance of scheduled maintenance requirements could have prevented the mishap.

Aero-7A launcher maintenance must be performed at the scheduled intervals prescribed in TO 1F-4C-6 and applicable maintenance work cards. Commanders, supervisors, and safety personnel should make Aero-7A maintenance an item for continuous emphasis.

(TIG Brief 17, 1971)

• improper routing

CASE 1:

Both pilots of the C-47 smelled smoke in the cockpit just after takeoff. The flight mechanic reported heavy smoke and possible fire coming from Nr 2 engine. Fire emergency procedures were applied, the engine shut down, and the aircraft returned to base.

The nose scavenge oil line had chafed against the left magneto blast tube to the point of failure. Oil leaked onto the exhaust collector ring causing the fire and heavy smoke.

CASE 2:

A QU-22B was airborne 45 minutes when the oil pressure began to fluctuate and drop. The pilot headed back to base. Upon arrival over the base the pressure was down to 15 psi.

After the aircraft landed it was discovered that the line connecting the oil screen to the filter had come in contact with the flywheel. An elbow fitting was turned at such an angle that it misrouted the line.

In both these incidents maintenance failed to properly route the oil lines. Two more chapters in the continuing story on "failure to follow tech data."

• follow the TO

Apparently some F-105D units are not following TO 1F-105D-2-6 and 4S-1-63-25 during maintenance on landing gear struts. Proper torquing of the upper and lower torque arm scissors assemblies appears to be one phase of the assembly where maintenance is not sticking to the TO. One major accident occurred this year when the strut failed. During the investigation the torque arm scissors pivot bolt and nut were discovered stripped. This nut could have possibly been overtorqued during assembly, although failure of this bolt and nut was not the primary cause of the accident. A one-time inspection turned up several other assemblies with too little or too much clearance, clearly indicating under- or overtorque.

TO 1F-105D-2-6 which covers removal and installation of the entire strut assembly does not list any torque value for the pivot bolt and nut. Normal torque for this size and type bolt as listed in the aircraft hardware TO is 450 to 500 inch pounds. The required torque when this bolt is installed in the torque arm scissors is 150 inch pounds in accordance with 4S1-63-23, the component tech order. So let this be a warning; when installing the strut you must consult TO 4S-1-63-23 for the proper torque for the pivot bolt.

• C-130 generator problem

All four engines of the C-130 were being run following IRAN. The Nr 4 generator did not come on the line and would not reset from the cockpit. The electrician reset the Nr 4 generator control panel, and the generator was then reset from the cockpit. The generator voltage came up, then failed, followed by heavy smoke from the cargo bay.

The mod team had goofed this one. The Nr 4 generator wires on terminal board 169 were improperly connected, causing a dead short between B and C phase.

Review of the records indicated that no maintenance had been performed in this area. However, new nuts were found on all terminals in the equipment rack. It was suspected that the new nuts were installed during the corrosion control portion of the IRAN, and that the wires were crossed at that time. ★

Ops topics

HEADS UP!

The refueling mission was going along nicely as scheduled. The block altitude assigned was FL 280-300, and both aircraft were at FL 290, heading southwest.

In the middle of the mission a commercial DC-9 passed from right to left, heading roughly northeast. At the nearest point, the airliner was within about 800 feet ahead of and 100 feet below the tanker.

Center was queried and confirmed the block altitude assigned. Furthermore, Center had no knowledge of an airliner in the area! A little research while filing a report to FAA disclosed that this was the second near-miss in that area in the past thirty days.

Need we say more? Heads up!

CAUSE AND EFFECT

The primary reason for defining cause factors is *not* so that someone can be blamed. AFR 127-4 is quite clear on that point. The purpose of identification of cause factors is to help us prevent an incident from becoming an accident or an accident from recurring.

A recent C-7 incident raised our eyebrows. The aircraft departed home station on a trash run. Shortly after level-off, the low oil quantity light flickered, and oil temperature was checked at 60 degrees. A few minutes later the light came on steady, and the pilot decided he'd better turn back for home. The crew monitored the oil temp closely and, when it went through 72 degrees, shut down the engine and landed at an outlying airfield.

Inspection showed the Nr 1 engine was 10 gallons low on oil. Duration of flight was .7 hours.

The aircraft was serviced, run, and reinspected with no discrepancy found. Oil consumption on the next flight was .8 gallons per hour.

The incident report listed the primary cause as undetermined, but most probably operator factor in that the copilot did not check the oil. We can't argue too much with that; it's likely that he didn't check the oil. But who checked the 781? And who serviced the aircraft? And who signed it off as being serviced? The message doesn't say.

CONVINCED?

The mission was airdrop, and the C-130 loadmaster was serving as the kicker. He was attempting to retrieve static lines when he slipped and fell from the aircraft! The loadmaster suffered only a broken arm. Why? *Because he was wearing his restraining harness,* and other personnel were able to pull him back into the plane. How's that for a convincing argument?

THE POWER OF SUGGESTION

A recent NTSB incident report points out an error which can happen when diligence on the part of flight crewmembers is not maintained. The following excerpts are taken from the preliminary report:

". . . . flight was assigned a cruising altitude FL 230 which was shortly changed to FL 290 for the flight leg to destination. In the vicinity of an enroute VOR, the flight was cleared to descend to FL 240. Crew reported reaching FL 240 and was then cleared to 11,000 feet and given altimeter setting of 29.99. The First Officer, during descent, reported leaving Flight Levels 290, 240, 230, and 17,000 feet to ATC. He further stated he advised the Captain of leaving 'one two thousand for one one thousand.' As First Officer was about to report level at 11,000 feet, he looked outside the aircraft and saw tree tops just below their flight level. Reported weather at the time was indefinite 400' obscured quarter-mile visibility in light drizzle and fog. G forces exerted during pullout forced a stewardess to her knees in the aisle. Aircraft climbed to and reported level at 11,000 feet to ATC. Flight then proceeded to destination and landed without further incident.

"The Captain in his statement of the incident stated, 'The altimeters in the plane are the old type. We all misread the altimeters some place in the descent and did not catch it until we had descended to what we thought was 11,000 feet.'

"Preliminary readout of the flight recorder revealed that the highest altitude flown during this flight leg was 19,000 feet.

"The altimeters installed were the 3-pointer type."

It appears that the power of suggestion was at work in this incident since all three flight deck crewmembers misread the altimeters by 10,000 feet.

The point we are trying to make is, individual diligence is a *must.* Do not be misled by the actions of a fellow crewmember. Always do your own check and double checking!

Take nothing for granted while flying an aircraft.

(Flight Safety Foundation Bulletin)

FLIP CHANGES

FLIP High Altitude Chart Information Changes: Beginning with the November 11, 1971 edition of FLIP enroute high altitude-U.S. charts:

a. The elevation, length of longest runway, ATIS frequency and the symbol indicating the availability of PFSV will be removed from the chart. Aerodromes will be shown only with the appropriate airport symbol and name.

b. Only those aerodromes with runways 5000 feet or longer and with an approved published instrument approach procedure will be shown.

c. ARTCC remote controlled air to ground sites will be removed from the chart and ARTCC frequencies on the front panel will be deleted.

d. The unusuable route symbol will be reduced in size.

HORIZONTAL TORNADO

On downwind, the O-2 pilot saw a C-130 making a straight-in approach to the same runway. He continued his normal pattern, dropped full flaps, and was cleared to land, number two. The tower gave the pilot the winds and cautioned him of possible wake turbulence behind the C-130; the pilot acknowledged.

About 1000 feet from the threshold and 50 feet in the air the O-2 hit the wake turbulence. The pilot added full power and did everything he could to get out of it, but didn't succeed. His left wingtip hit the ground about 15 feet right of the overrun and 350 feet short of the runway.

Much material has been published about wake turbulence, most of it containing the statement that the strength of the vortex may exceed the control capability of the aircraft caught in it. What does this mean? Simply this: If the turbulence is descending faster than your airplane can climb—you're going to descend, *no matter what you do!* If the turbulence rolls right faster than your airplane can roll left—you're going to roll right, *no matter what you do!*

What should the pilot have done? There's only *one* thing a pilot can do about wake turbulence: AVOID IT! The guy in the example above *saw* the C-130. He *knew* where the vortex was likely to be. And he hit it anyway. In fact, assuming the C-130 was following the VASI to a 50-foot threshold, and considering where the O-2 was when it hit the turbulence, the pilot had placed himself on a flight path along which he *had* to contact the vortex.

Let's consider two very important facts about wake turbulence: The first is that the vortex settles—it can always be found *below* the flight path of the generating aircraft. The second fact is that, while we know the vortex will dissipate, we don't know how long it takes! It may be as much as five minutes—and maybe even more than that!

Keeping these two facts in mind, let's consider what the pilot in our example might have done:

• He might have gone somewhere else. This is not usually practical.

• He might have extended his downwind and final sufficiently—say, two and a half minutes each—to let him land five minutes behind the C-130, or he might have done some 360s on downwind—say, two or three standard-rate turns. Unfortunately, at some bases this would allow several other aircraft—some of them tornado-generators—to come between him and the object of his concern. Usually, all he's done is substitute another problem for the one he had.

• He might have flown a short approach, used a moderate glide angle, stayed above the C-130's flight path (and the vortex), and landed a little long—past the touchdown point of the C-130. This last one makes a lot of sense to us. The pilot in this instance was looking at a couple of miles of asphalt in front of him, and he certainly didn't need all of it.

The main point we're making is: be aware that wake turbulence is a possibility—that it is often more than a light aircraft can cope with—and the smart pilot will use his judgment to avoid it.

WE TOLD YOU SO

The RF-4E was taxiing back to the parking area behind a C-5 headed for the fuel pit. The C-5 made a right one-eighty to position itself for the fuel pit and the RF-4E taxied on by. When the fighter reached a point approximately 100-150 yards beyond the big transport, it was suddenly engulfed in a cloud of dust and sand—as the C-5 advanced power to pull on into the fuel pit. The F-4 pilots brought the throttles to idle and closed their canopies and, when the dust settled, taxied on in to the ramp where a FOD inspection was conducted.

Yes, indeed! Forty manhours to blend out the first stage pit marks; replacement of the pitted right-hand camera door optical glass; and extensive polishing of the right windscreen.

The message ought to be loud and clear:

- Avoid taxiing behind the big boys whenever possible.

- If you must taxi behind him, *establish radio contact and coordinate your passage through the danger zone.*

DISTRACTION-BANG!

The F-106 pilot experienced a minor steering difficulty during the landing roll and spent some time trying to determine the problem after he cleared the runway. As a result of this distraction, he missed step 3 in the After-Landing checklist: he didn't disconnect and safety his parachute.

After he taxied in and shut down the bird, the pilot disconnected his seat belt and parachute harness, but failed to check the parachute firing lanyard (step 2, Before Leaving Aircraft checklist). As he got up to deplane, he felt a slight tug, realized that he had forgotten to release the parachute and immediately sat down to pull the ditching control handle.

Too late! The parachute deployment gun had been initiated and, after the appropriate time had elapsed (two seconds), the gun functioned as designed. The slug from the gun departed the aircraft between the right rail and the canopy.

It was only an incident, and we were lucky. But the whole thing could have been prevented by following the checklist. ★

THE HIGH COST OF HINDSIGHT

Maj RICHARD C. KIRK, Directorate of Aerospace Safety

In missile launch operations, as in most efforts, hindsight is no substitute for thorough mission planning. This fact was brought out recently in a mishap resulting in the loss of a multi-million dollar space vehicle.

The launch countdown had proceeded with minor glitches, all of which were thought to be corrected, and the booster was beginning its journey to orbital insertion. At T + 23 seconds, an abrupt decay in turbopump speed and main engine chamber pressure occurred. Subsequently, an explosion was observed and the missile impacted in the launch area. Missile performance post flight analyses indicated uncoupling of the turbine. The turbine then oversped and shed its buckets due to centrifugal force—shedding of the buckets resulted in the main engine exploding. Lack of lubricant caused overheating of the turbine drive gear and consequent shearing of the gear teeth which resulted in turbine uncoupling.

How did this happen? Mishap investigation revealed:

- The lubricant's (oronite) viscosity at about 0°F is high enough to restrict its flow.

- A broken gaseous nitrogen line to an AGE heater used to control missile temperature. The line was not inspected prior to launch.

- That the lubricant line temperature would reach −20°F if reduced heating occurred because of loss of nitrogen gas from the heater unit.

- Abnormally low missile temperatures were recorded during propellant loading. No specification for lower temperature limits existed.

Had the gaseous nitrogen line been inspected, had safety or technical analyses indicated a need for the establishment of temperature limits in the missile launch criteria, or had the missile launch countdown allowed for a complete analysis of all abnormalities, this loss of USAF property would probably have been avoided.

We have now acquired this hindsight and corrective action has been taken to prevent this type of failure from recurring. As indicated, however, better foresight can go a long way toward conserving USAF resources. ★

Toots

is interested in your problems. She spends her time researching questions about Tech Orders and directives. Write her c/o Editor (IGDSEA), Dep IG for Insp & Safety, Norton AFB CA 92409

Dear Fellows:

The responsibility for accurate technical data rests with everyone involved in aircraft maintenance or operation of a weapons system. You technicians must have sound procedures in order for you to perform the job correctly. Since you are close to the job, you are most likely to note the discrepancies that exist in technical data.

You are the backbone of good tech data because it is written with you in mind. Unless you can read, understand, and follow it, there would be no need to spend money writing, revising, and updating it. Our tech data is not just so much worthless paper, but the instrument by which our equipment is operated and maintained. Technical data and you technicians are dependent upon each other and one can be no better than the other.

If the data is well written, then it is up to you to produce good maintenance; however, if the data is poorly written, you have two alternatives: (1) You can live with and work around the data and do questionable maintenance, or (2) you can get the data changed and corrected so that you can perform the excellent maintenance that is expected of you.

The method of change is the familiar AFTO Form 22. By now you all know or should know the proper procedure for filling out and routing the form, but if you do have any doubts, TO 00-5-1 Sec. 8 covers the complete procedure.

An important requirement is the telephone number of the originator. Our good friends at the depots like this information so that they can call you firsthand for information when questions arise.

So there it is, fellows. It's up to you. Use those AFTO 22s, and if you have any problems write me in care of this magazine.

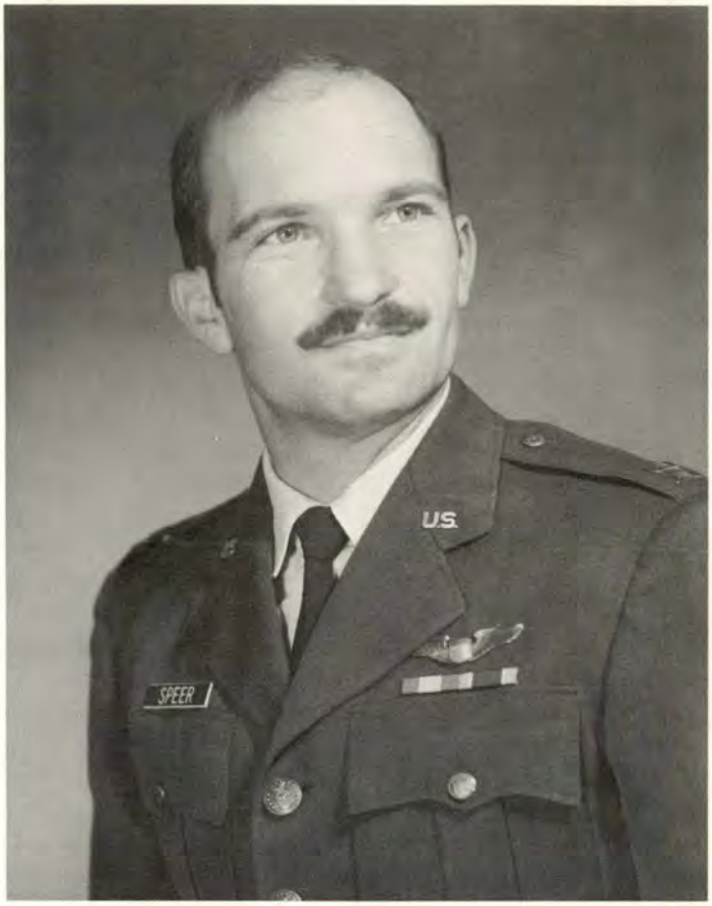
Toots

UNITED STATES AIR FORCE WELL DONE AWARD

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

Captain JAMES D. SPEER

122 TACTICAL FIGHTER GROUP, BAER FIELD, FORT WAYNE, IND.



Captain Speer was number four in a flight of F-84s on a night refueling mission. He had just been cleared to the precontact position when the radio made a "click" noise, and shortly afterwards all the cockpit lights dimmed and went out. Suspecting generator failure, Captain Speer switched to alternate inverter and reset the generator; the warning lights then illuminated indicating the generator had failed. Using his flashlight, he made the "circle on the canopy." The flight leader declared an emergency with Chicago Center, and Greater Peoria Airport was determined as the nearest suitable recovery field. During the 25-minute recovery period the battery could not power his UHF radio. Also, the inverter became unreliable and failed which, in turn, caused the fuel flow and fuel quantity gages to be inoperative. Captain Speer had to estimate his fuel flow and manually select and time the operation on each fuel tank to prevent flameout. He accomplished this by using his flashlight and aircraft clock while maintaining his formation position. During descent the engine surged and, not having enough electrical power for an airstart, Captain Speer switched the fuel selector to the unused wing auxiliary tanks and completed a blackout landing on a 7000-foot runway.

Captain Speer's knowledge of his aircraft and superior airmanship prevented the loss of a valuable aircraft and possible personal injury. WELL DONE! ★

EXPLOSIVES SAFETY

WANT BETTER MHE? HERE'S HOW

HY BOSCH, Directorate of Aerospace Safety

One of the most common complaints, in the explosives field, is "when are we going to improve our munitions handling equipment?" However, many of the loudest complainers have done little or nothing to get their greivances to the right people at the supporting depots. Maintenance failure data (AFM 66-1) and EUMRs (TO 00-35D-54) are the management tools available to turn complaints into action. **Problems not identified never get solved.**

DETERMINED OR UNDETERMINED?

F. P. O'GRADY, Directorate of Aerospace Safety

According to Webster, the word "determine" means "to fix conclusively or authoritatively"—in other words, "to find out."

This action—to determine—is very important when it pertains to explosives mishaps—whether accidents or incidents. The objective of each accident or incident investigation is to obtain facts, determine the cause or causes of the mishap, and to take timely corrective action which will reduce the probability of recurrence of a similar type mishap.

When the above objective is not met, the explosives accident prevention program is failing. It may also indicate that the commander of the unit involved in the mishap—all the way up to the major command—is not placing enough emphasis on the objective; that is, to determine the cause of each mishap regardless of its magnitude—whether a major accident or a minor incident!

Now, let's get down to specifics.

During the past few years, the percentage of reported explosives accidents and incidents with the cause listed as "Undetermined" has been alarmingly high! It remains alarmingly high!

As an example, 16 percent of all explosives accidents reported in CY 69 listed the cause as "Undetermined;" at the same time, 11 percent of all incidents were categorized in the same manner. The same condition existed —only higher—in CY 70. *Undetermined* was listed as the cause of approximately 18 percent of the accidents and 11.5 percent of the incidents.

The "Cause Undetermined" rate continues to be not only "high" but "alarmingly higher" as we go through CY 71. For example, the CY 71 rate through September is 21 percent for accidents and 14 percent for incidents. Of course, these percentages may change somewhat as additional data are received and computations made, but the major problem still exists.

As long as the "Cause Undetermined" condition exists, additional mishaps caused for unknown reasons will continue to occur without our knowing the specific corrective action to take to preclude recurrence. Thus, the resources of the Air Force and its combat capability are being jeopardized!

What can be done to eliminate or reduce to a minimum the frequency of "Cause Undetermined" mishaps?

Each individual—directly or indirectly involved in a mishap—whether an accident or an incident—must be thoroughly conscious of his responsibilities to determine —to find out—the actual cause of the mishap. This includes not only the person actively involved in the investigation, but also his commander—and his commander—right on up the line.

An individual may think he is taking "the easy way out" when the cause of a mishap is classified as "Undetermined." He is not! He is not only jeopardizing his own future, but the futures of others and the Air Force. He is leaving the door open for another mishap resulting from the same "undetermined" cause. The next mishap may be a catastrophe.

Let's be thorough, aggressive, and objective in our explosives mishap investigations and determine the actual cause of each and every one of them. Only then can appropriate corrective action be taken to preclude recurrence and conserve our vitally needed resources and combat capability. Are you "determined?" ★

THE PRIMARY CAUSE--YOU?

It had been a fun mission. The early morning launch to the range was always fun. It was a beautiful day. No wind on the range either, so the scores would be good. The Hun pilot maneuvered his bird for the turn to initial. The pattern was good, the touchdown perfect. It was almost time to relax when things went to hell. The bird veered sharply to the right and before the pilot could stop it the wheel was in the soft stuff off the runway. He could feel it when the strut failed . . . a wing dropped and then there was a whole lot of confusion. He was able to quickly evacuate the bird when it finally finished its slide. He stopped running when he was sure he was far enough away to avoid injury from an explosion, if it came. It didn't, but the fire trucks did, amid sirens and flashing lights, and poised their fire suppressant booms over the broken bird.

It was several days before they were sure. Mobile had confirmed that the gear appeared down and locked. the pilot sure that he had seen three green. The final determination, failure of the tire.

It isn't always this bad, sometimes we manage to stop without hurting much of anything but unfortunately any tire failure on takeoff or landing presents a very real accident potential. There was no positive way to determine exactly why the tire failed, but when something like this happens we start to question whether the pressure of the tire was within limits.

If indeed the pressure was outside of limits, how do you correct this type of error, as error it is in most cases? A recent spot check with the real world revealed some rather interesting things. When a fighter's main tire was found 90 pounds low the forms were examined to find out who had been responsible for checking the tires. He was identified and asked to explain why he had signed off the tire pressure as okay when it was obviously low. The answer was staggering, "How can I check the tire pressure? I don't even have a tire gage. My supervisor knows this but we just haven't gotten around to getting one."

This is fact, not fiction. That this particular condition exists makes you wonder about all sorts of things. If the supervisors aren't supervising, how many other items are simply signed off as okay without so much as a cursory examination? Why do things like this happen? Is it because a man is so rushed to complete the inspection that he hasn't time to do all the things on the list, so he doesn't do any?

Is it because he has determined that tire pressures are not important, so that particular check is eliminated from the inspector's "personal" list of "must dos"? If this is the case, then the supervisor needs to do a little educating.

Is it because we have so many items to check on the pre-, thru- and post-flight inspections that those items critical to flight safety are buried among less important items and, thus, none of the items are of any importance in the eyes of the airman responsible for performing the check?

For two years now the UEI teams have made a major issue of card items missed on inspection checklists, and rightly so. For here is one yardstick that tells them how well a unit functions in terms of supervision. Do these missed card items indicate that we are asking too much of our crew chiefs? If so, perhaps we need to take a hard look at what we are asking them to do and how long we give them to do it. One fact seems rather clear, there is something in the system that causes a man to perjure himself . . . he signs his name or initials to a piece of paper which says, "yes, I have inspected this item and found it to be suitable for flight." If it was not suitable for flight, he has placed the lives of the occupants of that aircraft in jeopardy.

We have no easy solution. All we can say is that there is a problem of missed card items and the problem is serious. So serious that we are losing airplanes because the inspections are not performed as required. The failure to check the tire pressure is but one example of which there are many.

If you are aware that a situation such as this exists in your area of responsibility, and have taken no corrective action, or if you have neglected items on your inspection, then you are stepping into position to be responsible for the Primary Cause of an aircraft accident. ★

Mail Call

THE LAST TO LET YOU DOWN

This is a shop motto of one of TAC's F-4 fighter squadrons. The message couldn't be clearer especially because it belongs to the Life Support section. I read and enjoy your magazine every month, but it seems that most notes or articles pertaining to Life Support shops are a list of discrepancies noted ("When You Need It, You Need It Now," Sep 71, page 16), i.e., helmets not inspected, tester not available for checking oxygen mask connectors, etc.

As a Life Support Superintendent, this makes me cringe. Not because of the article but because the discrepancies are so true and are repetitious. That's the fact and facts are easy. What's most important is WHY? Here is one possible cause found in many fighter organizations —Undermanned! Life Support technicians driving crewmembers, running ops snack bars, etc. Let's put command emphasis on management. Details are sometimes a necessary evil but keeping the Life Support technicians in Life Support, especially when they are short of troops to begin with, is imperative. Let's see some write-ups from behind the scenes. Not what, but why. Let's instill in all crewmembers from 2nd John to commander. "To Life Support they're—flyers first." How true, how true.

THE LAST TO LET YOU DOWN.

MSgt David H. Van Meter
Mountain Home AFB, Idaho

As long as we have dedication such as this, things are bound to improve.

F-102?? TF-102??

In your September 1971 issue of Aerospace Safety magazine you had a story in your Well Done Award section about two pilots who lost their windscreen while flying. I believe it said that while flying an F-102 the center windscreen blew out.

Shouldn't the story have read *TF-102?*

I read your magazine every month and find all of your stories very interesting.

MSgt Charles T. Freeman
Nellis AFB, Nevada

You're right—TF.

OUR COVER

In an effort to make our magazine more personal, we would appreciate any photographs from you in the field that might be used as a cover for *Aerospace Safety* magazine. We know that there are many outstanding color photos around that would be appropriate for publication—so send them in. Tell us the unit, people, and place involved. Eight by ten color glossies are good, but sometimes we can work from a 35mm negative. Send them to Editor, Aerospace Safety Magazine, Directorate of Aerospace Safety, Norton AFB, CA 92409. ★

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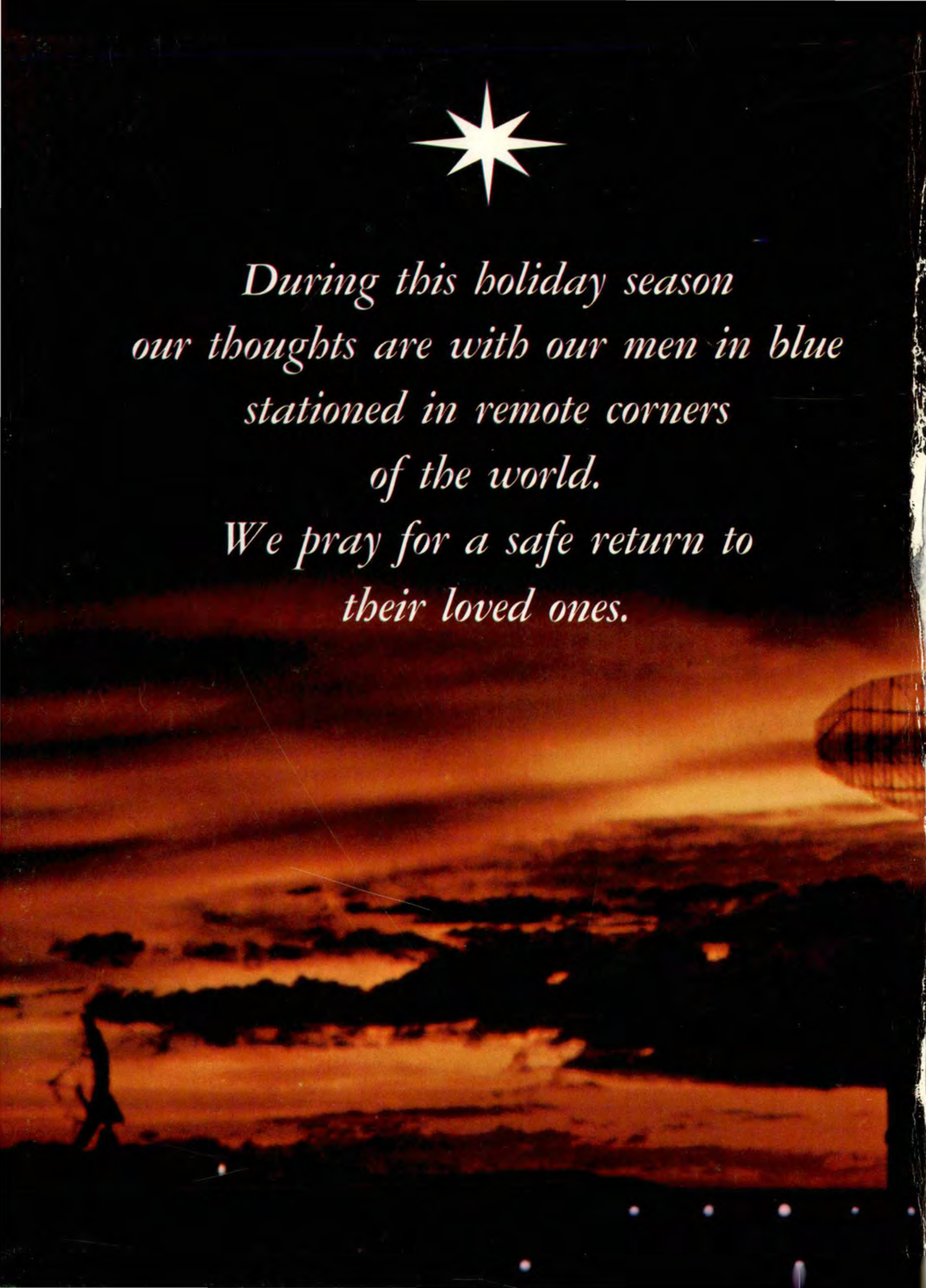
During this holiday season
our thoughts are with our men in blue
stationed in remote corners
of the world.
We pray for a safe return to
their loved ones.