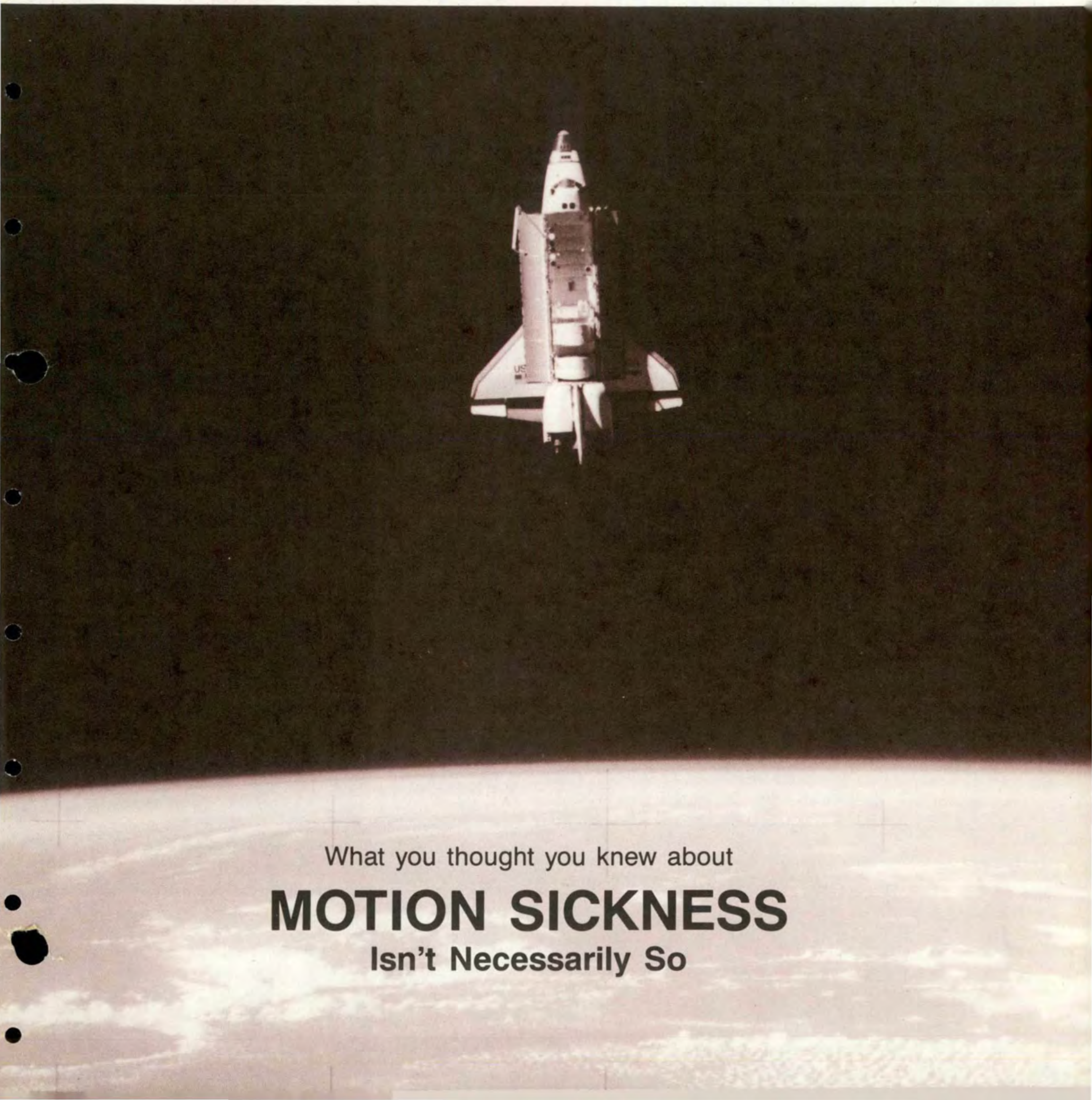
flying

SAFETY

FEBRUARY 1984



What you thought you knew about

MOTION SICKNESS

Isn't Necessarily So

THERE I WAS

■ . . . a senior flight examiner on C-130's with many hours in the airplane. We had shut down No. 1 engine and were landing at Dover AFB.

As I briefed the approach I very carefully explained that I would reverse the inboard engines after landing. After touchdown, I again verbally briefed that I was bringing the throttles to ground idle and was going to reverse the inboards. I counted the throttles 1, 2, 3, and reversed what I thought were 2 and 3.

The airplane suddenly veered right and headed for the grass. With a little luck, I was able to catch it and stay on the runway. Then I figured out what I had done.

As an IP/FE I had flown a lot of simulated engine out approaches on locals. In that case, the engine is merely pulled back to idle to simulate the failure, but in a real shutdown situation the throttle is pushed full forward. So, after landing, when I counted throttles I forgot that No. 1 wasn't there, but started with No. 2 and reversed 3 and 4. There was no harm done, but I sure felt dumb. ■

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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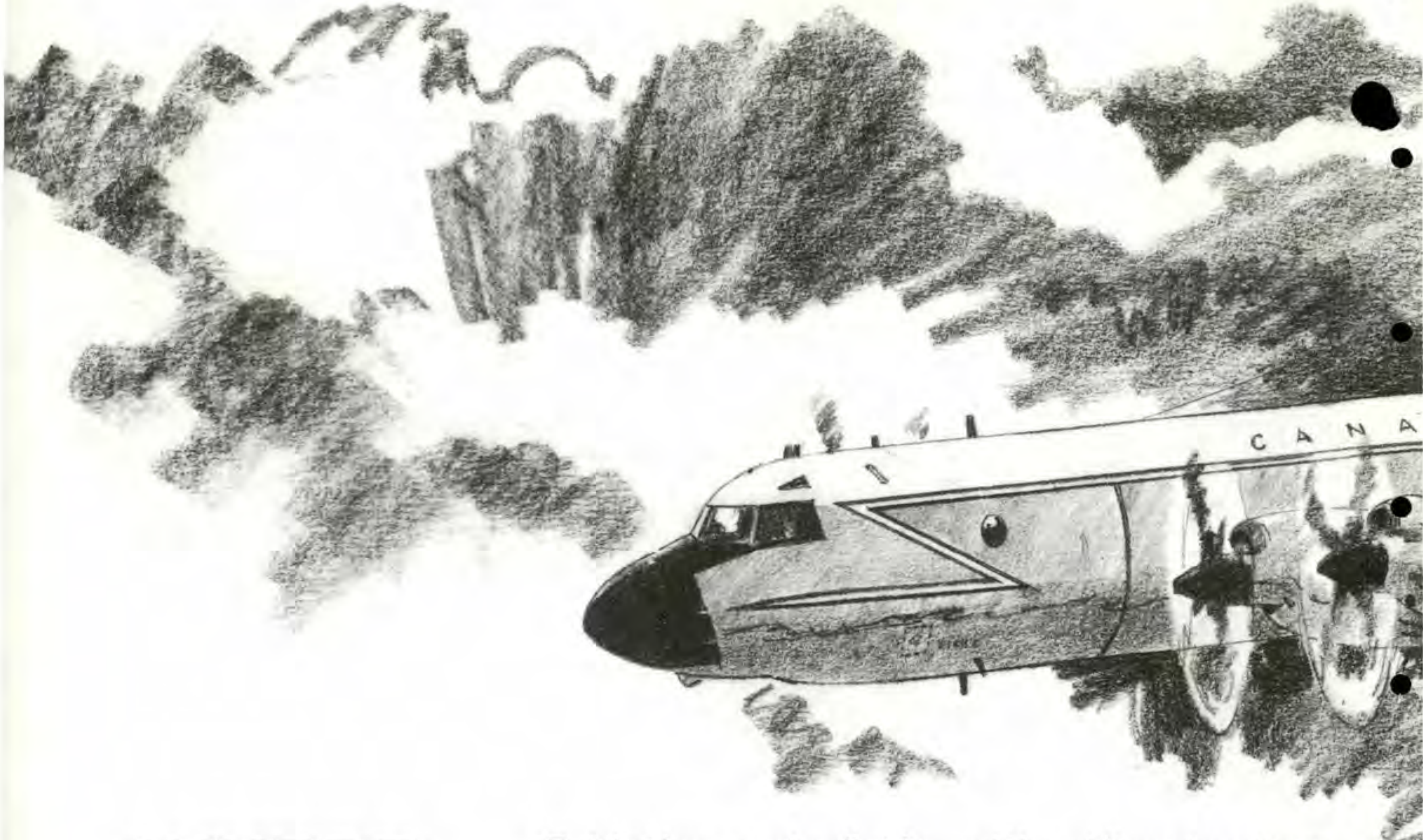


WHERE DO WE GO NOW?

SQUADRON LEADER "BAZ" COLLINS (RAAF)
Base Flying Safety Officer
RAAF Base Edinburgh,
Australia

■ It had been a routine all night CP140 Aurora covert patrol operating over the Atlantic southeast of base and, very tired, my crew and I were on descent back into CFB Greenwood eagerly anticipating our warm, comfortable beds at home. This was my last operational patrol with the squadron prior to returning to Australia in only four days time after three great years of exchange duty.

Pre-flight terminal forecasts the evening before had indicated all major coastal airfields would be below alternate limits, and Greenwood itself was forecast to be 300-600′ overcast, visibility 1½ nautical miles in fog and drizzle for our return next morning. This didn't perturb me unduly, as I explained to my relatively junior copilot, because Greenwood's "valley effect" would allow us to get in with no sweat off either the GCA or ILS. No one had ever diverted from Greenwood for marginal weather in the Aurora — yet!

We had nominated CFB Chatham, New Brunswick, as our alternate, had stacks of gas, so what could be so different about this trip compared to hundreds of other similar missions?

My copilot was in the left seat for the landing (it was his turn) and I elected to fly a standard GCA to the duty runway. With all the checks complete, we entered the soup on descent at about 3,500 feet under radar vectors for the precision approach. Greenwood's "actual" weather was transmitted to us as 150-200 feet overcast, ½ nautical mile in fog prior to commencing the approach. As we still had stacks of fuel, and the alternate was still looking good, I elected to attempt the approach.

Arriving at DH (200 feet AGL), one light only of the HIAL was seen by the pilot and a standard missed approach carried out. We climbed away for a second attempt, obtaining airways clearance to our alternate prior to intercepting the GCA finals. You've guessed it! Nothing at all seen this time! Once again, the missed approach procedure was carried out and we contacted terminal as we turned to our previous-

ly cleared track to Chatham. Then it all started to "cave in" on us.

Terminal informed us that Chatham had just issued a "special" — our alternate was now below limits — and asked us what our intentions were.

CFB Shearwater, near Halifax, was currently 1,500-3,000 feet broken to overcast, vis 1½ nautical miles and only 15 minutes flying time away. So, a rapid clearance was obtained and off we went towards Shearwater, remembering to ask Greenwood terminal to request the GCA for our arrival (60 minutes notice is required outside normal airfield hours).

Arriving overhead the Shearwater NDB we had recalculated our fuel and the navigator was busy getting inland United States airfield terminal weather reports, should we require them. In the hold, and set up for loiter overhead the NDB, Shearwater terminal informed us that they had not been advised of our GCA requirement and further, their current airfield weather was below limits too.

My brilliant NAV, who must have begun to feel the tight knot forming in my own stomach, immediately volunteered that Loring Air Force Base in northern Maine was "wide open" and we could be there in 40 minutes. I confirmed the "wide open" as 15,000 feet scattered 25,000 feet scattered, vis 30 nautical miles and away we went. Our airways clearance was quickly processed for us and the now "wide awake" crew prepared for our imminent arrival at the USAF SAC Base.

The "stacks of fuel" we once had was now reduced to just above minimum reserve required for landing. The weather had started to break up during this transit and contact with Loring Approach confirmed the field was wide open. "However, you had better arrive before 0600 local time because the airfield will be closed to all traffic from that time for runway work!" You've got to be kidding! I immediately declared "Bingo" fuel and they realized why we were coming.

Arriving in the Loring zone we were number three to two B-52s in the circuit — caution, wake turbulence! Why not, "life wasn't meant to be easy" — right?

A superb visual approach and landing was executed by my copilot and we finally rolled to a stop and taxied off the runway at 0559 as the airfield closed for the day.

The lessons to be learned from this entire drama are many. Suffice to say though, that we can never do too much pre-flight planning, especially for covert missions. In this case, an alert NAV was, on his own initiative, able to find us an airfield to land upon. I salute him.

Let this story serve to remind all aircrews that Murphy is always lurking around ready to invoke his "Law" on someone. Stay alert, plan carefully, consider the options, have an "ace up your sleeve," work as a team and enjoy that bed — wherever it is — at the completion of the mission. ■

About The Author

Squadron Leader Collins is an RAAF VP (P3 Orion) pilot. He served on exchange duty with VP405 Maritime Patrol Squadron at CFB Greenwood N.S. Canada from June '79 to July '82. At the time of this writing he was the Base Flying Safety Officer at RAAF Base Edinburgh, South Australia. In Jan '84 he returned to P3 operational flying.

"BIG" SKY,

MAJOR JOHN E. RICHARDSON, Editor

■ In the past two or three years there has been a great deal of discussion regarding air traffic and midair collisions. The record was especially bad in 1983 with eight midairs recorded through mid-December. When we look at our midair experiences over the last seven years there are some very obvious areas which deserve attention. Of the 40 Class A and B midair collisions which have occurred from 1976 to mid-December 1983, thirty-three were between fighters or trainers in the same formation or operating in a prebriefed combat training scenario. That's more than 80 percent of the total.

If we divide the 33 mishaps by type of maneuver in progress at the moment of impact, we find some interesting comparisons.

Maneuver in Progress	
ACM	13
Training	7
Rejoin (overshoot)	6
Lost Wingman	3
Climb/Cruise	2
Illegal Maneuver	2

It is not particularly surprising to find that ACM is involved in a large number of midairs. The complexity of ACM missions, the rapidly changing airborne situation and the high task demands on ACM aircrews all combine to create an unforgiving environment. But combat itself is unforgiving and we cannot afford the easy answer to more restrictions and less training. In fact, in most cases the procedures were adequate, they just were not followed. What kinds of problems are we talking about? If you fly ACM or have flown it recently you can make a fairly accurate list yourself, but to refresh your memory here are some all too common scenarios.

■ Three F-4s were engaged in an intercept/ACM mission. The first ACM engagement terminated when lead and No. 2 became separated by nine miles during number 3's attack. The flight then set up for a 1 on 2 engagement with lead as the attacker and 2 and 3 joined for fluid-two tactics. During the engagement 2 and 3 failed to properly coordinate their attack and became confused as to who was the engaged fighter.

Then they lost sight of each other but did not disengage. Both 2 and 3 initiated individual gun passes on lead. In the subsequent maneuvering 2 and 3 collided.

Losing sight of the other aircraft in a fight is always a problem, especially in the next cases.

■ The number one F-4 of a flight of three was the free fighter while No. 2 engaged No. 3. No. 2 had stagnated at about 7 o'clock 4 to 5 thousand feet behind 3. The two were in a level 4 G turn when No. 1 decided to come down from his high position to reposition for an attack on 3. The pilot of No. 1 had lost sight of the other two aircraft then reacquired one of them which he assumed was the trailing attacker, No. 2, but was actually the target, No. 3. As he came down to the attack, lead planned to enter the fight from a position some 5,000 feet behind the aircraft he saw. He never saw No. 2 and the aircraft collided as No. 1 reached the altitude of the other aircraft.

■ On an ACT mission the attacking F-4 called a Fox 2 shot from 5 o'clock, 3,000 feet. The defender (lead) honored the call with a right break, pitch back and roll over the top, forcing the attacker to overshoot to his 9-10 o'clock position. The attacker lost sight of lead and, assuming that he knew the direction of lead's flight path, began a hard turn which, in fact, took him into a collision course. Lead assumed that there would be adequate separation and did not notice the conflict until too late to avoid the midair.

In the confusion during a multi-aircraft engagement, situation awareness is very hard to maintain. When radio traffic is confused and heavy, one more means of maintaining control of the situation is lost. All too often the engagement then degenerates to a point of dangerous conflict.

■ Three F-15s were on a strike escort mission when they saw and identified an opposing fighter. No. 3 F-15 provided support for lead on the attack while No. 2 remained in extended trail. During lead's attack No. 2 saw a second aggressor threatening No. 3 and without notifying the flight began an attack. As the lead F-15 pulled off the first attack, he also spotted the second aggressor and immediately began a roll to engage this new threat. He did not check the position of the other F-15s and during the maneuver Nos 1 and 2 collided.

■ The mission was a mixed DACT consisting of F-15s, F-16s and F-5s. The aircraft were on different radio frequencies. Two of the F-5s were killed but one did not get the call and remained in the fight. A third aggressor element wingman initiated an attack on an F-15 without advising his lead and element integrity was lost. The F-5 element leader, once he realized the situation, did not make the required radio call and reentered the fight without talking to his wing or GCI. As he entered he was engaged by the lead F-15. His reaction to this attack placed him up sun when the F-5, the one who did not acknowledge the kill, reentered the fight and the No. 2 Eagle engaged him with a radar attack. Eagle 2 was also turning with Eagle No. 1 and visually watching the fifth aggressor above the flight. The No. 2 F-15 and

LITTLE SKY

No. 3 F-5 were so busy with their respective attacks that they did not clear their flight paths and collided. No one else in the fight observed the potential conflict in time to voice a warning.

Sometimes the "heat of the battle" leads to a disregard for a dangerous situation in an attempt to get that kill or avoid it, depending on your position.

■ An F-16 was engaging an F-4 in a DACT engagement. Both aircraft were maneuvering offensively for forward quarter missile attacks. Both pilots had visual contact at about three miles. The F-16 pilot continued to maneuver for an AIM-9L shot and did not break off at the prebriefed minimum range. The two pilots continued their attacks to within one mile where last ditch evasive maneuvers were too late to avoid a collision.

■ An IP was leading a flight of F-5s on a BFM mission. The IP initiated a high angle gun attack on the other aircraft whose pilot countered with a hard defensive turn which negated the attack. Despite the fact that the attack could no longer be pursued the IP did not call "Knock it off." The student transitioned to a more vertical maneuver placing the aircraft on a collision course. The IP lost sight of No. 2 but did not anticipate or counter the maneuver of 2. No. 2 saw the possibility of a collision but pressed the attack anyway until the midair occurred.

■ After one aircraft aborted, two F-15s continued on their alternate mission of basic fighter maneuvering. During an engagement both pilots allowed aircraft energy to decay until maneuvering ability was limited. The lead lost sight of two while converging at close range. He did not maneuver to regain a visual nor did he knock off the fight. The wingman saw a dangerous situation developing but did nothing to alter the conditions. The two aircraft collided and were destroyed.

Of course, ACM is not the only place where the midair potential is high. During our study period, there were as many midairs in formation turns and rejoins as there were in ACM. The most common factor, as might be imagined, is losing sight of lead and still pressing on.

■ Four T-38s were on a four-ship formation training mission. After a pitchout, lead established a 45-degree bank left turn for the element rejoin. Nos 3 and 4 got behind the normal rejoin reference line which placed lead in the sun. The IP in No. 4 lost sight of lead and asked his student if he still had the lead element. The student replied that he did and since the IP still had No. 3 visually he continued to join on 3. During the rejoin, No. 3 crossed to the outside of the turn behind the lead element. The student in No. 4 had lost sight of the lead element but failed to tell his IP. The IP in No. 4, concentrating on the rejoin on 3 did not realize the crossunder had occurred and so he did not move to the outside of 3 but climbed up toward a normal fingertip position striking No. 2 from below.

■ An F-111 was rejoining on lead after range work. The pilot maintained a position above and ahead of the normal line. During the rejoin lead increased his bank angle to avoid overflying a town. No. 2 increased bank angle and G to avoid an overshoot and lost sight of lead. After losing lead the pilot of No. 2 looked inside the cockpit to check his altitude then started to maneuver away from the last known position of lead but did not clear in the direction of the maneuver. The No. 2 aircraft had passed under lead to the outside of the turn and so when the No. 2 pilot pulled to move away from where he thought lead was, his aircraft collided with lead from below.

Lost wingman procedures are supposed to prevent midair collisions. But going lost wingman is an emergency procedure just like partial panel instruments. If you aren't prepared before it happens it's too late to figure it out.

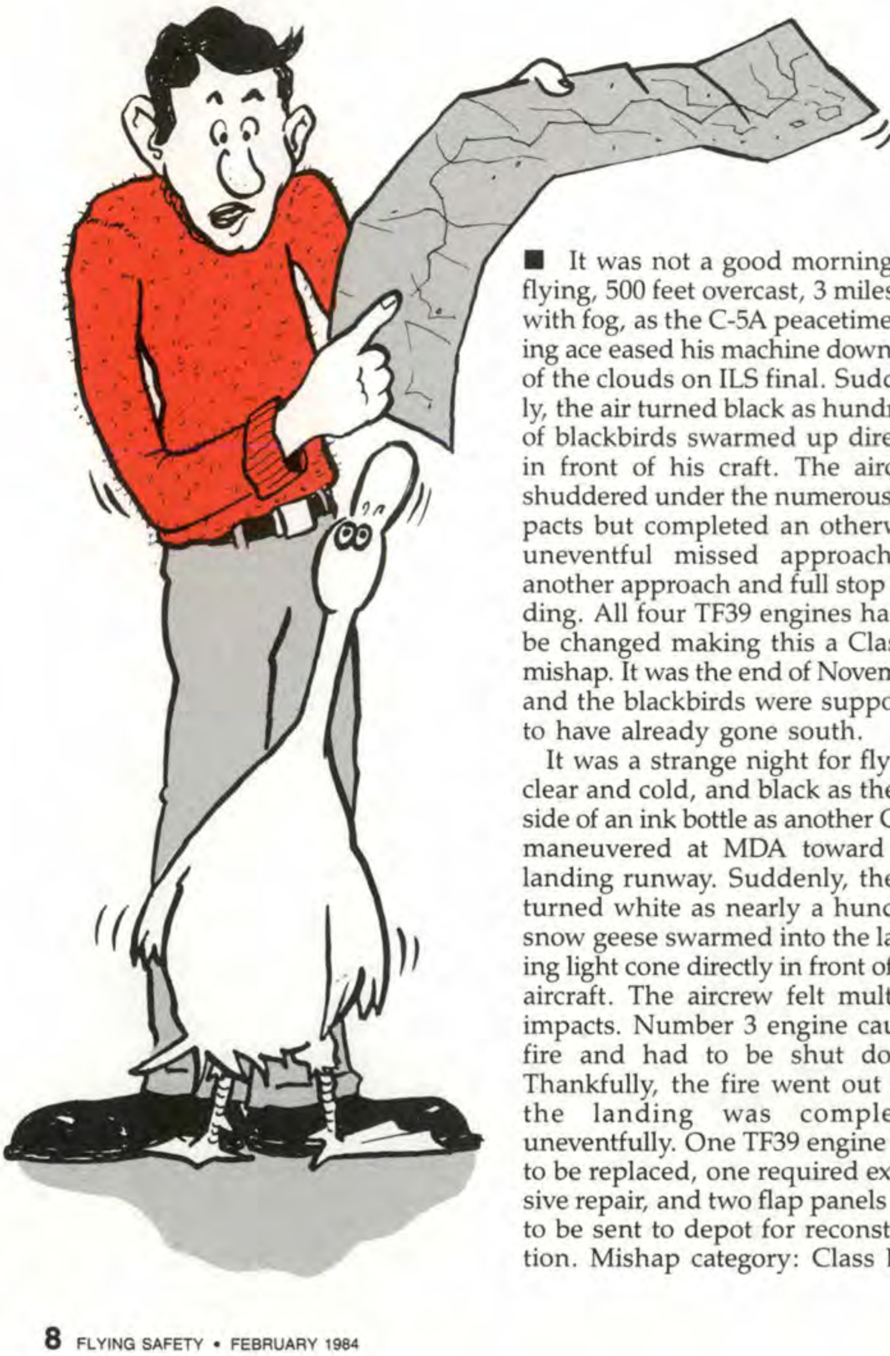
■ A flight of four F-4s was descending for entry into low level. As the flight approached 7,000 feet in IMC the flight lead decided the weather was unsuitable and receiving the clearance began a climb to abort the route. During the climbing turn, No. 4 became separated from the flight and leveled at 9,000'. The flight of three leveled at 10,000' and then received clearance to 14,000'. During the climb to 14,000' Nos 3 and 4 collided because 4 failed to maintain altitude separation and climbed into the formation.

Finally, we should say a word or two about the illegal maneuvers category listed in our table. In both cases the midair occurred because a member of the formation was taking pictures.

ACM and formation flying provide some of the most challenging and enjoyable flying there is. But within the challenge is always the requirement for maximum attention to the task at hand. In every mishap reviewed in this article, the one thing which made the mishap inevitable was inattention. When the big sky becomes the little sky we can't afford to be inattentive. ■

IN CASE YOU'RE LOOKING FOR . . .

A FEW GOOD BIRDBRAINS



MAJOR DWIGHT D. STERLING
436th Military Airlift Wing
Dover AFB, DE

■ It was not a good morning for flying, 500 feet overcast, 3 miles vis with fog, as the C-5A peacetime flying ace eased his machine down out of the clouds on ILS final. Suddenly, the air turned black as hundreds of blackbirds swarmed up directly in front of his craft. The aircraft shuddered under the numerous impacts but completed an otherwise uneventful missed approach to another approach and full stop landing. All four TF39 engines had to be changed making this a Class B mishap. It was the end of November and the blackbirds were supposed to have already gone south.

It was a strange night for flying, clear and cold, and black as the inside of an ink bottle as another C-5A maneuvered at MDA toward the landing runway. Suddenly, the air turned white as nearly a hundred snow geese swarmed into the landing light cone directly in front of the aircraft. The aircrew felt multiple impacts. Number 3 engine caught fire and had to be shut down. Thankfully, the fire went out and the landing was completed uneventfully. One TF39 engine had to be replaced, one required extensive repair, and two flap panels had to be sent to depot for reconstruction. Mishap category: Class B. It was early January and the snow geese were supposed to have already gone south. And whoever heard of snow geese flying on a dark, moonless night?

It was a lousy night for flying: Indefinite ceiling, 100 feet sky obscured and visibility ¼ mile with fog. The C-5A pilot was glued to the gauges as he eased his heavyweight machine off the runway and up into the weather. A few seconds later the aircraft shuddered under the impacts of over 60 unforeseen and undetected snow geese. Number 2 engine indicated overheat and was retarded to idle; after a few minutes, number 4 engine caught fire and had to be shut down. Thanks to the skill of the crew, however, the aircraft and the 53 souls on board were returned safely. Four more TF39 engines were damaged — another Class B mishap. It was late January and the snow geese were supposed to have already gone south. And whoever heard of snow geese flying in the clouds?

To say the local wintertime bird population was unusual is, at best, an understatement. But why? And what does one do about it? Who has the answers?

After the November strike we turned to the Air Force Engineering

Services Center BASH team for help. They responded quickly as Captain Robert Kull arrived in just a few days. He spent several days exploring the airfield environment and offering suggestions on how to manage the blackbird problem until the birds finally did move on south.

He provided us with additional cassette tapes of bird distress recordings to help in scaring the birds away. He loaned us a 12-gauge sleeve insert to our Very Pistol so that we could use the cheaper crackershells to scare birds away. Although extremely effective, the M-74 airburst cartridge we were using cost nearly $14 a round compared to $.50 for a crackershell round. He also provided plans for the sleeve insert so that we could locally manufacture our own.

We contacted the U.S. Fish and Wildlife Service and the Delaware Division of Fish and Wildlife for their assistance. They were only too eager to help and provided a wealth of information on blackbird habits.

Armed with new knowledge freely provided by these visiting experts, we survived the remainder of the blackbird season. By Christmas the blackbirds were gone and we thought our troubles were over. The snow geese, however, had been quietly gathering in the area for several weeks and by January had reached unprecedented numbers.

Before the first goose strike mishap investigation board could finish its work, the second goose strike occurred. In desperation, all training in the local area was terminated and accomplished elsewhere. All flying organizations with aircraft known to transit our airfield were advised to avoid our airspace as much as possible and to make every effort to schedule departures and arrivals at times other than around sunrise and sunset, the times of greatest observed activity.

A FEW GOOD BIRDBRAINS continued

The team of experts that had gathered in November loaned their talents again to help in understanding the new problems. Mr. Mike Harrison, resident bird expert from the Federal Aviation Administration also agreed to help, as did radar and electronics experts from both MAC and Air Force Systems Command.

Other participants included the outdoor editor from the local newspaper as well as our own Air Traffic Control and weather personnel. The Army National Guard provided helicopter support so the gathered experts could survey the many local wildlife areas as part of the investigation.

We learned that the numbers of snow geese wintering in the area had been increasing steadily since 1978. The reasons included protection afforded by 12 wildlife refuges within 30 miles of the airfield; the types of private and state controlled agricultural crops being grown in the area; milder winters allowing late season planting and harvesting; hunting controls; cultivation of the snow goose's favorite food, cord grass, on national and state owned land; even mosquito control actions undertaken by the state which had increased waterfowl attractive acreage. We learned about so many things over which we had no control; things we might never have learned without the experts' help.

A color-coded bird activity scale instituted after the November bird strike served to warn aircrews of the level of observed bird activity in the area. But how to warn of unobserved bird activity?

A mobile Army tactical GCA radar unit from the 2d Platoon, 192d Air Traffic Control Company provided an interim solution. It was used to provide radar advisories to aircrew via the Command Post for the remainder of the season until the geese were gone.

So much help from so many people. In five months we had come to be on nearly a first name basis with experts we previously didn't know existed. We learned that bird habits can and do change. We learned that these experts know about changes in bird habits. We learned that our 1978 BASH study needed modification to keep up with changes in local bird habits.

In today's dynamic environment, the best airfield bird management program could easily need modification in a few years, and the experts are there and eager to help. The following list of experts is obviously not all inclusive but is a good starting place. Get to know them. Use them. Don't wait — the birds will be back in a month or two. ■

Maj Geral Long/Capt Robert Kull
Directorate of Environmental Planning
Air Force Engineering and Services Center (AFESC/DEV)
AUTOVON 970-6240

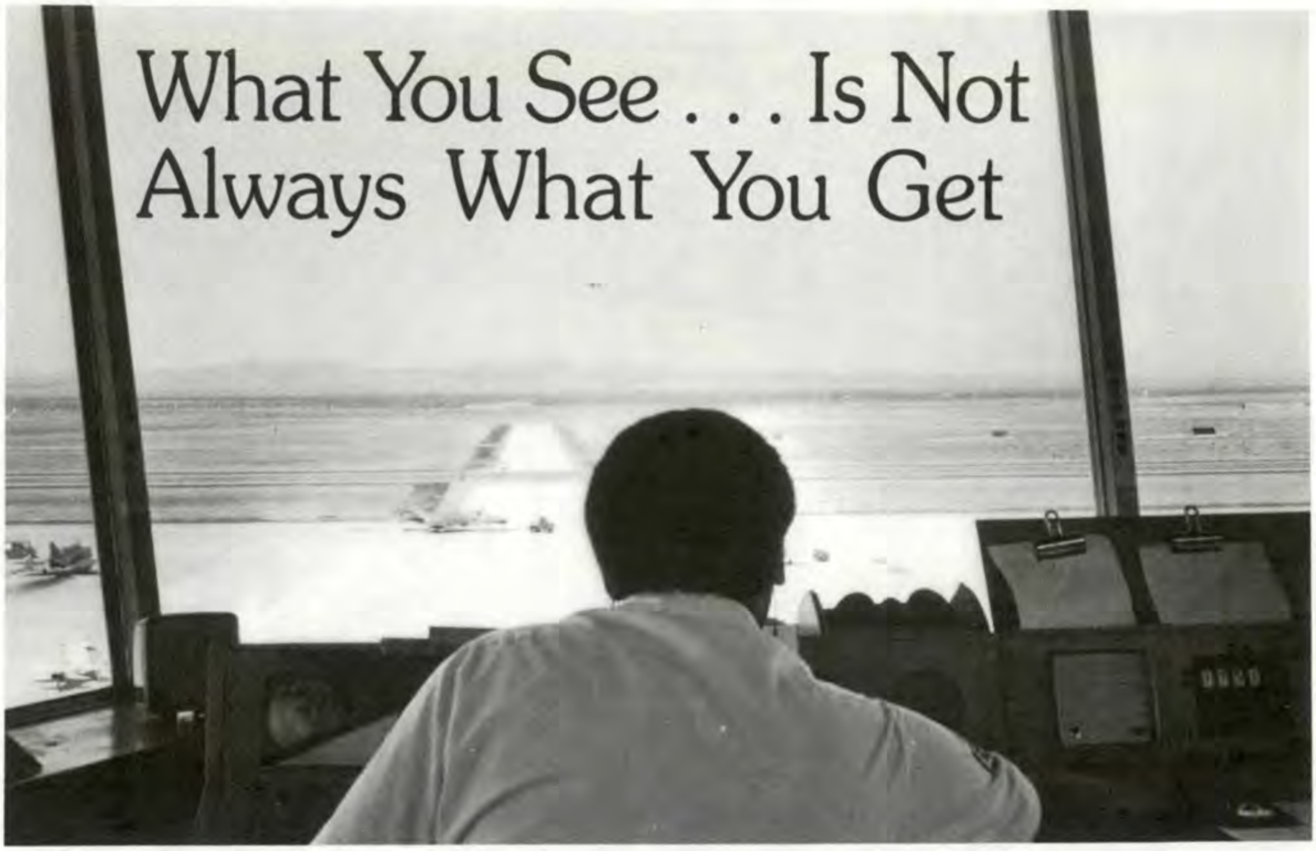
Federal Aviation Administration
(202) 426-3854
Mr. Les Terry

U.S. Fish and Wildlife Service
(301) 269-1949

Your own State Division of Fish and Wildlife

Your own local area experts: Newspaper outdoor editors, local hunting clubs, bird watching clubs, local chapters of National Audubon Society.

What You See . . . Is Not Always What You Get



SMSGT MICKEY TURNBO
Tower Chief Controller
United States Air Force Academy
Colorado Springs, CO

■ It may be OK for some people to view the world through rose colored glasses but for a pilot clipping along at 350 knots or a tower controller with a window full of airplanes nothing less than clear, unrestricted vision will do. A clean, clear windshield for the pilot or control tower windows and shades for the controller have obvious advantages when seeking to make the best possible control decision.

But researchers may have important physiological reasons why clean viewing windows such as aircraft windshields or control tower windows can enhance safety. Researchers at the Whitely Psychology Laboratories at Franklin and Marshall College in Lancaster, Pennsylvania, say that tests have indicated our eyes often *involuntarily* focus on a dirty or blemished window, rather than on an object seen through the window. This phenomenon is known as the "Mandelbaum Effect." When we view distant objects through an intermediate surface, such as aircraft cockpit or control tower windows, two superimposed images can appear on the eye's retina if the transparent surface contains dirt, scratches, streaks or some other visible material or flaw.

According to the Mandelbaum Effect, the eye will tend to focus on the image closest to its "resting focus" or "dark focus." The resting focus is where the eye focuses when relaxing in total darkness. In tests at Whitely Laboratories the average resting focus was found to be about 26 inches, or about the distance from a pilot's or air traffic controller's head to the viewing surface they see through. In other words, our eyes can often focus involuntarily on a dirty or scratched window, rather than on a potentially dangerous situation.

Let's consider, for example, the visual conditions of flying or controlling traffic at night or in bad weather. Our viewing surfaces (windows/windshields) are often covered with small scratches or streaks of water and dirt, which could serve as accommodative stimuli. Your eye wants to focus near its resting focus and the dirt or scratches accommodate. At the same time, distant stimuli which contain important information for the pilot or controller are often dimly illuminated or of low contrast. The real tendency would be for the eyes to focus on the stimuli that is nearest to the "resting focus" (i.e., the dirty window). This tendency is compounded if the individual is tired or overly relaxed.

While this research may not be conclusive, and of course each situation will vary with different individuals, there is solid evidence that restrictions to clear vision impacts our ability to analyze objects in more than the obvious way of making them difficult to see. It is the responsibility of all concerned (pilot, controller, ground support personnel) to provide and maintain as safe a flying environment as possible. Let's have a closer look at the surfaces we view the outside world through before we begin operations. ■

What You Thought You Knew About MOTION SICKNESS Isn't Necessarily So

PATRICIA S. COWINGS, Ph.D.
NASA Ames Research Center
FREDERICK V. MALMSTROM, Ph.D.
University of Southern California

■ Our understanding of motion sickness historically has been built from bits of truth, anecdotes, quackery, misconceptions, and old wives' tales. Motion sickness takes its place alongside other human medial problems like pregnancy and the flu; everyone has been personally affected by it, and everyone thinks that he or she knows the symptoms, causes and treatments. More than 10 years of first-hand research on motion sickness at the NASA Ames Research Center has revealed quite a few surprises about the nature and the control of motion sickness. There are, for example, many cases where the common sense approaches to motion sickness treatment have been quite useful. But, there have been other cases where the traditional theory and treatment has been downright wrong and even counter productive. In the following article, we'd like to go into a brief review of the history, theory, causes, and applications of motion sickness research. And finally, we'd like to leave you with some useful thoughts about what seem to be the most promising "cures" for motion sickness.

Motion Sickness Isn't Just Vomiting

Many older, more experienced aircrew personnel will say they've never experienced motion sickness just because they've never experienced inflight nausea and vomiting. The fact is that vomiting is only one of a number of debilitating and unpleasant motion sickness symptoms. The *classic* textbook progression of symptoms a motion sickness victim experiences may look something like this:

- Yawning or sighing
- Drowsiness
- Facial Pallor
- Cold sweating
- Nausea
- Vomiting

This list is by no means universal, nor does everyone exhibit the same sequence or the same number of symptoms. Some aircrew may go to stage no. 2 during flight, with moderate malaise, and stay at that plateau for a considerable time. Other people, with very little prompting, go directly to the vomiting step. And still others may have unique symptoms such as hot skin flushes, severe headaches, or increased flatulence. Motion sickness isn't that easy to define scientifically because it's subject to a very wide variety of personal symptoms. Yet, motion sickness *does* exist and it *can* detract from a person's performance effectiveness. Therefore, both NASA and the Air Force have determined it's a problem well worth curing.

If the experiments work as planned, we can envision the time when aircrews and astronauts alike will routinely undergo motion sickness training, much as they undergo altitude chamber training now.

So, What is Motion Sickness?

That's a really loaded question. If you think one has to be *moving* to experience motion sickness, then you're wrong. In stationary humans, visual input alone has long been known to produce sensations of motion (a psychological process known as "vection"). For this reason some individuals experience "cinerama sickness" and "simulator sickness" during exposure to certain visual motion displays such as the Disney World and Epcot Center attractions. Suggestibility and anticipation plays a large role here too. We've had experimental subjects in the rotating chair at NASA who experienced motion sickness symptoms well before the chair started rotating. To add to the puzzle, many people experience motion sickness symptoms only after the motion stops (sometimes called "land sickness"). In this instance an individual adapted to the pitching, rolling and yawing of a ship or aircraft experiences the symptoms only after docking or landing.

The most accepted explanation for motion sickness is the sensory conflict theory. The background for this theory works on the presumption that our ability to orient ourselves in space relies not only on the visual system but a whole group of back-up systems, such as the inner ear vestibular system, the internal muscular kinesthetic system, the proprioceptive (pressure-sensor) system, the sound-direction locating system, and any other sensory input that could give you any clues as to your orientation or direction of motion. Imagine, for example, that we could devise a nasty motion-sickness apparatus where: (a) your eyes tell you that you're stationary; (b) your inner ears tell you that you're rotating counterclockwise around a vertical axis; (c) your skin pressure and the pressure of the blood in your temples tells you that you're hanging upside down; and (d) your auditory senses tell you that you're moving rapidly away from the source of a sound. Is the thought of this situation alone enough to make you feel queasy?

In reality, what kinds of devices are there to induce motion sickness? Dr. Ashton Graybiel has used several ingenious devices for the U.S. Navy, such as rotating platforms and a slow-rotating room. Subjects have been known to spend days and even weeks at a time on such constantly moving devices. One of NASA's motion sickness inducing devices is the Rotating Coriolis Chair.

This device rotates the subject at any desired speed, rotates the visual background at any desired direction and speed, and allows the subject to orient his or her head randomly to different planes. So far, we have found no one who can survive the experience indefinitely (save for a few individuals with severe inner-ear vestibular damage.) What we have found is a very wide range of individual tolerances; some people experience motion sickness symptoms right away, and some exceptional people may hang on for an hour or more before calling it quits.

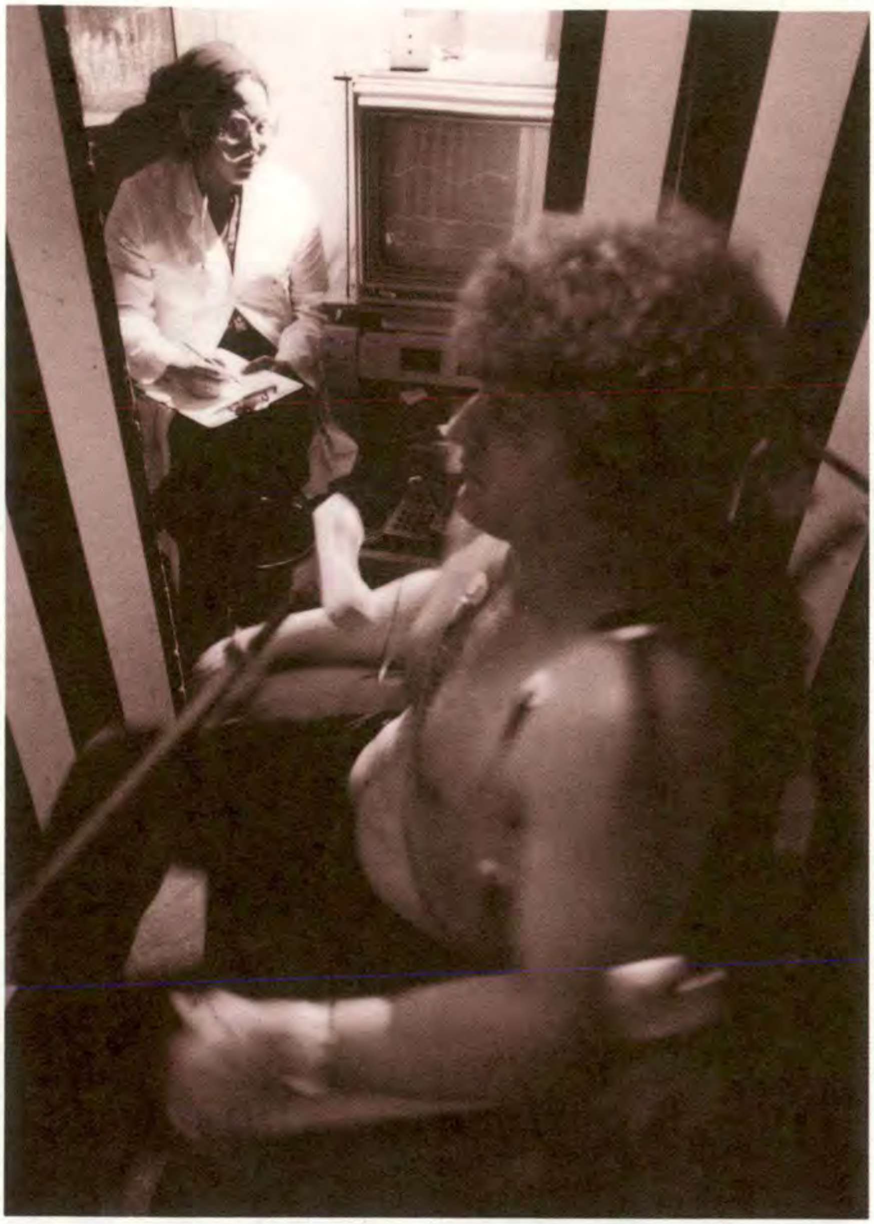
continued

NASA uses this Rotating Coriolis Chair to study motion sickness. The chair moves at various speeds while the visual background turns at differing speeds and directions.

This man is either in the throes of motion sickness or well on his way. According to NASA researchers, although tolerances vary, no one survives the Rotating Coriolis Chair indefinitely.

MOTION SICKNESS

continued



Laboratory experience suggests that sooner or later almost everyone has a tolerance level for motion sickness. Other laboratories have even produced evidence that pigeons can experience motion sickness symptoms. If birds, who traditionally operate in three dimensions, do it, what chance of resisting it do we nominally two-dimensional humans have? Could, for example, drugs cure the problem?

What Effects Do Drugs Have?

To paraphrase Abraham Lincoln, some of the drugs are good some of the time, but not all of the drugs are good all of the time. There is no shortage of laymen and physicians alike who swear by a particular remedy. Some of the more popular remedies have been the belladona alkaloids (like atropine) and antihistamines (like dramamine). In direct contradiction to the anti-motion sickness remedies, we have both direct and testimonial evidence from pilots and astronauts alike that these drugs just aren't effective in combating the problem. Other controlled laboratory studies show very mixed results indeed, as to the effectiveness of anti-motion sickness drugs. Flyers have complained of drugs (like scopolamine and dexidrine) producing unwanted effects such as dryness of the mouth, impairment of short-term memory, tunnel vision, reduced night vision and (believe it or not) nausea.

What is likely is that *some* of the anti-motion sickness drugs are effective at controlling *some* kinds of motion sickness *some* of the time. Even more likely is that, as any physician knows, people are quite susceptible to the "placebo effect." If the physician gives the patient an inert sugar pill with the confident statement, "It'll cure your sickness," quite often the patient's symptoms disappear! Motion sickness, likewise, is full of anecdotes of mysterious self-cures claiming a wide

(Above) NASA researcher, Dr. Patricia Cowings, has determined through experimentation that motion sickness symptoms can be controlled through biofeedback. (Right) Dr. Cowings, with husband Bill Johnson, inside the rotating drum.

Evidence shows that pigeons can experience motion sickness. If birds, who operate in 3 dimensions, do it, what chance of resisting it do we 2-dimensional humans have?

variety of methods. Some aircrew swear by 100 percent oxygen; yet others believe that hot coffee and fresh air will do the trick. Our experience with human subjects suggests they're pretty ingenious at alleviating their own unpleasant symptoms. Therefore, if for you, hot coffee and 100 percent oxygen works to counteract your motion sickness symptoms, continue to use it. On the other hand, don't expect that the same method will work for your copilot.

With the lack of consistent results of drugs in combating motion sickness, it is no wonder that both NASA and the Air Force are extremely reluctant to use drugs to cure the problem. If we can't use drugs on aircraft or Space Shuttles, what can we do? Well, there are at least two alternatives. One alternative is that we could select only those aircrew members with a low susceptibility to motion sickness. The second alternative is that we somehow *train* aircrews and astronauts how *not* to get motion sickness. To address the first alternative, we must first ask the following question:

Are Sea Sickness, Air Sickness and Space Sickness the Same Thing?

That's an awfully good question, and the answer is that nobody knows for sure. Although the documented symptoms of all types of motion sickness seem to be about the same, one type of motion sickness does not necessarily follow from another. For example, a pilot can be susceptible to sea sickness and never become airsick. Or an astronaut who has never experienced any symptoms of sea, air or space sickness may get violently ill on the merry-go-round in his children's playground. To date, we have been unable to predict a candidate astronaut's susceptibility to space sickness purely on the basis

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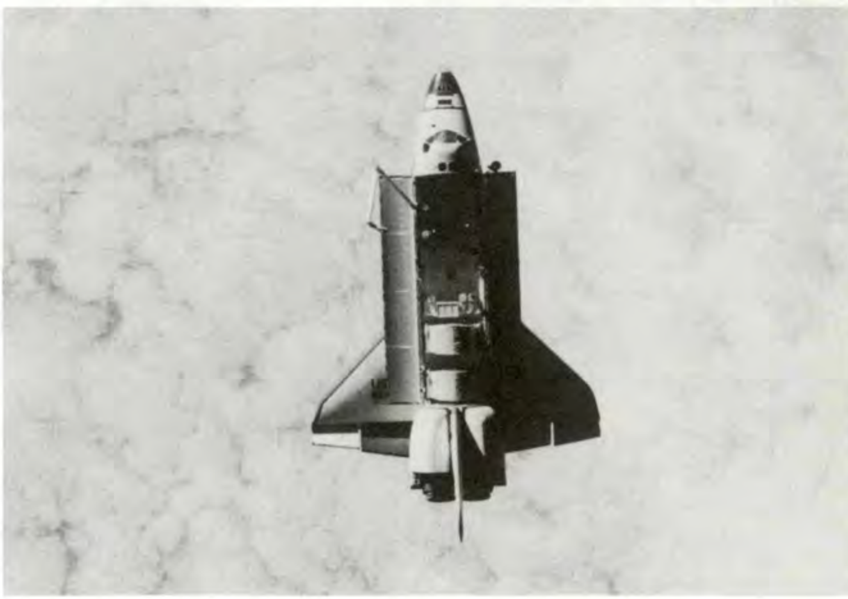

Astronauts Joseph P. Allen, IV, right, and William B. Lenoir, participate in a biomedical test on the Earth-orbiting Space Shuttle Columbia. Dr. Allen uses gaffer's tape to secure Dr. Lenoir to the floor. Lenoir has electrodes attached to his face for measuring his responses to predesigned activities. These responses will be evaluated and compared with responses to the same occurrences in one-gravity.

of his or her history of motion sickness on Earth. Hence, preselection of astronauts on the criterion of an inborn immunity to motion sickness doesn't seem promising.

What was once called "space sickness," or the motion sickness-like symptoms some astronauts exhibit during weightlessness in space, is now considered part of a larger problem, officially called the Space Adaptation Syndrome — SAS for short. Numerous published reports on both Soviet and U.S. astronauts have indicated that the entire SAS *can* be quite debilitating. Can immunity to the symptoms of SAS be learned? We believe we have some promising leads.

Can People Learn Not to Experience Motion Sickness?

At first glance, the question may appear to be a put on. Isn't that like asking whether people can learn not to catch the flu? It is well documented that the younger, less experienced aircrews are more susceptible to motion sickness than the older experienced ones. Whatever the cause of motion sickness, there is very clearly some sort of adaptive effect which takes place. The first hints that aircrews develop a learned immunity to motion sickness came from pre-World War II experiments by the Soviets in which pilot candidates were (and still are) exposed to a full range of ground-based acceleration stimuli. Unfortunately, this sort of "adaptation training" has quite a few drawbacks. For one thing, it's a time consuming and rather unpleasant experience. Only those people with a history of low susceptibility to motion sickness seem to gain any benefit from it at all. But most importantly, adaptation is what we Psychologists call, "stimulus specific."

In other words, if we were to rotate you *clockwise* in the Coriolis chair for an hour every day, eventually you'd "get used to it." You'd adapt, and no longer experience symptoms. But the first time we rotated you in a *counter clockwise* direction, your symptoms would more than likely return full blown. Evidence from the Soviets indicates that such adaptation training on Earth does not prevent the symptoms of zero gravity sickness in space. So, *now* what do we do?

Enter Biofeedback

In the 1960's Dr. Neal Miller (now of the Rockefeller University) performed some landmark experiments in which he trained animals to *voluntarily* raise and lower their heart rates. Prior to that time, it was widely belived that "involuntary" (or autonomic) responses like heart rate, blood pressure, galvanic skin response, or skin temperature were not subject to conscious control. Dr. Miller later extended the concept of conscious control of autonomic responses (now called "biofeedback training") to humans. Later in the decade, Dr. Joe Kamiya of the University of California at San Francisco revealed that with biofeedback people could control certain types of brain waves. On the basis of these and other findings, one of us (Cowings) reasoned that if motion sickness symptoms, *no matter what the cause,* were characterized by changes in autonomic activity, then these "involuntary" responses should be amenable to control by biofeedback techniques. Today, both Dr. Neal Miller and Dr. Joe Kamiya serve as co-investigators on Cowings' Space Shuttle Experiments designed to test learned self-control of autonomic responses as a treatment for SAS.

AFT: The "New, Improved" Version of Biofeedback

At the NASA Ames Psychological Research Laboratory, we developed an easier to learn biofeedback technique called AFT (Autogenic Feedback Training). It involves the person using self-suggestion exercises or mental images which are associated with the body's autonomic responses. For example, let's say you were lying on a cot and we placed electrodes on your arm to measure muscle activity. If we then asked you to "think about the movements associated with throwing a baseball," we would register a tiny increase in the activity of those muscles you use to throw a ball, even though you were lying perfectly still! Your nervous system begins to stimulate (or prepare) the body to throw a baseball when you simply think about doing it. The mental exercises of autogenic therapy combined with the "immediate" information about your body provided by biofeedback, enable people to control several different physiological responses simultaneously.

Results of the AFT control technique have been quite encouraging. Much as an engineer would attack a problem, the "remedy" for motion sickness looks like this: we teach the potential motion sickness sufferer to suppress the motion sickness symptoms. If you build toward motion sickness symptoms by developing cold, clammy hands, we teach you to have warm, dry hands. If your breathing becomes irregular and your heart rate speeds up during the Coriolis chair ride, we teach you to breath evenly and make your heart rate slow. In other words, if we can treat the symptoms, we can treat the illness. Ground-based experiments with scores of aircrews and non-flyers alike in over ten years of experimental development of AFT as a precise training regime indicate that virtually anyone can eventually learn to control, if not entirely eliminate, their own motion sickness symptoms.

Some Interesting Findings about AFT and Motion Sickness

The research at this laboratory has exploded some old myths and supported others. To date, the accumulation of data at the NASA Ames Research Center indicates:

- Subjects who had AFT can withstand Coriolis acceleration over a significantly longer time and at higher velocities than those who had no AFT.
- Regardless of their histories, persons with high or low susceptibility to motion sickness can derive comparable success in controlling their symptoms with the aid of AFT.
- Historically, women have been reported to be more susceptible to motion sickness than men. But in well controlled NASA settings, women can use AFT to suppress their symptoms as well as men.
- If you learn to control your symptoms during Coriolis acceleration, you can also control them during other types of motion sickness tests like visual stimulation or linear acceleration. Other motion sickness remedies (drugs included) have not yet demonstrated this capacity for "transferring" to several different stressful situations. The implication of this is that AFT may also be effective in combating the symptoms of zero gravity sickness in space.
- Eventually, nearly *anybody* can learn to control motion sickness symptoms through AFT but, people vary greatly in their rate of learning. Over the years, careful experimentation has yielded information on types of feedback displays and training schedules that produce the greatest amount of learned self-control in a minimum amount of time. When properly trained using the NASA-developed AFT technique some subjects, who received only six hours of training demonstrated that they "remembered" how to control their symptoms up to two years later.

Carefully controlled experiments on zero-gravity sickness have been severely lacking. One reason is, of course, that it's not possible to stimulate weightlessness on Earth for more than a few seconds at a time (i.e., during parabolic flight). Future experiments planned for the U.S. Space Shuttle program will include tests of AFT as a treatment for SAS in crewmembers. The first of these tests is planned for late in 1984 and the possibility of creating a drugless motion sickness treatment is quite exciting. If the experiments work as planned, we can envision the time when aircrews and astronauts alike will routinely undergo AFT motion sickness training, much as they undergo altitude chamber training now.

Motion sickness is one of those baffling biological responses which seems to serve absolutely no useful purpose, but very little is presently known about the true nature of the problem. Developing a usable model of motion sickness would be a notable first step, and future Space Shuttle experiments ought to shed considerable light on the motion sickness problem, its causes and its cures. ■

About The Authors

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HUMAN FACTORS HAPPENINGS

COLONEL GRANT B. McNAUGHTON, MC
Directorate of Aerospace Safety

Coping with the human element in mishaps is our greatest challenge for the 1980's. Things like hypoxia, fatigue, and task saturation must be dealt with on a personal, individual level. The first step in this process is awareness. To assist in increasing awareness, *Flying Safety* is establishing a new, regular feature. This series will summarize and discuss various human factors problems.

Hypoxia In A Fighter

■ The mishap flight was a day VMC practice scramble-intercept. The mishap pilot, flying as wingman, was well rested, well prepared, well nourished, alert, and eager to fly. During an Ops check on climbout, however, he failed to notice a lack of cockpit pressurization.

The flight climbed rapidly to 27,000 feet then descended to conduct intercepts, the wingman's altitude varying from 14,000 to 21,000 feet. Over the next 13 minutes, the wingman exhibited a subtle but progressive deterioration, manifested by impaired performance both in aircraft control and on the radios. When Lead called for his wingman to confirm proper function of his navigation equipment, the response was merely an acknowledgement of Lead's transmission. Although Lead had directed the wingman to the east point, corroborated by two calls from GCI, the wingman trailed Lead to the west point. When Lead called that he was ready to begin the intercept, the wingman should have called, "Ready." He did not. Instead he asked, "What point is . . . ah . . . two cleared to?" Lead then requested the wingman's position but wing didn't respond in a timely manner. Lead called the wingman three times before receiving an answer. Shortly thereafter, wing was able to confirm his position off a TACAN station.

Lead attributed wing's errors to faulty radios or trouble understanding transmissions. It did not occur to him at that time that the wingman might be developing hypoxia.

The subsequent intercept was a fairly easy stern conversion requiring no maneuvering by the wingman other than GCI directions. During this phase of flight, the wingman missed several radio calls. When he initiated or responded to calls, his transmissions sounded lethargic and were sometimes incomplete. Several of his transmissions appeared to be mimic responses to calls made to him. Finally, GCI told him several times to check his Mode III squawk; he changed twice but still failed to set the correct code.

Following the intercept, the flight was cleared to FL 360. After joining for the climb, Lead called for an Ops check by transmitting his fuel remaining. Wing responded with

Your wingman's difficulties may be due to faulty radios or misunderstanding, but it never hurts to say "Go to 100 percent O_2."

"Two." This was not a normal response. He should have responded with the same data as Lead, yet he was hypoxic to the point where he responded only from habit.

Next, the wingman slowly drifted beneath Lead and Lead asked if he was visual. Wing responded negative and was told he was nearly underneath Lead. Wing then called visual and moved out into a low position which forced him to look into the sun while watching Lead. Someone thinking rationally would have flown level to high on the flight-lead to avoid the sun. Realizing the sun problem, Lead called the wingman to "take it up." The wingman reacted by pulling back on the stick. Shortly after this, Lead assumed the wingman was merely repositioning aggressively and redirected his attention back to his own aircraft and navigation. He then made several calls to wing which went unanswered. Looking back, he spotted wing's contrail, thousands of feet above him, arc over into a steep dive. The wingman had either reached his time of useful consciousness for his altitude or become so hypoxic that the 2-3 G pull was sufficient to put him out. Lead called for pull out, then for ejection, both without response. The aircraft impacted near the vertical.

Though remains were insufficient to confirm hypoxia, toxicology and alcohol were negative. The SIB effectively ruled out other causes of subtle pilot incapacitation, such as carbon monoxide, decompression sickness or hyperventilation. Furthermore, the wingman had been young, a good athlete, and a nonsmoker, low in coronary risk factors. The subtly progressive incapacitation is consistent with hypoxia.

In order for hypoxia to occur, failures in both the cockpit pressurization system and the O_2 delivery system would be required.

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Hypoxia is a subtle killer. Despite the wingman's erratic behavior, Lead did not think of hypoxia until after the impact

HUMAN FACTORS HAPPENINGS

continued

The mishap aircraft had had a recent history of cockpit presssurization problems. Also, on one of the last flights in the same aircraft another pilot had, on reflection, noted his personal hypoxia symptoms, yet had apparently not reported them.

What could have accounted for the O_2 delivery deficit? Analysis of voice recordings indicates the wingman's O_2 mask was on. Damage to the CRU-60 prongs indicated proper attachment, as did damage to the O_2 regulator supply hose. Had the quick disconnect come lose, the wingman should have noticed a breathing restriction through the anti-suffocation valve. That leaves the regulator, and though it had undergone its 60-day check less than a month before, there is no capability to check percent O_2 increase as ambient altitude increases.

Why didn't the wingman realize he was becoming hypoxic? His last physiologic chamber ride had occurred just over two years before the mishap, while still in UPT. In all likelihood, he was among that unfortunate group who develop no subjectively recognizable symptoms of hypoxia; or perhaps, with only two chamber rides under his belt, he was still relatively low on his own hypoxia recognition curve. Among the lethal characteristics of hypoxia is erosion of the ability to recognize it.

One might also wonder why neither the control agency nor the Lead picked up on the wingman's difficulties at the time. The reason is that the changes in the wingman's actions were very subtle. By his own testimony, the flight Lead's first thought after the crash was hypoxia, but by then it was too late.

We feel awareness of this problem is important and urge wide dissemination. Not only should continued emphasis be placed on a proper PRICE check and checks for proper cockpit pressurization, but flight members should be alert to changes in their element mates. Missed calls, incomplete or inappropriate responses, delayed or lethargic responses, or inappropriate flying behavior should wave the red flag. True, it may be due to faulty radios or misunderstood transmissions, but it never hurts to say, "Go to 100 percent."

Height Illusion Over Water

An A-7D was to make a target clearing pass over a ship on a water range, then provide defensive awareness training to a two-ship formation coming in hot. Environmental conditions included a high overcast, haze from the surface to 1,500 AGL, and blending of sky and surface eliminating the horizon, despite 4 to 6 miles visibility. With no wind, the mirror smooth surface was unbroken except for the presence of the single target ship. The mishap pilot descended from cruise-in altitude, presumably crossing the target ship about 500 AGL at about 570 knots. He impacted in a shallow descent, relatively wings level, about 3 NM beyond the ship with no call and no attempt to eject.

The flight lead of the incoming two-ship remarked what a day it was for visual illusions. The observation was also made that the glassy smooth surface, like a mirror, conveyed the impression of one's being twice as high as actual. Height estimation is difficult enough over

There are many situations in flying where you simply cannot trust your vision. Height estimation over water or other featureless terrain is one of these situations.

water, but a mirror surface can be doubly deceptive.

Another source of potential deception over smooth water is a sort of "Moon Illusion" in reverse. When the moon is on or near the horizon, it appears relatively large, hence near; when it is high, it appears smaller, hence more distant. Not all of this difference can be explained by atmospheric thickness. Some psychologists feel it may be related to isolation, to the lack of surroundings containing objects of known size. Similar illusions may also be expected with other airborne objects such as birds and aircraft. But the illusion may also involve objects below the horizon as well. The theory is that isolated objects in featureless surroundings, such as water or a snowfield, would tend to appear smaller than actual, hence deceptively distant. The hazard of the surface or something on the surface appearing farther away than actual should be obvious.

The mishap pilot's only reliable cue to height over the water was his altimeter. For reasons unknown, he apparently failed to reference his altimeter for about 20 seconds after crossing the target ship. To reach his impact point after crossing the target ship at 500' AGL would require only a 1.6^0 descent angle — barely noticeable. Chances are that he was heads-down updating his instruments or heads-out looking for the in-coming bogeys, unaware of his insidious descent, comfortable in the premise that he had sufficient altitude.

There are many situations in flying where you simply cannot trust your vision. Height estimation over water or other featureless terrain is one of those situations. Recognize these treacherous situations and respect 'em. Use your instruments and ensure you'll still be around to pass on a few war stories to the next bunch. ■

A shallow descent over featureless terrain or water may go undetected if you rely solely on outside clues for altitude reference.

OPS

It Takes Two

■ Want to know the formula for a Class A mishap?

2 C's = 1 A

Simple, isn't it? Two malfunctions occurring on the same sortie and there you have it, one Class A. For example:

T-37: A bolt in the right engine failed and entered the accessory drive resulting in right engine failure (would have been a Class C). However, shortly thereafter an oil hose in the left engine failed resulting in heavy smoke (Class C also). Since both occurred on the same sortie, the pilot bailed out (wisely) and we logged a Class A.

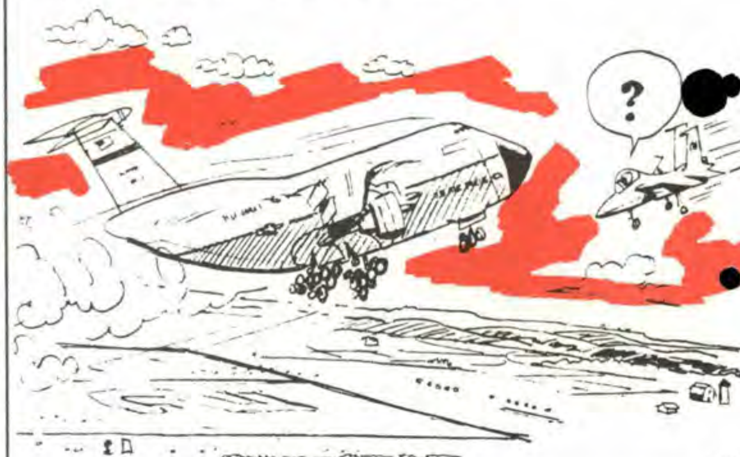
The utility hydraulic reservoir cap came off and fluid was lost during inverted flight (could have been a Class C, maybe just an emergency). But, while inverted, the right engine fuel control malfunctioned and the pilot shut the engine down (Class C again). The right engine would not restart but did provide windmilling rpm to permit a controlled bailout. Hence, another Class A.

Many times one or both of the malfunctions is an error by the pilot. For example:

T-37: After take off the pilot shut down the left engine due to a fire light (it was a false indication, a typical Class C for Tweets). The pattern was poorly planned, resulting in a single engine go-round. Pilot judgment errors during the go-around placed the aircraft behind the power curve and it crashed; there were two fatalities.

T-38: While performing an energy gaining maneuver, the right boost pump failed causing the right engine to flameout (Class C so far). The pilot held the aircraft in a low airspeed condition with the left engine at idle and induced idle decay. The pilot maintained the low airspeed, high sink rate condition while attempting multiple air starts with no success. (Get this.) After both crewmembers ejected, the engines started. (Make no mistake — far better they ejected and watched their aircraft fly away than to keep trying a restart into the ground.)

Think about this the next time you're faced with a broken airplane, or make a procedural error (there are those who have and those who will). Flying is a very unforgiving business. In this game *two strikes, and you're out.*



HATR Crosstell

The following is a classic example of an aircrew misinterpreting Air Traffic Control instructions.

An aircrew was preparing for departure from a military base. Due to the weight-bearing restrictions of the taxiways, the aircraft was given progressive taxi instructions to the departure end of the active runway. Tower expected the crew to back-taxi down the runway before take off. The crew was issued these instructions: "Runway entry approved. Runway . . . in use. Minimum time on runway. Right 180 approved, your discretion." The crew did not query the controller and, therefore, made some erroneous assumptions.

First, they thought they were cleared for take off. Second, they assumed they were cleared for an opposite

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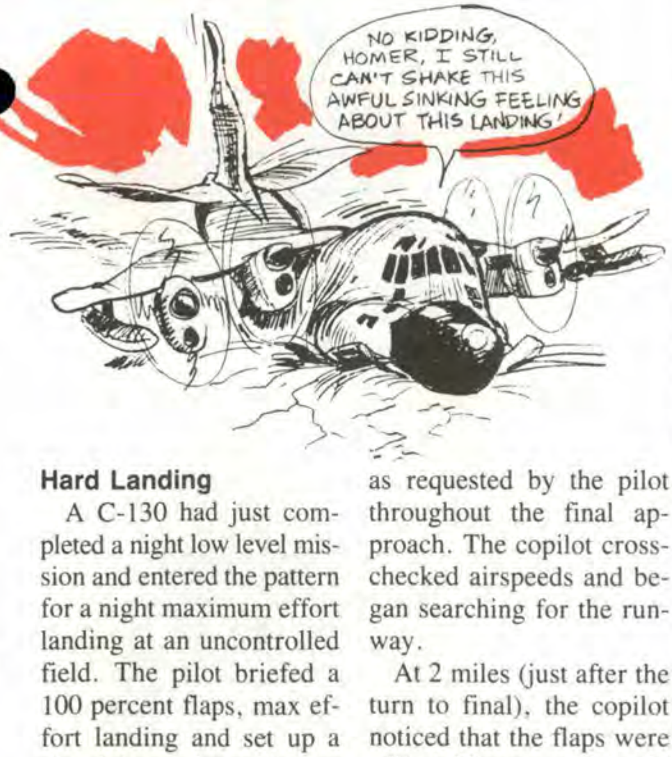
direction take off with a right 180-degree turn after take off. They then took off opposite the direction of traffic without clearance. Investigation revealed the controller's terminology, although not the best, was correct.

The potential for misunderstanding was there, but before the crew took such unusual action as a take off against traffic they should have queried the Tower to be sure they were right.

Tower controllers also have a responsibility to do all they can to provide precise, understandable instructions to aircrews. Being technically right according to the book is no help if the misunderstanding results in a mishap.



Hard Landing

A C-130 had just completed a night low level mission and entered the pattern for a night maximum effort landing at an uncontrolled field. The pilot briefed a 100 percent flaps, max effort landing and set up a visual downwind with gear down, flaps 50 percent.

After turning final, the pilot slowed to the computed maximum effort threshold speed. The navigator was calling altitudes as requested by the pilot throughout the final approach. The copilot crosschecked airspeeds and began searching for the runway.

At 2 miles (just after the turn to final), the copilot noticed that the flaps were still at 50 percent. He did not say anything at the time and then forgot about the flaps while concentrating on airspeed and the runway. The pilot had been concerned about the terrain while on base and so missed his normal habit of selecting 100 percent flaps on base.

As the aircraft crossed the landing threshold at about 100 feet AGL, the pilot realized that the pitch attitude was too high and that the flaps were still set at 50 percent. He called for full flaps, and the copilot selected them. The pilot considered going around but felt that the increase in thrust would have caused an even higher pitch attitude. The aircraft touched down firmly, damaging the ramp.

Airplane Dry Bay Fire Hazards Targeted in Air Force Effort

The Air Force has awarded a $1.4 million contract to The Boeing Company, Seattle, for a 42-month program to investigate fire protection techniques for aircraft dry bays. The objective is to develop the technology necessary to control or negate dry bay fire hazards.

The manager for the program is Tom Hogan in the Aeronautical Systems Division's Aero Propulsion Laboratory at Wright-Patterson AFB, Ohio. Hogan is in the laboratory's Fire Protection Branch.

According to Hogan, "The dry bays of concern, as we define them, include any area on the aircraft through which fuel or hydraulic lines run, and where release of combustibles creates hazardous conditions. The space around a fuel tank is one example. The leading edge of a wing is another.

"The fire problems — either from gunfire or other causes — are associated with leaks into the dry bays. As vapors fill these bays, there is potential danger of fire or explo-

continued

sion. Presently, most aircraft do not carry protection systems to protect these areas. Although many systems have been evaluated, most have not been adopted due to penalties such as weight, complexity, or agent corrosiveness."

Under the terms of the contract, Boeing will perform five major tasks:

- Review the technology for existing concepts;
- Suggest new concepts (including improvements to existing ones);
- Write a test plan to evaluate the new concepts;
- Build replica dry bay equipment and perform small scale environmental and ignition tests; and
- Perform full scale testing at Wright-Patterson — including effectiveness of the system against gunfire.

While Aero Propulsion Laboratory will manage the overall program, the Flight Dynamics and Materials Laboratories along with ASD's Deputy for Engineering also will be involved in testing and evaluating the future system.

Icing Tales

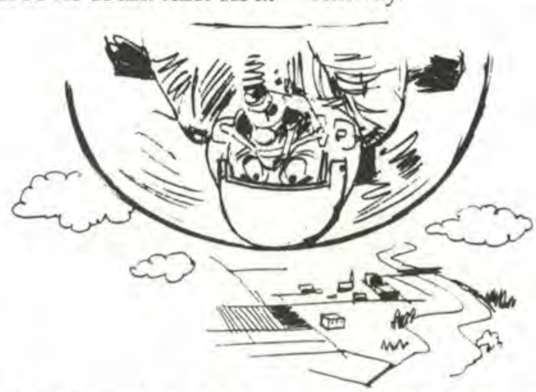
■ A B-52 was proceeding inbound to the initial approach fix at the recovery base. The aircraft was just below the clouds with an OAT of -10°C when a sudden buildup of ice on the wings and engines occurred. The buildup reached one and one-half inches, disrupting engine air flow and causing compressor stalls on four of the engines with two flameouts. The crew was able to restart the engines and recover uneventfully.

■ Two T-37s were on a scheduled formation mission. During departure, the flight passed through a broken cloud layer at 1,900 feet AGL and entered the clouds again at 9,000 feet, breaking out at 17,000 feet. After leveling off, the lead aircraft noticed a fuel imbalance. The wingman noticed a buildup of clear ice on Lead's wing tank vents. The flight split up and began recoveries. During descent through 15,000', the left engine on the former lead aircraft flamed out. The IP was able to restart the engine and recover without further problems.

Bounce, Bounce, Crunch

A student pilot returning from a solo cross-country in an Aero Club Cessna 152 was cleared to land at an Air Force base.

The pilot flew a tight downwind and base leg, then got high on the glide path. He was attempting to land in the first 1,000 feet so he could turn off at the Aero Club taxiway. As a result, the steep approach caused a hot touchdown, and the aircraft bounced. The pilot did not attempt to go around, and the aircraft bounced twice more — the nose gear failing on the third contact with runway.



That Unsecure Feeling

An electric jet pilot was recovering from LAD delivery, when his lap belt became disconnected. The pilot reconnected the

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belt and checked to be sure it was secure. Then, during the roll in from a pop up delivery, the belt disconnected again. At this point the pilot headed for home.

During RTB the pilot discovered that when he applied Gs to the aircraft his survival radio and flare in the survival vest contacted the lap belt connector and released it. After landing, personal equipment specialists, found that the pilot's survival vest had not been modified to ensure clearance between survival equipment and the lap belt connector.

Just A Slight Cold

An A-10 pilot had leveled his aircraft at 9.500 feet for 30 minutes before descent to the range. During the descent, he experienced sinus pressure at 8,000 feet and pain at 4,000 feet. He informed lead, declared an emergency, and climbed to 5,000' where the pain subsided. He then made a gradual descent for landing. Even after landing, the pressure on the sinuses remained until relieved by medication. The pilot was DNIF for five days.

Prior to the sinus block the pilot had no recognizable symptoms of a cold. He had been swimming for several hours on the two days prior to this flight. It is probable that the blockage was the result of irritation forms chlorine or a slight, unrecognized cold.

Hazardous Traffic

What's a person to do? Everywhere one turns, ample evidence exists that people are out to get you. Paranoia, *paranoia* — or is it self preservation instead?

A C-141 inbound to a non-Air Force base (want to be sure the Air Force controllers who read this won't get paranoid) had traffic called to them by Approach. The alert pilots identified a low flying helo going away from them — no factor. A bit later when cleared for an ILS approach, the GCA controller called traffic on a second helo inbound to the field. The cargo pilots assumed it was the helo previously spotted. A potentially hazardous conflict occurred.

- When you lose sight of traffic, tell the controller.
- Don't hesitate to ask for avoidance vectors when unable to acquire the traffic.

A C-141 inbound to the overseas airport was cleared to 2,000 feet MSL. This was below the minimum safe altitude. The aircrew questioned the controller and were assured the assigned altitude was correct. The aircraft was leveled at 4,000 feet anyway. Within a few seconds the low altitude alert system sounded. An expedited climb to minimum safe altitude followed by a published approach brought the crew safely down to earth.

What's the moral? Situation awareness! It is an absolute must if you plan to become an "old pilot." This crew did a superb job of that. Apparently the controller lost the beacon target and thus was distracted, and when he looked back at the scope he misidentified the primary target. Could have been a tragic mistake except for the alert pilots.

So, if you have to be a little paranoid to live to a ripe old age — go for it! — Lt Col Gaspar, Directorate of Aerospace Safety. ■

The Snow Scene

Snow and winter flying can be especially hazardous for helicopters. The following article, adapted from the US Army *Flightfax* has some good points for USAF rotary wing types.

■ Most snow-related mishaps happen because of whiteout. Whiteout has been described as a phenomenon which occurs when light from snow on the ground and snow-laden clouds exactly match. The whiteout we'll discuss here is that induced by blowing snow and helicopter rotors. When an aircraft is flown over loose snow, the movement of the air picks the snow up and circulates it, forming a snow cloud. Visibility is reduced to zero as the aircraft descends or climbs out through a snow cloud.

Whiteout Mishaps

■ The pilot of an OH-58A, while hovering his aircraft 2 to 3 feet over a snow-covered field, lost visual reference because of blowing snow. The aircraft drifted to the left, the left skid hit the ground, and the aircraft rolled onto its side. Following is a paraphrased version of the pilot's account of the mishap:

"I picked up the aircraft and turned it 90 degrees. There was no difficulty maintaining ground reference. The furrows of the plowed field showed as brown rows, and we were parallel to and about 10 meters from a treeline which was plainly visible. Overall visibility was at least ½ mile. We could see a distant treeline. I told the copilot that I wanted to reposition the aircraft about 20 meters forward.

"I picked the aircraft up to a low hover and began to move forward. We went maybe 15 meters and were well able to maintain visual contact, both with the treeline to the near left and with the ground. Suddenly, blowing snow engulfed my side of the cockpit and I lost all visual references. I tried to regain visual contact with the ground and then with the treeline to my immediate left. Since conditions had permitted me to hover that far for possibly 15 to 20 seconds, and since I knew I was close to trees over a slope, I did not attempt an instrument take off. I felt the helicopter was moving slowly forward and that I would be able to see the ground again any instant. I told the copilot that I couldn't see the ground. He replied that we were drifting left and down. At that instant, we tipped left and the aircraft rolled."

This mishap points out the relative ease with which any pilot can be trapped into a whiteout situation. The pilot, who was well qualified and highly experienced, was not new to winter operations. This was the third year he had flown in a snow environment.

■ The crew of another OH-58 landed because of deteriorating weather and darkness. They spent the night with the aircraft and the next morning proceeded with the mission. Less than an hour after takeoff, they flew into marginal weather conditions. As the copilot tried to land, he became disoriented in blowing snow. The pilot did not take control and make a go-around. The left skid hit the ground, and the aircraft rolled over.

■ When the lead pilot of a flight of three UH-1s landed short to a snow-covered area, the pilot of the No. 2 aircraft, instead of going around, decelerated abruptly and terminated his approach at a hover. The No. 2 pilot lost outside visual reference because of rotor-induced blowing snow. The aircraft drifted and rolled to the right, coming to rest inverted.

The helicopter produces the greatest amount of rotorwash when hovering. So when making an approach to a snow-covered terrain, do not terminate to a hover. Disorientation will most likely occur in the blowing snow. There are certain things you must do to make a safe landing or takeoff over snow.

Taking Off

The techniques used for taking off from snow will certainly vary

depending on the type of aircraft being flown. But the principle for this type of takeoff is common to all helicopters. The following takeoff techniques are recommended:

■ Insure skids are free from obstructions.

■ If the snow is only a few inches thick, apply pitch to the blades before takeoff to blow away the snow. This will reduce the density of snow that will be lifted on takeoff.

■ After completing the above, stabilize the helicopter on the ground until the snow cloud dissipates.

■ Position the cyclic for takeoff. If there are no obstructions along the takeoff route, the cyclic should be positioned to achieve a maximum performance takeoff attitude. If the takeoff is to be made over an obstacle, a near vertical ascent should be made.

■ The aircraft should have no forward movement until it is clear of the ground. Apply sufficient torque for a positive rate of climb.

■ As the helicopter begins to climb, blowing snow will increase and ground reference may be temporarily lost. Maintain heading and flight attitude.

■ When clear of the snow cloud, adjust flight attitude and torque so as to achieve normal climb airspeed and rate of climb.

Landing

Before beginning an approach, you should learn all you can about the touchdown area; for example, the condition of the snow, the slope of the area, and the location of obstacles. If you are landing to an improved landing site, some forward airspeed on touchdown may be desirable. If you are landing to an unfamiliar tactical site, however, forward speed should be dissipated upon touchdown. Plan your approach so that only minimum power is required to terminate the approach.

■ The initial position of an approach to the snow is the same as any other approach. The main difference is in the last 50 feet, instead of making the normal deceleration below effective translational lift airspeed, you should maintain this airspeed until just before touchdown. This allows you to keep the helicopter in front of the snow cloud until touchdown, after which it will become engulfed in the snow cloud. As the aircraft descends to an in-ground-effect altitude, blowing snow will develop to the rear of the aircraft. At this point, begin a deceleration. After the aircraft has begun to decelerate, it should be positioned in a landing attitude. Once ground contact is made, reduce torque until the aircraft is firmly on the ground.

Another technique for landing in snow is using a shallow approach. Plan the approach to arrive at the predetermined touchdown area with minimum or no ground run and the aircraft on a landing attitude. This is accomplished by progressively establishing a landing attitude during the approach. By obtaining this attitude and properly applying collective pitch, airspeed should be dissipated so as to arrive at the touchdown area with little or no ground run.

Commanders of units operating in cold weather areas must be sure that their aviators are thoroughly trained in the correct techniques for snow takeoffs and landings. Winter with all its hazards is upon us. You can make it a mishap-free one if you act now. ■

MAIL CALL

EDITOR:
FLYING SAFETY MAGAZINE
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NORTON AFB, CA. 92409

"Gotcha"

■ Just a little "gotcha" on your November 1983 issue of *Flying Safety*. In reading Major Turner's excellent article, "It's All Downhill" (p 24, 25), I kept getting an uncomfortable sensation looking at the aerial picture of the approach to RW 12. Not having previously flown this approach, I tried to visualize the wind sheer, the 3.0 degree glide path and the displaced threshold. For some reason, I kept pushing my No. 2 Skillcraft pencil to the "go around power setting" every time I looked at the picture.

Finally, it dawned on me. If you ever see this picture in the air go around, give control to the copilot and see the flight surgeon after landing. Your eyes are in backwards. Apparently in publishing the article, someone put the negative in backwards — gotcha!

OTTO KANNY, III, Major, USAF
AFMPC
Randolph AFB TX

You're right. To correct the problem we have reversed the editor's head. Now he can see things correctly.

This is the way Runway 12 really looks from final approach.

Unrestricted Vision

■ I wrote an article "What You See Is Not Always What You Get!" about vision after the replacement of three of our control tower windows and all tower shades brought the issue of obstructed vision vividly to our attention. We hadn't realized how much more difficult our job had become because of the poor visibility we had. I hope the information will be useful to your readers.

MICKEY TURNBO, SMSgt, USAF
Tower Chief Controller
United States Air Force Academy
Colorado Springs, CO

SMSgt Turbo's article is on page 11. He makes some interesting points for pilots and controllers.

"Hypothermia — Missing In The Atlantic"

I read your article "Hypothermia — Missing in the Atlantic" in the November 1983 issue with interest. I noted the first paragraph was incorrect regarding the year of the sinking of the TITANIC. It should read 1912 vice 1882. The sinking of the luxury liner TITANIC led to the creation of the International Ice Patrol. Each year since 1914, with the exception of the war years (1917-1918 and 1942-1945) the Coast Guard has maintained the patrol.

I have been a Coast Guard aviator since 1963 and an avid reader of flight safety periodicals. I consider *Flying Safety* magazine to be one of the top periodicals in the safety business. Keep up the good work!

R.F. BLACKBURN, Captain, USCG
Coast Guard Group North Bend, Oregon

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UNITED STATES AIR FORCE

Well Done Award

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

FIRST LIEUTENANT
Blair E. Hansen

FIRST LIEUTENANT
Ronald J. Harlow

20th Tactical Fighter Wing

■ On 31 March 1983, Lieutenants Hansen and Harlow departed on a two-ship F-111 cross-country sortie. While cruising at FL 270, the crew detected a faint unusual odor and went to 100 percent oxygen. Then they experienced a sudden loss of cabin air flow, a cabin pressure caution light, and the cabin altitude rose to 14,000'. Lieutenant Hansen saw one of the caution lamps flash twice then remain on followed by illumination of twelve more caution lamps, including pitch and roll flight control, both engine overspeeds, and the wheel well hot light. Lieutenant Harlow reacted immediately to the most serious problem in the wheel well and shut off the bleed air. Lieutenant Hansen began slowing to gear lowering speed by reducing power to 85-87 percent and sweeping the wings forward. With airspeed below 300 knots and gear down, the pilot advanced the throttles to military power, but both engines stalled. The stall recovery attempt was unsuccessful and Lieutenant Hansen put the aircraft in a slight dive to maintain 300 KIAS. He was able to maintain control despite sluggish flight controls. Passing FL 220 the number two engine responded to an airstart attempt. The number one engine also responded shortly thereafter, and both engines were at mil power passing 10,000 feet. Lieutenant Hansen recovered to level flight and then initiated an emergency single engine approach to the closest suitable airfield. On touchdown, the ground roll spoilers failed to extend but despite this and the possibility of brake and antiskid damage from the wheel well hot condition, the crew was able to successfully stop the aircraft without further damage. The quick reaction, superior airmanship, and exceptional crew coordination demonstrated by Lieutenants Hansen and Harlow resulted in the safe recovery of a valuable crew and aircraft. WELL DONE! ■

Prepare For F.O.D.* Season

*Feathered Object Damage

Update Your Bird/Aircraft Strike Hazard Program