AEROSPACE

SAFETY • MAGAZINE FOR AIRCREWS

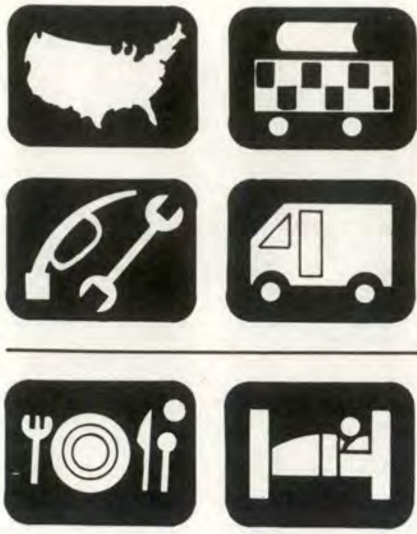
FEBRUARY 1980

WINGMEN DO IT BETTER—a close look at togetherness

MURPHY RIDES AGAIN—the notorious villain strikes

A HECTIC 24 HOURS—six shots at the barrier

A LITTLE ICE CAN GET YOU—cool it when you have ice



X-COUNTRY NOTES

MAJOR DAVID V. FROEHLICH
Directorate of Aerospace Safety

■ **WHO'S ELIGIBLE?** – We've had numerous inquiries about the Rex Riley list and who's eligible (in some cases vulnerable) for an evaluation. The current philosophy is based on *both* availability and quality of transient services.

AVAILABILITY is pretty easy – Currently bases must meet the following minimum criteria in order to be eligible for a Rex Riley evaluation:

- USAF, ANG or AFRES installation listed in the IFR Supplement as possessing facilities to serve transient aircraft and crews.
- Open (with transient services personnel) a minimum of five days per week and eight hours per day.
- Not be listed as OBO (Official Business Only status).
- Not be under a permanent PPR (Prior Permission Required status) with the intent of keeping transients out.
- Have no other continuing restrictions or shortages of facilities or services to transient aircraft or crews (i.e., no MD-3, MA-1A, LOX or similar commonly needed servicing items available).

Obviously several of these restrictions are very subjective! The key is *intent*! There are several bases which obviously discourage transients by PPR status, limited hours or published lengthy delays. Not to say that they are not justified in their policies or attitudes, 'cause they know their mission and capabilities better than we do. The intent of the Rex Riley program, however, is to recognize locations that a *variety* of transient aircrews can *easily* transit and obtain *good* service. (For info, we are carrying approximately 100-110 bases world-wide as eligibles with 57 currently on the list.)

QUALITY is the other biggee – Probably this is even more subjective, but it is also very common sense. In these days of shrinking budgets and UDL's, the good turn places are those that are experts at doing more with less. They make up the difference with desire. An airfield chief put it well – "You may have to park 'em in the boondocks, feed 'em C-rations and put 'em up in a tent. The key is meeting the crew, explaining why you have to inconvenience them and letting them know that that's the absolute best you can do. If you're trying your hardest, most crews will work with you."

That's the extreme, but the obvious answer is attitude. We've seen some folks in ancient facilities providing excellent service and some folks in brand new shiny buildings that didn't care two hoots!

We have a list of who we think is eligible, and there are roughly 100-110 bases world-wide that fall within the criteria. We try to monitor the IFR Supplement, NOTAMS, FLIP Area Planning and all the other airfield status documents. "There is only one of us," however, and once in awhile the status of a base will change. Let us know!

REX ALMOST SPREAD-EAGLED – This last trip we landed at a SAC base and were informed that they had no inbound flight plan and we should hold our position for identification. We sat, surrounded by security police folks, for a few moments until the airfield manager came out and checked ID cards. Point – we had filed properly and had a route of flight the whole leg but somehow the "inbound" had slipped through the crack. We did not call PTD while inbound to let them know we were coming! That call would have given the base ops folks an extra 30 minutes to check the system. Good reason for all transients to give dispatch a call inbound to warn them and protect yourself. All in the cause of better service!

THANKS – We'd like to pass on our appreciation to some super professional crews and support personnel in the 1866, 1867 and 1868 Facility Checking Squadrons (AFCC). We negotiated an agreement for them to provide inputs to The Rex Riley files, and they have really grabbed the ball and run. We are getting useful and thorough comments on overseas installations and with these comments, are able to build up-to-date and complete files on our out-of-CONUS locations. Thanks for the support! ■

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Page 2

Page 5

Page 24

SPECIAL FEATURES

REGULAR FEATURES

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The FORMATION CHALLENGE

MAJOR JAMES L. GILLESPIE, CF
Directorate of Aerospace Safety

■ The highlight of any airshow is a tight-knit aerial demonstration team flawlessly performing synchronized maneuvers. It never ceases to amaze how effortlessly they hold position, how gracefully they change formation, and how smoothly they guide their craft through a routine. To those of us who know better, we realize this doesn't just happen. It takes hours of dedicated practice for pilots already acknowledged to be the best at what they do, to perform in a consistent, safe and precise manner. The end result being a calibre of formation flying sufficient to instill pride in all of us.

The skill of formation flying is optimized in the aerial demonstration arena. The tactical necessity, however, can be found in the depths of air doctrine and strategy; thus, it goes unquestioned as to the need for military formation flying skills.

A good deal of time is devoted to mastering the basics during undergraduate pilot training. The fundamentals are further honed during operational training. Although the multimotors fly formation in their own inimitable fashion, it is the fighter pilots who capture the imagination. The mark of a fighter jock, once his bomb scores and air-to-air capabilities have been established during ''happy hour,'' is how well he can lead a four-ship in an aerial engagement or how he can stick on the wing through maneuvers not yet invented. With such a well established criterion, is it any wonder that an embryo fighter pilot one day will find himself in a situation where he runs out of ability and ideas at the same time?

In 1978, operator factor formation mishaps cost the United States Air Force five aircraft destroyed, four fatalities and approximately $24.1 million. To the end of 1979, the cost was nine aircraft destroyed, seven fatalities, and $56.0 million. An increase in all three categories, but, more dramatically, in dollar value. As the cost of weapon systems increases, the dollar value loss will rise in proportion. In this case, two F-15s and two F-111s created an impact for 1979 (no pun intended). The point here is that operational formation flying carries an inherent risk in terms of lost resources, financial as well as human.

Pilots must be fully trained and proficient when participating in formation operations. An error in judgment or momentary lapse in

continued on page 4

WINGMEN DO IT BETTER

LT COL HORST GAEDE, GAF
Directorate of Aerospace Safety

■ How would you like your next flight as a wingman being evaluated like this?

– The wingman realized the flight was being conducted in an illegal and unsafe manner, but chose not to make a direct comment to the leader, or

– Although aware that the flight had been continued to below the minimum altitude, the mishap crew elected to follow number 1 through his last ditch, split S type maneuver.

These two cases ended up in smoking holes with more than just embarrassment on the wingman's part. They caused loss of life and aircraft and should give us some serious thought.

Talking about flight and formation tactics, policies and individual responsibilities, the picture has changed over the years. During World War II, e.g., German fighter aces used to select and fly with the same wingman day after day (or as long as he survived). The wingmen were nicknamed "KACZMAREK" (which sounds awfully Polish), and their main and only objective was to clear the leader's 6 o'clock when he was out adding more and more kills to his account. They usually did not engage in the "shootout" unless circumstances dictated or the leader ran out of ammo. Because of their very specific task and responsibility, they had to stand back behind their leaders; their names were hardly ever known.

Today, we work things differently. Going out to perform and to train for the "real life," we share almost equal responsibilities, play the "Engaged and Free Fighters" game, stress mutual support, work as a team!

Still, we designate flight leads (we even call them that), but wingmen are more "grown up," with equal rights and opportunities! With more responsibilities, too?

We expect the flight leader to know and consider the capabilities of his wingman or -men and hold him responsible for:

– Flight integrity and air discipline.

– Directing radio communications.

– Navigation.

– Keeping the flight clear of other aircraft and objects.

– Planning and performing all maneuvers without exceeding either

continued on page 4

The FORMATION CHALLENGE

continued from page 2

concentration can be crucial. The 19 formation mishaps reported during the period break down are: Nine airborne collisions (eight involved wingmen hitting lead); one collision with lead during the takeoff roll; two cases of the pilot losing aircraft control immediately after takeoff; three instances of lost wingman (two of these became disoriented and crashed; the other hit another member of the same formation in cloud); one departed flight during attempted rejoin; two flew into the ground, one struck a grain elevator. Also there was one case of vertigo where the wingman broke out of formation and recovered single ship. Surprisingly, formation rejoins contributed to only three occurrences of wingman hitting lead.

The greatest potential for mishap exists while flying in close formation. Add to this a bad weather penetration, whether a departure or recovery, and the plot thickens. Close formation flying is an exercise in discipline. The formation leader, being the eyes and the brains, is responsible for maneuvering in such a manner that the weakest member can hack the mission. At all times he must be aware of problems his wingmen may be battling, whether it be turbulence, vertigo, or both. A thinking man's formation leader who anticipates every eventuality, can greatly reduce the associated risks.

The wingmen have no less responsibility for the safety and integrity of the formation. If the leader maneuvers aggressively, is rough or is making it unnecessarily difficult for his wingman, he should be told. Confusion within the formation must not be allowed to exist. The absolute cooperation of each member is imperative for mission accomplishment.

Periodic in-depth personal reviews of formation fundamentals are necessary to avoid airborne embarrassment. False pride can be the single most significant factor leading to a formation mishap. In this demanding environment, performance is all important. Generally, you are the best judge of your strengths and weaknesses. Introspection can be a worthwhile exercise. ■

WINGMEN DO IT BETTER

continued from page 3

aircraft limitations or aircrew capabilities.

Our concept of the wingman's task and responsibility include such things as consideration of others in the formation and capability to react to any circumstances precisely and surely. We charge him with responsibility for:

– Performing within briefed or otherwise defined parameters.

– Maintaining flight discipline and integrity, unless emergency conditions are encountered, or in the interest of flying safety.

Last, but not least, we expect all wingmen in a formation to feel responsible for the safe conduct of the mission and to

– Bring to the attention of flight leads any unsafe condition or violation of flight regulations.

In other words: When you are out there, Blue 2, don't just hang in there, keeping communication to an absolute ZERO. Don't close your eyes, no matter how great your respect for lead's ability and judgment might be. The old saying, "What you don't see, won't hurt you," is not true in aviation.

If you see something wrong, SPEAK UP! If you don't speak up when you observe an unsafe condition, at best it could be embarrassing and at worst, it could be fatal.

And, if this still doesn't trigger you, try to think of it this way: An aircraft might be replaced, a friend might be gone forever! ■

MURPHY...

Rides Again

MAJOR ROGER L. JACKS
Directorate of Aerospace Safety

■ Occasionally, crew coordination is put to a hard test when Murphy's Law is lurking in the shadows. This is the story of a B-52 crew that was having one of those unforgettable days.

It started at base operations while the crew was filing its paperwork. The copilot looked toward the door and then quickly back to the crew. "I think we're in for a long day; we've got company coming guys!" As the other crewmembers turned around to look, they saw two men wearing white scarfs coming through the door.

"Great!, just great!", remarked the nav; "just what we need, a no-notice standboard!" Suspicions were quickly confirmed as the two men made their way to the crew and informed the aircraft commander that the pilot and nav teams were being given a no-notice standboard.

Silence fell over the group, and anxiety levels were rising when the copilot quipped, "You guys have the wrong crew. Rumor control has it you're getting on with E-04 in a couple of hours."

"Sorry about that. I guess today's your lucky day," retorted the stan eval pilot.

"Yeah, we're really lucky," grumbled the radar nav.

The aircraft commander was lost in his own thoughts: "We've got a sharp crew; the mission is straightforward; it shouldn't be a problem if only . . . if only something unforeseen doesn't screw us up."

The first part of the mission was smooth. The takeoff, departure, air refueling and navigation events were flawless. Activities aboard the B-52 were at a quick pace as the crew prepared for their descent into low level. The pilot and copilot were getting weather updates, entry

MURPHY... continued

clearances, and digging the low level map out of the mound of pre-mission paperwork. The electronic warfare officer was busily stowing the sextant and had offered a cup of coffee to those so inclined. The nav team was copying low level weather data, working the low level entry point timing problem and rechecking the bombing and navigation data displays. The gunner was reviewing bomb run timing charts and checking the operation of his stop watch.

The weather report indicated it was going to be a rough and rocky road to the simulated bombing targets. Clouds, turbulence, and rain had all been forecast. The pilot, gazing down toward the low level route, informed the crew that it did, in fact, look "pretty grim." As the pilot eased the big airplane into a shallow descent, the radar nav took one last gulp of coffee and started looking for navigation points on his radar scope. The crew was all business; aircrew tasks were foremost in everyone's mind.

As the B-52 descended into the low lying clouds, the aircraft began to be battered by the turbulent air. The navigator was busily scanning his data display panels. A quick plot of the aircraft's position on his low level chart, confirmed by a cross check using the radar scope, told him things were going well. His eyes continued to dart from object to object gathering information. Suddenly, he felt a queasy feeling manifesting itself in his stomach. The crew compartment that encapsulated the navs had become a churning sea of motion. The navigator searched for something to focus his eyes on that wasn't jiggling hoping to avoid the grand finale to air sickness.

In the meantime, the evaluator was getting cramped on his makeshift seat between the two navigators. With a lull in the turbulence, the evaluator took advantage of the calm air and stood up to stretch his legs. He had leaned against the crew ladder providing entry to the upper deck, when suddenly he felt searing pain spreading down his back. He clawed at the clothes on his back as the radar navigator announced to the crew that they were initial point inbound. The bomb run had begun.

Out of the corner of his eye, the radar nav saw a sight he couldn't believe. The evaluator with pain on his face was shedding his clothes with reckless abandon. The radar nav was mentally trapped between the evaluator's crisis and the bomb run. To add to the confusion, the turbulence intensified, and the navigator began turning different

shades of green. In a shaky, distressing voice, he asked the radar nav, "Have you eaten the potato chips out of your lunch yet?"

"You've got to be kidding," replied the radar nav, "We're on the bomb run and you want to know my eating habits?"

"Have you?", demanded the nauseated nav.

"Yeah! Now check my cross hair placement," yelled the radar nav.

"Can I have the potato chip bag, radar, I think I'm going to be sick," said the nav.

Handing the nav the crumbled bag, the radar nav selected his first offset aiming point and let out with an, "Oh, no!"

The pilot, fearing the worst, asked, "What's going on down there?"

The radar nav replied, "The lousy offset is in backwards. Nav, get the right offset in. Pilot, hold this heading unless you've positively identified the target area."

"I've got the target in sight, radar, I'm going to ease us a little bit to the left," said the pilot.

"My timing shows 90 seconds to release, radar," yells the copilot.

"That checks with the gunner's timing, radar."

"How's the offset coming, nav?", asked the radar, trying not to inflict his voice with panic.

"I've about got it," reports the nav. "Boy! I'm in bad shape."

"Thirty seconds, radar," warns the copilot.

"O.K., pilot, I'm on the offset, in the bombing mode and the steering indicator is good," states the radar nav.

"Roger, radar, coming 3 degrees right," adds the pilot.

"O.K., guys, the nav is feeling bad, help me with the timing run."

"Roger, radar, got you covered," says the copilot.

"Gunner's ready, radar." A few seconds later the radar announces simulated bombs away.

The pilot turns the giant aircraft precisely to the radar nav's desired heading, and copilot, gunner and radar nav recheck the time to the second simulated bombs away. Seconds later, the bomb run is over, and the pilot starts a climb out of the low level route.

As the radar turned to see how the evaluator was making out, he saw a guy standing behind him wearing only jockey shorts and flight boots. The tension that had built up in the radar nav was shattered with his laughter as he gazed upon the pitiful looking evaluator.

"What happened back there," he quipped.

"Some SOB forgot to lock the push button dispenser on the coffee pot. Something or someone hit the button and hot coffee poured down my back," replied the evaluator. "Take a look, I think I've got blisters."

"Just a second," said the radar. "Nav, how are you feeling?"

"O.K., now that the damn turbulence has let up. Why does everything always happen at the worst time?"

"I don't know, nav, but it does. If you're all set, take the navigation and I'll see if I can help the evaluator take care of his burns."

As the radar assisted the evaluator, the navigator paused a second and thought about how lucky he was to be on a crew with a group of hard workers – professionals that backed each other. He had learned a lot about crew coordination, but little did he realize he would have the opportunity to demonstrate the same skills an hour later.

"Demon 22, this is Oakland Center, descend and maintain one six thousand."

"Roger, Oakland Center, Demon 22 is out of FL 250." The pilot had begun the descent when the copilot asked, "What altitude did he say?" The pilot responded with, "He said we're cleared to six thousand." The copilot gave a nod of understanding.

"Pilot," said the nav, "How about checking that altitude. I'm pretty sure he said one six thousand."

"O.K., nav, copilot, give Center a call and check it out."

Crew coordination – it can protect your career and it can save your life. ■

Birds Of A Feather

Bird strikes are routine—several are reported nearly every day. Once in a great while, though, one really gets your attention. Here is such a one. It meets all the requirements of a hairy tale and provides a good learning experience. Also, we commend the crew for their great handling of a difficult situation.

■ An F-4E was on a low level navigational training flight at 2,500 feet AGL, 6,200 MSL, 450 KCAS, when the pilot saw a large bird (estimated wing span 6 feet) in front of the aircraft. He made an immediate pull and roll but was unable to miss the bird. The left external tank departed the aircraft at impact. Investigation revealed that when the armament wire bundle was severed, jettison voltage was provided to the wing tank. A straight ahead climb was initiated and airspeed was reduced to 300 KCAS. A check of the engine instruments showed that the left EGT was at 800 degrees C and that the left rpm was at 70 percent. The left throttle was then retarded to idle and all engine instruments indicated normal. The pilot also lost intercom and UHF radio communications.

At this point, the WSO took control of the aircraft to assure that it was climbing to a safe altitude.

The WSO initiated a call to the wingman and instructed him to rejoin to assess damage. Control of the aircraft was returned to the pilot after ascertaining he was okay by using handsignals. Throughout the remainder of the flight, the pilot passed notes to the WSO relaying aircraft status and other vital information. The WSO relayed directive information to the wingman as the flight proceeded back to base.

Approximately 45 NM from base, the left engine oil pressure decreased rapidly from 25 PSI to 15 PSI. The engine was shut down to avoid further damage, and a note was passed to the WSO explaining this action. During the descent the pilot regained intercom and UHF communications. At 25 NM from the field the utility hydraulic pressure began to fluctuate down to 1,000 PSI while in straight and level flight. It was decided to start the left engine on final due to possible loss of utility hydraulic pressure. On extended final, the left engine was started, and engine instruments remained within limits for the remainder of the flight.

When the landing gear were lowered on a 10 mile final, the right main gear indicated ''barber pole'' in both cockpits. A missed approach was accomplished, and the emergency gear lowering checklist was followed; however, the right main gear continued to indicate barber pole in both cockpits. Because the right main gear appeared to be down and because other electrical problems had been encountered, a wheels down, approach end, BAK-12 arrestment was decided upon. The flight terminated in an uneventful BAK-12 approach end arrestment.

The crew demonstrated outstanding crew coordination in handling the emergency during the communications failure. Good crew coordination between front and back seat has saved several aircraft.

That was the case in a bird strike last October that partially disabled the front seat pilot of another F-4. At 480 knots and 500 feet AGL the aircraft struck a buzzard. The bird hit the right quarter panel and slammed into the cockpit, breaking the pilot's arm, shattering his visor and damaging the right side of the parachute housing container. The IP in the back seat took over and made the landing.

Crews flying dual seated aircraft can prepare for such emergencies by thoroughly briefing for them, particularly for low level flights and during bird migration seasons. ■

Destructive force of a birdstrike is illustrated by photos on page 8 and below. Strike occurred at 2,500 ft AGL at 450 KCAS.

Hypothermia...

LT COL GEORGE J. BIFOLCHI • Directorate of Aerospace Safety

■ *Weather conditions: Ceiling obscured, visibility one-half mile in ice fog, wind calm, temperature minus 50 degrees Fahrenheit. The cargo compartment of the tanker was unheated because the auxiliary power unit wasn't operating. For two hours the heavily clad pilots, navigator and boom operator struggled to keep warm in cockpit temperatures nearly as cold as outside. As the last of four spare aircraft providing air refueling support for an airborne reconnaissance mission, the crew did not expect to launch. Then the unexpected occurred . . . the crew completed their final checks, advanced power and released brakes. The heavy aircraft lumbered down the runway and slowly rotated into the black arctic night. A few minutes later the crew reported having a problem raising the gear. Thirty seconds passed . . . radio and radar contact were lost . . . and a huge fireball lit up the sky.*

Most of us relate cold injuries with "exposure" to the elements; however, we usually expect sufficient warning to eliminate the problem before becoming incapacitated. Yet even knowledge of cold weather hazards with adequate warning is not enough if we fail to apply good judgment in a timely manner.

A significant factor in this accident was the overwhelming distraction caused by chilled extremities. Also suspected was a subtle but pernicious hypothermia resulting from a lowering of the body's inner core temperature through a loss of heat. In extreme cases the loss of heat can result in uncontrollable shivering, increasing clumsiness and loss of judgment followed rapidly by unconsciousness and death.

Hypothermia has a well documented history. Although relatively rare as a threat to the flier, it constitutes a high risk for a traveler in mountainous terrain or a cold weather crash survivor. During World War II, it was a routine threat to waist gunners aboard unpressurized bombers flying at altitudes above 25,000 feet. Hypothermia has meant death to scores of mountain climbers suddenly beset by unplanned for conditions . . . it's known as a kill[er] of the unprepared.

The body maintains thermal equilibrium by regulating the production and loss of heat. Body heat is produced through eating and muscular activity while external sources of heat, such as the sun, a campfire or warm liquids, also contribute. The most immediate benefits of increased heat are realized through warm liquids or sweet foods that are quickly transformed into heat energy. Heavy physical heat production up to ten times the exertion can increase body basal metabolic rate, while heat production drops to 80 percent of the basal rate when sleeping. Intense shivering produces heat equivalent to running at a slow pace (six times the basal rate). Body hormones can also produce heat when adrenalin is increased or when body illnesses produce fever.

Heat loss occurs through the mechanics of cooling, respiration, radiation, evaporation, conduction an[d] convection. Not much can be done to decrease heat loss through respira-

cold weather killer

tion – inhalation of cool air and exhalation of warm air. Radiation, on the other hand, is a leading cause of heat loss through an uncovered or unprotected head. At 5 degrees Fahrenheit, radiation can account for the loss of up to 75 percent of the total body heat produced. Evaporation losses occur through sweating; however, this process should be assisted by wearing loose fitting fabrics that "breathe" but still retain body heat. Conduction occurs when the skin transfers heat through contact with metal or stone surfaces. Convection heat losses occur when the warm air layers next to the body are removed by a brisk wind.

Two elements accelerate the loss of body heat: wind and water. Windchill is a product of temperature and wind velocity. The chill factor at 40 degrees F with a wind blowing at 25 miles an hour is 15°, generally considered "very cold." At 0°F the same wind will produce a chill factor equal to −45 degrees. Water conducts heat 240 times faster than air. When clothing gets wet it no longer insulates by trapping warm air next to the body, but instead, rapidly dissipates the heat into the atmosphere. Experiments have shown that wet clothing retains only 10 percent of the heat retained by dry clothing. Moreover, a cold wing blowing against wet clothing can cause "waterchill" which will dissipate heat much quicker than the body can produce it.

Maintaining the body's thermal equilibrium seems simply a matter of balancing "calories lost" with "calories gained"; however, body heat loss through cooling is often compounded by heat loss through physical exertion. The thermal balance in cold wet conditions is maintained by a combination of shivering and increased work rate. In severe cold stress, the metabolic demand may be so great that only an individual in top condition can meet it over a sustained period.

The body's initial response to cold is constriction of the blood vessels of the skin and tissue beneath. This action decreases the amount of heat transported to the skin with a resulting decrease in the temperature of the skin. The skin and surface tissues then act as insulation for the body core which maintains a constant temperature of 99 degrees Fahrenheit.

As skin temperature drops, sense of touch and pain decrease, the muscles and their motor nerves are weakened. Shivering produces heat, but it also consumes energy and, if it is intense and prolonged, can result in exhaustion. Continued heat loss produces violent and uncontrollable shivering, difficulty in speaking, sluggish thinking and amnesia. Advanced heat loss results in muscular rigidity, erratic heartbeat and labored breathing, unconsciousness and, finally, death. Simple maintenance of heat equilibrium can become extremely difficult in a survival situation where a lack of resources, physical injury, or poor planning have rapid and disastrous consequences.

Field treatment for hypothermia involves two aspects: Preventing further body heat loss and increasing the existing level of heat. Several actions are essential:

- Obtain shelter from wind and rain.
- Remove wet clothing and replace with dry clothing.
- Insulate the victim from cold or dampness.
- Add heat by any method available.

Shivering is a good sign that the victim is able to provide self-warmth. When shivering stops, the individual is no longer able to warm himself and must be assisted by others.

A cold sleeping bag, regardless of rating, will not provide sufficient warmth to treat hypothermia. The sleeping bag should be prewarmed by another individual who has stripped down to his under garments in order to transfer maximum heat from his body to the bag. Conscious victims of hypothermia should be given warm fluids or sweetened foods which are most quickly converted to heat.

To prevent hypothermia you must plan for the unexpected, be alert to the causes and know how to treat it effectively. Your choice of survival clothes may well be limited to those you wear in flight. Will they keep you warm and protect you from the rain? Do you carry food in your flight suit for quick energy and heat? Injuries will affect your efforts to keep warm; therefore, avoid situations which lead to uncontrolled heat loss. Minimize the effects of wind and rain. Conserve your energy; exhaustion can produce a loss of heat as great as that caused by wet clothing. Be familiar with the symptoms of hypothermia and probable sources of heat loss . . . and remember hypothermia can subtly become a cold weather killer. ■

SPATIAL

MAJOR KENNETH C. DOZIER, MC, FS

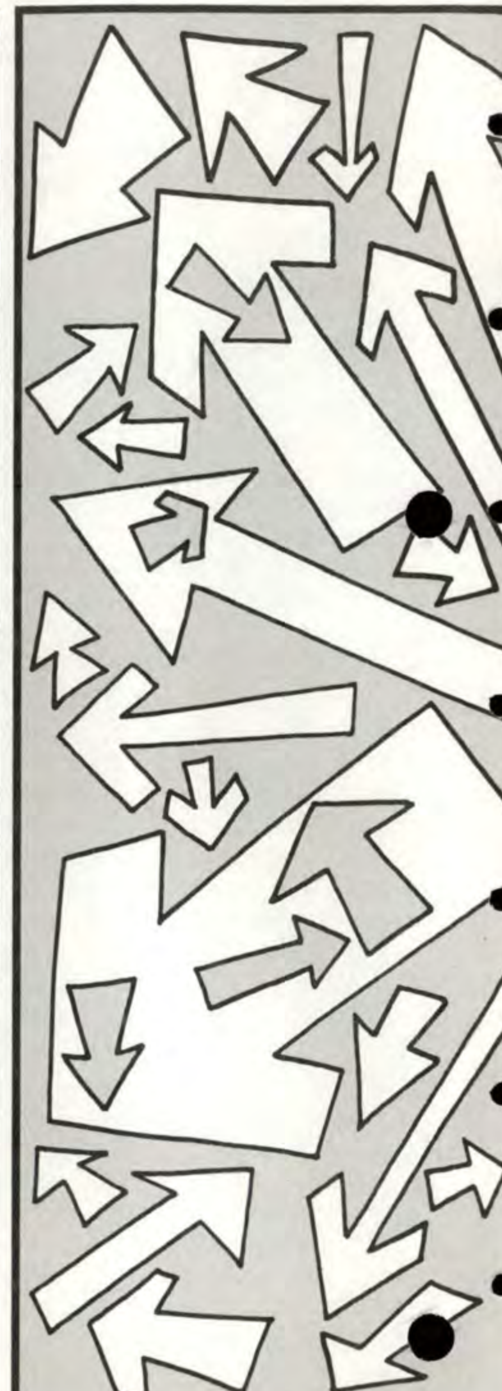
■ "Flying by the seat of your pants" can fly you right into a smoking hole, for things aren't always as they seem to be. Spatial disorientation, or pilot's vertigo has claimed, on the average, six aircrews per year for over 20 years, and with our newer, faster, and more demanding aircraft, the numbers aren't likely to improve unless each of us prepares to compensate for spatial disorientation.

Spatial disorientation is a false perception of your position in relation to the earth's surface. Even the most experienced pilots are subject to spatial disorientation, because in flight you cannot depend on your usually reliable senses. On earth your sense of balance and orientation comes from visual, touch, and inner ear centers. However, G-forces, weather, pressure changes, and the high speeds encountered in flight can confuse you. The only reliable sense you have in flight is visual. The old adage of "Believe your instruments," is absolutely true!

How many of you have experienced one of the following:

> I was flying straight and level, but I felt as if one wing was down.
>
> I was sure I was flying straight and level, but I was actually in a turn.
>
> My copilot said that on several occasions after leveling off from a bank, I over-banked in the opposite direction.
>
> While on instruments, I found myself leaning to the right in order to feel as if I were sitting upright.
>
> When I flew out of "the soup," the horizon seemed severly tilted, but my instruments said I was straight and level.
>
> I was flying on a dark, star-filled night down the coast, when all of a sudden, I couldn't distinguish the position of the horizon, or the difference between stars and surface lights.
>
> We were flying in fog, and I became confused by the flickering of the rotating beacon.
>
> I was flying in and out of the clouds, going from VFR to IFR and I really got disoriented.
>
> After a rapid climbout to 20,000 feet, I felt as if I were isolated and separated from earth.
>
> We were about three hours out from the coast on a routine flight, when I had the strangest sensation that I was going in the wrong direction, and I even considered turning around.

These comments weren't from "The Twilight Zone." They were made by experienced pilots who suffered some form of spatial disorientation. It is not difficult to imagine that any of these false perceptions could result in disaster. To clarify,



DISORIENTATION

USAF Hospital Beale • Beale AFB, CA

the following are some of the most likely situations to produce spatial disorientation:

The transfer from VFR to IFR.

Fixing on isolated light sources during night flight.

Prolonged high altitude flight in which a false horizon is likely to be perceived.

Prolonged acceleration or deceleration in line of flight.

Prolonged turns.

Sub threshold changes in altitude.

Formation flying.

Poorly lighted and positioned instrument panels.

Rapid head movements.

Inadequate IFR training and experience.

Flying with upper respiratory infection.

Alcohol and/or drugs.

Fatigue.

It is mandatory that you believe your instruments. You should not unnecessarily mix VFR and IFR, but you should make an early transition to IFR in poor visibility. Furthermore, you should review in your mind how to compensate for spatial disorientation. If you suddenly find yourself disoriented, go to your instruments immediately. Then check and cross check your instruments. Stay on your instruments until external visual references are absolutely clear. Again, do not make repeated transitions from VFR to IFR. Maintain a correct instrument scan, and do not omit altimeter checks.

Prior to performing acrobatics maneuvers, review spatial disorientation correction procedures. Finally, if orientation cannot be regained, abandon the aircraft.

If you are still of the opinion, "It couldn't happen to me," may I make a suggestion. See your physiological training officer and ask for a flight in the Vertigon. The Vertigon is a simulator designed to produce spatial disorientation and score your ability to compensate. It is the opinion of some researchers that the ability to compensate for spatial disorientation can be improved by practice in such simulators as the Vertigon. It is well documented that improved scores appear with repeated Vertigon flights. Hopefully, the improved ability to compensate for spatial disorientation can be transferred from the Vertigon to the cockpit.

In conclusion, spatial disorientation is a normal reaction to unreliable sensory inputs. Even the most experienced pilot can be affected. The oldest and best advice around is still "Believe your instruments." ■

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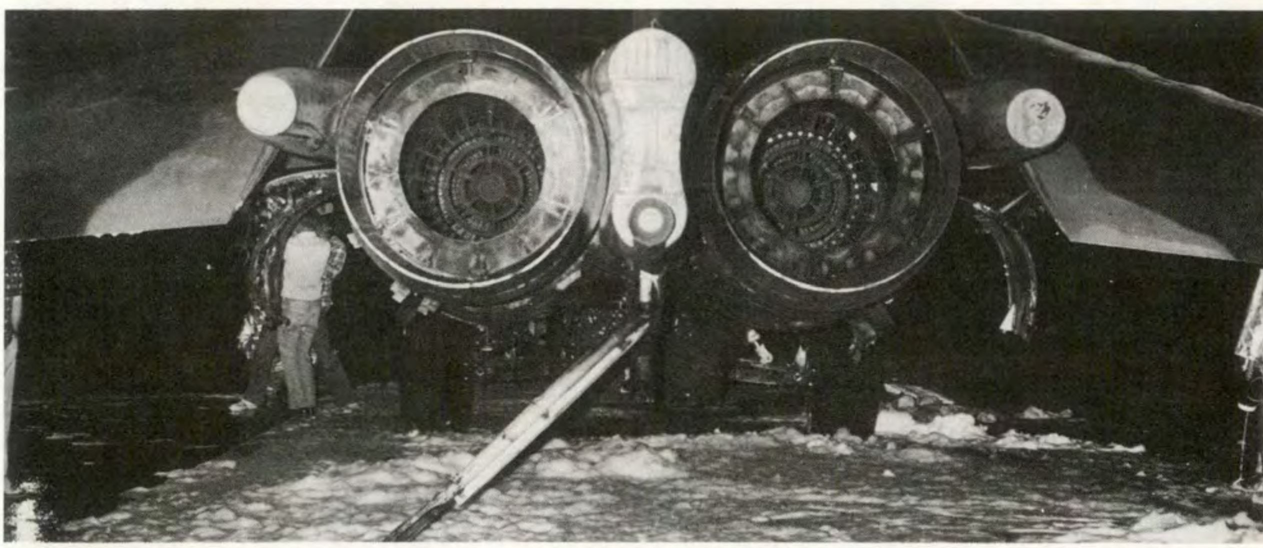
A special thanks to: Major Mike Blanchard, Norton AFB, CA and Captain Cliff Cunningham, Beale AFB, CA.

A HECTIC 24



HOURS

LT COL CURTIS O. ZEIGLER • Cannon AFB, NM

■ Seldom has an Air Force base had so much activity, with a potential for catastrophe, in a 24-hour period than Cannon AFB, NM. The 24 hours included seven barrier arrestments, one of which was a burning F-111D, and three blown tires. Members of the 27th Civil Engineering Squadron had a real test of their readiness, with barrier maintenance personnel, pavements and grounds troops, and firefighters all having a part.

At 1930, 20 September, the action-packed 24 hours began. A transient T-38 blew a tire on landing, skidded and caught the departure end barrier cable with the tire which was then burning. The fire was quickly extinguished by firefighters, but the main runway was closed. This left the secondary runway with both its barriers operational, one of which had just been repaired and put back in operation. At 2030, after moving the T-38 from the main runway, (still closed because of FOD) the call came that an F-111D was returning from the bombing range with an engine fire. The aircrew asked for an approach end barrier arrestment on runway 12 of the secondary runway, 12-30.

The fire trucks were at the T-38 emergency and had no time to pre-position for the F-111, which hooked the arresting cable and stopped at a taxiway intersection where a P-2 and O-11A were positioned.

The crew egressed while the trucks immediately began foaming the fire, which did not go out immediately but continued to burn, completely engulfing the rear half of the aircraft. By this time, the P-2 and O-11A were joined by the P-4 and F-7 runway foamer which began resupply to the O-11A and P-2.

At that point it was evident that fuel was feeding the flames, so Mr. Jesse Ford and Mr. Frank Martz, covered closely by two other firefighters with foaming handlines, entered the blazing area to shut off the valves in the wheelwells. After approximately six minutes the fire was extinguished. Firefighting agent had been emptied from all fire trucks except the P-2. The second foamer was en route from the station manned by off-duty firefighters and the other equipment had begun to reservice.

The pavement under the cable was inspected by the base engineer later that evening and found to have scarred the pavement in the exact spot which had been smoothed by the pavements maintenance folks after an earlier engagement.

The 24-hour saga continued as barrier maintenance troops began to replace the barrier tapes and cable even before crash recovery had defueled the aircraft and completed its movement from the runway. The change out was completed at 1400, 21 September, just as rain began and the Friday afternoon Navy transients began their descent on Cannon.

First, a Navy A-7 blew a tire on the main runway, closing it because of FOD potential. The barrier that caught the burning F-111 the night before had just been put back in service after tapes and cable change when the need to use the secondary runway arose.

The second Navy A-7 took the approach end barrier on runway 12. It was reset quickly by the firefighters in time to catch the third Navy A-7 in the same barrier.

The fourth A-7 landed at the opposite end of the secondary runway, 30, blew a tire, spun 180 degrees but remained on the runway. He was towed to a taxiway barely off the runway when A-7 nr five took the approach end barrier on 30.

All this took place in less than an hour while the primary runway was still closed. The A-7 was removed from the runway and the barrier reset just in time to catch an F-111D approach end engagement at the 30 end.

The main runway was opened and the 24-hour period wound down with the recovery of 14 F-14s, all routine landings.

People, vehicles and equipment out of many shops displayed their capabilities well by working together at their maximum effectiveness. The highly trained and motivated troops performed in the professional manner that aircrews depend on and take for granted. The Civil Engineering folks showed how they are part of "Readiness is our Profession" and "Fly and Fight." ■

I Learnt About

■ Once upon a time I was on exchange in the United States flying Phantoms. My squadron was tasked to fly four aircraft across the Atlantic to the Azores. We were to position the aircraft as en route spares for our sister squadron which was due to take part in a major NATO exercise in the Mediterranean. The plan was for us to fly from the East Coast to overhead the Bermuda TACAN, meet up with our tankers east of the Bermudas and then fly unaccompanied the remaining 1,500 miles to Lajes.

I should have realized something was fishy when our "hours hogging" squadron boss opted out with the feeble excuse that he "Couldn't afford the time away" or something, and gave me the lead – despite the chance of a two week "swan" around the Med while we waited to fly the spares home again.

At this point a look at the flight plan was in order. Having done so, the reason for the rather abrupt and slightly mysterious phone call from HQ, which I received earlier, asking what we normally used as a landing fuel reserve suddenly became clear. On the "deck" with 2,000 lb at the Azores was the best we could do and that assumed no headwind, no fuel venting, no transfer problems, and no "cold" engines. Being a veteran of the Leuchars to Tengah Lightning run this fuel margin didn't impress me one little bit, especially as navigation for the majority of the unaccompanied 1,500 miles would be by the nav's DR and you know how unreliable that can be! To add to our problems the Doppler update to the nav computer had been removed so any unforecast wind would be undetected until too late, the radio compass was notoriously unreliable – almost useless in fact – and Lajes had no DF facility. We would be relying almost completely on TACAN at the other end and an unplanned 30 knot crosswind would put us outside TACAN range. After much complaining, we did manage to get the refueling bracket moved a little farther east, but this still gave us, at best, a planned 3,000 lb overhead. Anyway the order was to GO.

Our reserve aircraft were the last to take off. The diversion of 6 out of the 12 previous aircraft into Bermuda should have given someone the clue that the fuel plan was inadequate. But although at this point the whole exercise was looking rather "dodgy," to say the least, we did feel a certain obligation to "press on" if at all possible.

For some reason my Nr 4 was nearly 1,000 lb down on the rest of the formation when we rendezvoused with the tankers. They had agreed to come 100 miles closer to avoid a "chicken fuel" diversion into Bermuda. However, having plugged in, Nr 4 filled up in one go and then had to remain in contact for the rest of the now extended bracket. At 210 knots with three drop tanks, reheat was required to stay in contact for much of the time, and a few eyebrows were raised back at base when it was discovered that he had taken a total of 24,000 lb. After all, at maximum fuel

Flying From That

A Royal Air Force pilot tells of his experience and some of the pitfalls that may await aircrews over the Mid-Atlantic.

weight a Phantom holds only 22,000 lb. The tankers had to cut into their own fuel reserves to leave us full at the dropoff point – I learnt some more about tanking from that!

The unaccompanied leg started off reasonably uneventfully, except that it now became apparent that Nr 4's airplane was actually using more fuel than the rest and it wasn't just a "throttle pumping" problem. I calculated he would be overhead Lajes with 2,000 lb. The weather forecast was still good and the tankers informed us we had a 20 knot tailwind during the refueling – so we pressed on. We passed the "no-return" point with little change in the situation, then the clouds began to appear and got thicker – and thicker – until we were all in close formation with 400 miles still to go.

There was an emergency tanker available 200 miles due west of Lajes. The chances of finding it were not good as he was in thick cloud at the time and Nr 4 could not afford the fuel to make an attempt. We attempted to get an Air-to-Air TACAN and radio compass fix on him. However, not one aircraft in the formation could achieve a TACAN lock-on and the radio compasses gave a very weak return, which showed we were well to the south of track when abeam his position. With a dry mouth I called the formation to turn 30° to port. The next 15 minutes were the longest of my life. Nr 3 got the first angle lock on Lajes TACAN, which to our relief came up just to the left of our nose, and a few minutes later he also achieved a range lock at 85 miles.

However, our troubles were far from over. Lajes still refused to talk to us even though we could hear them loud and clear. We were still in thick cloud at altitude and apart from the forecast, in which we no longer had much faith, we had no idea what to expect down below. By this time the Nr 2 had lost his main gyro and had no TACAN, Nr 4 was getting very short on fuel and my ASI failed in the descent. We recovered in pairs on modified TACAN descents avoiding a 2,000 ft hill 2 miles to the north of Lajes, and broke cloud over the sea at 800 ft. Nr 4 landed with 700 lb of fuel remaining.

I learnt a lot from that trip, but four lessons stand out in my mind. First, planning to have low fuel reserves is not too bad in itself but when the chances of getting lost are good, the "pucker factor" is bound to increase if there is the slightest miscalculation. Second, long overwater flights have to be meticulously planned and the presence of a tanker – at any stage – must not trap one into a false sense of security. Third, if tankers are not available to accompany the fighters, then whenever possible an INS equipped aircraft should be included in the formation. And finally, an air traffic controller from one's own service pre-positioned at the destination airfield can do much to ensure the aircraft's safe arrival.

Next month I will tell you about the flight home. – Courtesy *Air Clues*, October 1979. ■

Helicopter In-Flight Icing

From an article by Arthur J. Negrette, 129th Aerospace Rescue and Recovery Squadron, California ANG, which originally appeared in *Aerospace Safety,* March 1977. The information is still current and valid.

The inherent limitations of helicopters and their susceptibility to icing hazards require a more comprehensive understanding of in-flight icing conditions and their relationship to helicopter operations.

■ A major finding of artificial and natural icing tests conducted by the Army in 1974 was that moderate ice accumulation (about one-half inch) on inboard portions of the UH-1H rotor blade – and similar aircraft – was sufficient to prevent a safe autorotation in the event of an engine failure.

This abnormality results from ice accumulation in greater amounts near the inner portions of the rotor disc, which directly affects the blade's efficiency with respect to upward airflows during autorotation. The reported result is that, with about one-half inch of ice on the main rotor blade's inner portion, minimum (safe) rotor rpm cannot be maintained during autorotation.

Helicopter pilots should not judge or estimate main rotor blade ice accumulation by observed buildup on the windshield or other parts of the aircraft, since icing occurs at an accelerated rate on the rotor blade as compared to accumulation on the fuselage. A more reliable method for operators of UH-1 aircraft is to estimate ice buildup on the main rotor blades by monitoring power required (torque indications). Researchers indicate that blade icing of one-half inch or greater will be accompanied by a 5- to 6-psi torque increase over the before or "no ice" power requirement.

This phenomenon does not appear to be unique to the UH-1 and deserves the attention and consideration of all helicopter operators.

Many helicopter pilots are inclined to disregard the potential hazards of main rotor blade icing owing to the in-flight "shedding" of ice. In-flight shedding can and does occur. Unfortunately, it is as likely to create a problem as it is to relieve one.

Symmetrical (affecting all rotor blades simultaneously in the same way) shedding in flight can be beneficial by restoring the rotor blades to a more efficient or clean configuration and by reducing the weight of the aircraft. Asymmetrical shedding (affecting less than all of the main rotor blades), however, can create extremely severe vibrations, depending on the amount of ice discharged, rotor system, and other factors.

The severity of vibrations resulting from asymmetrical shedding is generally a function of

the unbalanced weight of the rotor system, and therefore, may be expected to be greater for semi-rigid (2-bladed) systems and 3-bladed fully articulated systems than those rotor systems employing four, five, or more main rotor blades.

In short, the severity of vibrations resulting from asymmetrical main rotor shedding can be extremely hazardous and operators can expect the vibration levels caused by asymmetrical shedding to decrease with an increase in the number of main rotor blades (for a constant rotor mass) since the imbalance represents a smaller percentage of the rotor mass. Conversely, vibration levels may be expected to be greater when asymmetrical shedding occurs on 2- and 3-bladed systems.

Ice shedding from the main or tail rotor can also produce problems apart from an unbalanced rotor system. Though documentation is less than authoritative, researchers have experienced and expressed a concern for structural or foreign object damage to the helicopter's fuselage, rotors or engines resulting from rotor blade shedding. This particular hazard appears to be more threatening to large multi-engine aircraft and especially tandem rotor systems.

Asymmetrical shedding can be minimized by avoiding static temperatures lower than −5° C. Research indicates that by operating in environments of −5° C, or warmer, shedding will generally occur symmetrically. Tests of UH-1 aircraft suggest that by rapidly varying main rotor speed or entering autorotation, symmetrical shedding may be induced when static temperatures are −5° C. or warmer. Collective and cyclic inputs were generally ineffective in producing symmetrical shedding and may result in asymmetrical shedding. At temperatures below −5° C., it is not possible for the pilot to induce shedding.

Most helicopters are not equipped with windshield anti-icing systems and, therefore, a complete or substantial loss of forward visibility will normally occur following prolonged flight in icing conditions. Normal defogging systems are not capable of preventing this windshield buildup. However, visibility usually remains clear through the side windows even in moderate icing.

Light helicopters such as the OH-6 and OH-58 are "ultrasensitive" to in-flight icing. The limited power available and smaller control surface make this type of aircraft extremely susceptible to icing.

Flight tests in icing conditions indicate that light helicopters experience a rapid degradation in aerodynamic characteristics and handling qualities with a corresponding increase in vibration levels. These limitations are vividly illustrated by icing flight tests with the OH-58A where five test flights were conducted. One flight in the cloud was as short as 1 minute and the longest was only 7 minutes.

Aviation weather education has oriented pilots to think of aircraft icing as a function of the following two atmospheric conditions that must prevail simultaneously:

- Free air temperature at or below freezing (0° C.)
- Supercooled visible liquid moisture or high humidity.

Though this explanation provides some insight into aircraft ice formation, it presents only a meager perspective of the icing environment for operators of rotary wing aircraft.

The inherent limitations of helicopters (service ceiling, range, endurance, speed, and power availability) and the previously discussed icing hazards require a more comprehensive understanding of in-flight icing conditions and their relationship to helicopter operations.

Research studies indicate that in-flight encounters with icing conditions occur most frequently in

Helicopter In-Flight Icing continued

the vicinity of frontal zones. In addition to the threat of icing in frontal clouds, frontal systems also create the necessary conditions for in-flight icing "outside of clouds."

Warm front icing may occur both below and above the frontal surface.

Figure 1 illustrates how freezing rain or drizzle can be produced by precipitation falling through the front into subfreezing cold air below. As noted in figure 1, this particular form of icing is most often found when the temperature above the frontal inversion is greater than 0° C. and the temperature below is less than 0° C. Where temperatures above the frontal surface are subzero, ice pellets or snow may be noticed below the front and are normally not of concern to helicopter operators.

Icing in the clouds above the warm front's surface is characteristic of icing found in stratiform and stratocumulus clouds and usually consists of rime or mixed rime and clear ice.

Cold front icing normally occurs in an area preceding and following the front (figure 2). In this region, aircraft are likely to encounter the most intensive icing in clouds immediately above the frontal zone. Aircraft penetrating a cold front can expect clear icing to be prevalent in the system's clouds at the lower altitudes (0-15,000 feet msl) and a mix of clear and rime ice at higher altitudes.

Freezing rain or drizzle may also be experienced in a "shallow" or "slow-moving" front where the warm air is lifted over the advancing cold front. This condition often produces clouds and precipitation well behind the surface position of the front. Upon falling through a subfreezing cold front, the rain becomes supercooled and freezes on impact with the aircraft.

Aircraft icing is more probable and severe over mountainous or steep terrain than over low or flat elevations. The presence of a mountain range causes strong upward air currents on its windward side which are capable of supporting larger than average water droplets and thereby compounding the icing hazard. The movement of a frontal system, with its companion turbulence and updrafts across a mountain range, combines the normal frontal lift with the upslope currents of the mountains to create an extremely hazardous environment for rotary wing aircraft.

The severest icing occurs above the crest and to the windward side of the ridges. This zone usually extends 4,000 to 5,000 feet above the mountain and can extend much higher when cumuliform clouds have developed. ■

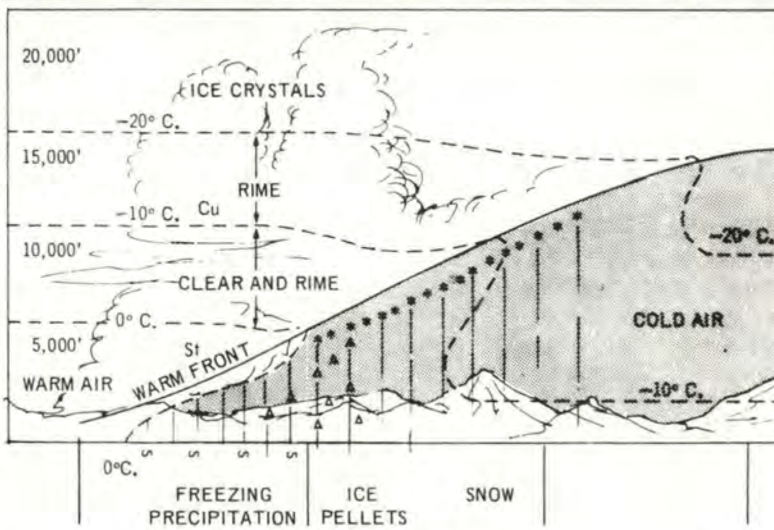


FIGURE 1 - Warm Front

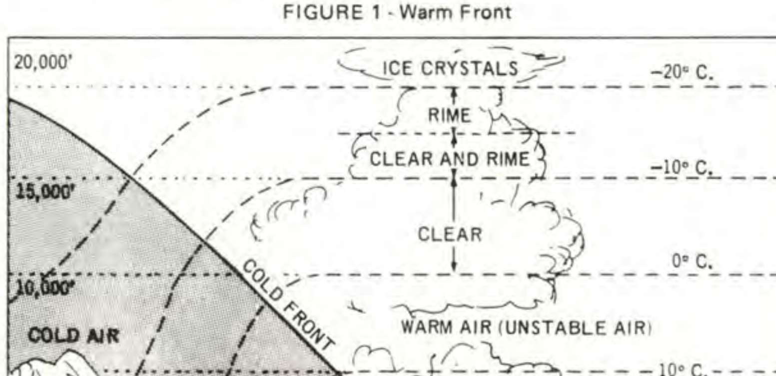


FIGURE 2 - Cold Front

OPS topics

VTOL Hazard

■ During Harrier hover flight a 30″ X 30″ X 6″ piece of runway patching material was dislodged onto the runway surface. A KC-135 departed shortly after the Harrier cleared the runway and narrowly missed hitting the dislodged material. The patch was determined to be several years old and composed of material which had not adhered to the underlying surface. Corrective action taken by the unit included:

- Designation of an unpatched 2,000 ft section of the runway for Harrier hover flight operations.
- Area situated so it could be visually scanned for FOD following Harrier operations. A runway check to be conducted by Base Operations following completion of any given Harrier flight test sequence.
- Designated the compass rose as an alternate hover area.
- Conducted a block-by-block inspection to identify any area in need of repair.

Mishap

No mishap resulted, but under the right conditions one could have when a C-9A was given an erroneous altimeter setting by Approach Control and GCA. On PAR to a foreign air base, the C-9A was given an altimeter setting of 30.13. Strange, there developed a big difference between the barometric and radar altimeter readings. On the ramp the difference was 177 feet, with the pressure reading the

higher. The smart crew, always alert – and a bit suspicious – always cross checks.

Austerity Versus Safety

On a recent trip we stopped at a base that had put a severe restriction on the use of power carts in order to save MOGAS. The intent is good and there may not be a hazard created, but as the "energy belts" are tightened watch out that safety is not jeopardized by cutting things too close. Overflying higher than optimum for gross weight to save gas, or doing extended preflights or maintenance on battery power could critically reduce an already thin safety margin.

Reporting Hard Landings

A recent Class C mishap report sounded very "ho-hum" at first – about $25,000 worth of landing gear damage after a landing made with a 60 degree, 5-10 knot crosswind. On the subsequent takeoff, after taxi-back, the crew heard abnormal rubbing or scraping noises during gear retraction. After the full stop landing, the gear was written up as a "suspected landing gear rub." On post flight inspection, cracks were found in both main landing gear shelf bracket assemblies.

What really got our attention was what followed the discovery of the damage – the crew then returned to the aircraft and wrote up a hard landing. The crew had apparently discussed the taxi-back landing as firmer than normal, some felt it was a hard landing. One wonders what would have been the future of this aircraft had not the post flight inspection found visible damage or if the damage had been invisible?

Without getting into the whole bag of worms on the subject of integrity, we'd like to make a very serious point. No one likes to admit his pilot skills aren't always the very best, and the guy who has never spanked one down rather firmly just doesn't have the total hours logged yet – sooner or later it'll happen. When it does, how will you enter it in the post flight AFTO Forms 781? Sure, maintenance doesn't like extra work, especially when Ops is calling for more airframes than the

command saw fit to allocate to the whole wing. But, any maintenance man worth his salt would rather take the time to make sure his aircraft is right than have to answer to a mishap investigation board. If in doubt, don't hesitate, write it up! That's what special inspections are for – make sure the aircraft you turn over to the next aircrew is truly airworthy. Who knows, the next time you accidentally have to pull a few Gs, wouldn't you like to know the previous aircrews had written up all their hard landings? Lt Col John J. Griffin, Jr., Directorate of Aerospace Safety. ■

Bubble gum, bailing wire, and ASIP

or . . . how we keep your aircraft from falling apart

MAJOR PAUL L. TILEY
Directorate of Aerospace Safety

■ The AC climbed the ladder to check the front cockpit and stow his helmet bag prior to beginning his preflight. He mumbled under his breath as he saw the VGH recorder where he normally stowed his helmet bag.

Later, as he was preflighting the right wheel well, he saw the counting accelerometer and thought to himself, "I wonder what they really use that thing for?" He continued the walkaround, noticing the scab patches on the lower wing skin outside of the wingfold. Grasping the dump mast and shaking it to check for security, he thought back to the aircrew meeting two days ago when the squadron FSO briefed on the increasing number of lost dump masts. "Boy, these birds are getting old. I wonder when we are going to lose a wing or something else?"

Every crewmember is concerned about the structural soundness of the aircraft he flies, and rightfully so. The "man" responsible for your aircraft within AFLC is the System Manager, who monitors the structural condition of your aircraft through the Aircraft Structural Integrity Program (ASIP). ASIP has been around for some time, but the field of fracture mechanics has, within the last five years or so, developed to the point where the service life of an aircraft can be more accurately determined.

What Does All This Mean To You?

It means those structural components which will cause loss of the aircraft if they fail can be better identified and their operational lifetime established.

It means structural fatigue is NOT directly related to airframe flying hours.

It means that *how* the airframe flying hours are accumulated is the important factor.

It means changes in mission or tactics which cause fatigue to accumulate faster or slower can be identified.

How Is All This Done?

The methods vary by type and category of aircraft. Let's take the F-4 as an example.

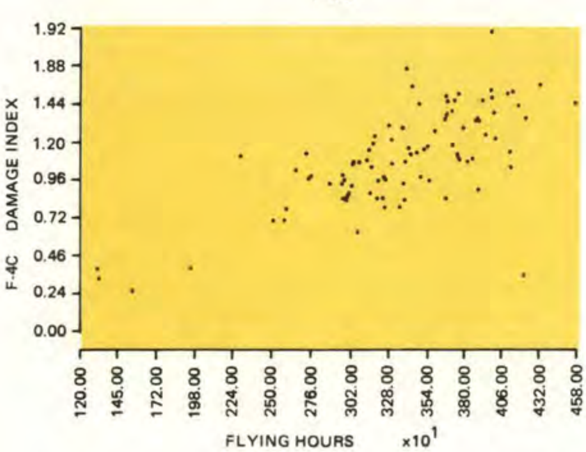
The F-4 was in the active inventory prior to an operational ASIP. As the state-of-the-art developed, four elements were identified and implemented for the F-4.

In 1973, a flight load survey was conducted. An instrumented F-4 was flown through a wide variety of maneuvers to substantiate design loads and stress values. Changes in these values were made as required, based on the flight tests.

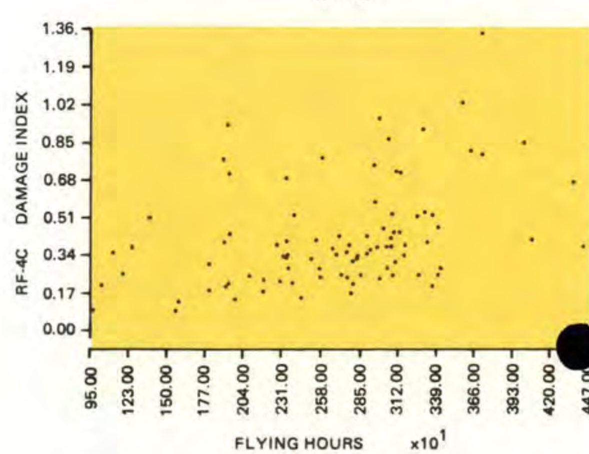
Following the flight load survey, full scale fatigue testing was

Charts are representative of ASIP data. Note difference between F-4C and RF-4C damage index patterns, reflecting different missions. ASIP permits advanced planning for maintenance and safety, as shown in chart, page 23. C-141A diagram shows reference load point locations for which data is calculated for stress analysis.

DAMAGE INDEX - FLYING HOURS
F-4C



DAMAGE INDEX – FLYING HOURS
RF-4C



performed. Actual F-4 airframes were tested in a laboratory using the average flight loads determined in the 1973 test.

This information and current structural analysis methods were used to conduct a damage tolerance assessment study. The purpose of this study was to determine which structural components were critical and to establish operational limits for the aircraft.

Now, we have a method of converting G loading or G-cycles to damage index (DI).

So What, You Say?

Now that we know how to relate G-loading cycles to DI, all we need to know are the G-loading/cycles of each aircraft. The counting accelerometer in every F/RF-4 and the VGH recorders in 13 per cent of the F-4 fleet provide this information. The data are sent to Oklahoma City ALC for computer analysis. The end product is a by-tail number listing of current damage index. This can be compared to the operational limits given in terms of DI.

The same system can be applied to a bomber/transport type aircraft. Consider the C-141A for example. Since the flight profiles for bomber/transport remain fairly consistent, the airframes are not subject to as much scatter in the damage index, but the basic elements of ASIP remain the same.

Fatigue design mission profiles were defined for the C-141 in 1962, prior to present state-of-the-art structural analysis. These profiles were modified in 1968 by the first service life analysis (SLA I). VGH data was used in SLA I. In 1972, a second service life analysis (SLA II) was done based on VGH data and data collected from the individual aircraft service life monitoring program.

The results of SLA II were used in a damage tolerance assessment study. Based on the damage tolerance assessment study, a new magnetic tape strain recorder was installed to monitor 41 load/stress points.

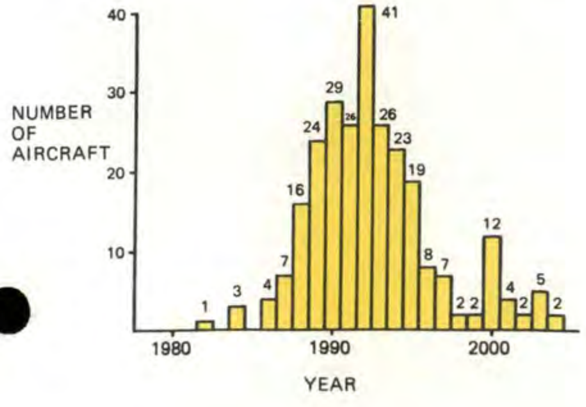
OK, OK—What's The Bottom Line?

The bottom line! While scab patches and/or skin cracks may not be very esthetically pleasing, they don't necessarily mean the aircraft is ready to fall apart. With the cost of parts these days, it is not always economical to replace a panel or part as soon as a crack appears. ASIP allows the System Manager to replace those parts that have to be replaced without throwing away parts with useful lifetime. It also allows the System Manager to schedule aircraft for programmed depot maintenance by tail number, and to determine when the service life of a particular aircraft has been reached and it is ready for the "boneyard."

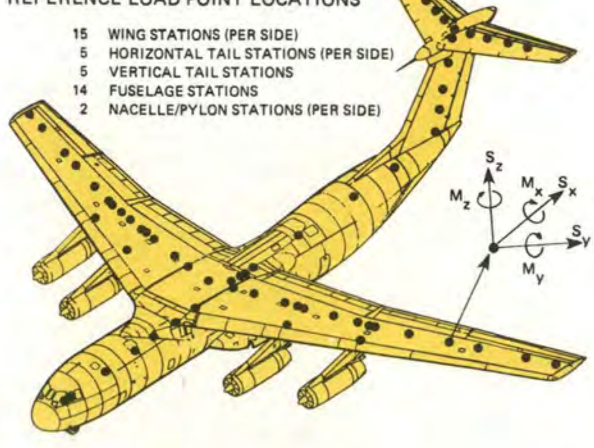
ASIP allows the MAJCOM to shift aircraft if they see a particular aircraft or block of aircraft accumulating damage too quickly.

ASIP is working for *you*! ■

FREQUENCY DISTRIBUTION
F-4C @DI = 2.69
(CENTER WING LOWER TORQUE BOX SKIN @ B.L. 100)



C-141A DADTA 6-COMPONENT
REFERENCE LOAD POINT LOCATIONS



A Little Ice Can Get You

Pitot static system icing can cause confusing symptoms that may lead a pilot to take the wrong actions. Understanding of this phenomenon and how to deal with it is insurance against a disaster if your system ices.

■ An F-106 had just leveled off at FL 390 when the pilot noticed he had no VVI or altimeter indications. Then the airspeed indicator went, followed by intermittent flashing of the CADC fail light.

The problem? This pilot quickly (and correctly) opted for pitot static system icing. Having reached this decision, he promptly took the kind of actions that would save himself and his aircraft. He turned toward base and asked for help. Alert aircraft scrambled and joined on him for recovery. At 5,000 feet the problem cleared, instrument indications became normal, and the pilot made a ho-hum landing.

During cruise at FL 370, a C-141 lost number 2 mach and airspeed. Later, the number 1 system became inaccurate. The crew used ground speed and power to maintain airspeed. They called for help and another aircraft joined on the C-141 and took it in for a safe approach and landing.

☆ ☆ ☆ ☆

A B-727 crashed when the pilot misread the situation and allowed the aircraft to stall. As the aircraft climbed through 16,000 feet, indicated airspeed began to increase above normal for the climb attitude of the aircraft. Thinking they were in an updraft, the crew attempted to reduce airspeed by increasing pitch attitude. At 24,000 feet, both overspeed warning horns sounded followed by buffeting and stick shaker. In an attempt to remain below barber pole speed, they reduced power to idle, which resulted in the stall.

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An Air Force aircraft encountered an almost identical situation. Altitude and airspeed indications were increasing. To correct these, the pilot retarded throttles and pushed forward on the yoke. With no response, he extended the speed brake and finally lowered the gear. The aircraft then departed and entered a spin. The crew ejected successfully.

☆ ☆ ☆ ☆

These and other similar mishaps have a common theme – some sort of pitot static system malfunction. The CADC can be affected also, and can itself produce similar symptoms if it malfunctions.

Failure of the pitot static system frequently is insidious and catches the pilot by surprise. The cases cited above were all thought to have been caused by ice in the system. When that is the case, all indications may be normal during the flight until moisture in the system freezes. Most pilots would expect airspeed to decrease, possibly to zero, if the pitot static system ices over. Then if the airspeed increases, confusion may ensue with the pilot trying to reduce speed by retarding the throttle and using other techniques, e.g., pulling back on the pole, extending speed brakes or gear. Simultaneously, there probably would be an altitude increase indication which would further confuse the pilot. Rationale for this seeming contradiction is taken from an article from a previous issue of *Aerospace Safety:*

"**C**lose examination of pitot tubes will reveal a small drain hole. This hole allows atmospheric moisture to drain out of the pitot system during flight. If this hole freezes before the inlet hole freezes, and then the inlet hole freezes over instantaneously, total pressure is trapped in the system. This total pressure is the dynamic pressure that was being rammed into the pitot tube, plus the static pressure existing at the altitude the aircraft was maintaining. When this happens, the airspeed indicator acts like an altimeter. When altitude is increased, static pressure decreases and the airspeed indication increases. Of course, the reverse is true when altitude decreases. The result of both inlet and drain hole freeze-up can be disastrous."

If you suspect your pressure instruments are reading erroneously because of pitot static failure, you have several alternatives besides stalling the bird. AFM 51-37 recommends using the attitude indicator as the primary reference with a known power setting. If you have an angle-of-attack indicator, use it. Using these, in VMC, you should be able to safely fly the aircraft. Then, call for help and get a join-up for an escorted approach and landing.

You can also get ground speed from a Center and some approach controls. However, don't forget to convert to airspeed – that's the one that's important.

Another action that has been successful is providing an alternate static source by breaking or pushing out the glass on a non-essential instrument such as the mach indicator or VVI. Then depressurize and descend if necessary. The indicated readings probably will not be perfectly accurate, but they should be close enough.

A primary contributor to pitot static icing is the aircraft being subjected to heavy rain prior to flight. Even without freezing, water in the system can foul up the airspeed indication. It is not unusual for pilot and copilot indicators to read 20 or more knots differently *on takeoff*. What then? Which do you believe? Neither! Abort, if you are below rejection speed.

Any time your instruments seem to be giving funny readings, get suspicious. Suspicious, not panicky. Be calm and remember what you learned about flying. What the Dash One says. What you've read here. Then – fly the airplane: Pitot heat on, known power setting, attitude indicator, angle-of-attack.

Call for help. Don't penetrate any weather without an escort. You'll fly again tomorrow. ■

THE PROFESSIONAL APPROACH

AIR FORCE COMMUNICATIONS COMMAND
Scott AFB, IL

■**Q:** You have just departed Scott AFB with a destination of Travis AFB, passing 15,000′, climbing to FL 350. You're on an IFR Flight Plan in VMC conditions and lose two-way radio communications. What do you do?

A: Well, I'd look around the cockpit and see what the Flight Information Publication, IFR Supplement has to say about losing two-way radio communications. I can't find it anywhere!

In that case, we'll give you the answer. However, it is in your best interest to be fully informed on the US procedures (Federal Aviation Regulations 91.127 and 91.3(b) for two-way radio failure.

Now, let's answer the question.

On an IFR Flight Plan, the transponder should be adjusted to reply on Mode 3/A Code 7700 for one minute, then changed to Mode 3/A Code 7600. This process should be repeated each 15 minutes for the duration of the flight. Air Traffic Control Facilities will attempt to communicate by transmitting on guard frequencies and available NAVAID frequencies.

If you are able to maintain flight in VMC, then continue flight under VFR and land as soon as practicable and notify ATC. This procedure also applies when two-way radio failure occurs while operating in Positive Control Airspace (PCA). The primary objective of this provision in FAR 91.127 is to preclude extended IFR operation in the air traffic control system in VMC. Pilots should recognize that operating under these conditions may unnecessarily, as well as adversely, affect other users of the airspace, since ATC may be required to reroute or delay other users in order to protect the failure aircraft; however, it is not intended that the requirement to "land as soon as practicable" be construed to mean "as soon as possible." You, the pilot, retain the prerogative of exercising your best judgment, and you are not required to land at an unauthorized airport, at an airport unsuitable for the type of aircraft flown, or to land only minutes short of your intended destination. The primary objective of this provision is to preclude extended IFR operations in the air traffic control system in VMC.

Q: Now let's take that same problem, that you have departed Scott AFB passing 15,000′, climbing to FL 350. You are on an IFR Flight Plan and in IMC. Weather reports indicate that you will remain in IMC. You lose two-way radio communications. Now what do you do?

A: Adjust the transponder as indicated in our first answer. Then continue the flight by the route assigned in the last ATC clearance received. If you are being radar vectored, proceed by the direct route from the point of radio failure to the fix, route or airway specified in the vector clearance; in the absence of an assigned route, proceed by the route that ATC has advised that may be expected in a further clearance; or in the absence of an assigned route that ATC has advised may be expected in a further clearance, by the route filed in the flight plan. The route should be flown at the highest of the following altitudes or flight levels for the route segment being flown. Either the altitude or flight level last assigned; when appropriate the minimum altitude/flight level *(this shall apply for only the segment of the route where the minimum altitude/flight level is higher than the ATC assigned altitude);* or the altitude or flight level ATC advised may be expected in a further clearance. The intent of the rule is that a pilot who has experienced two-way radio failure should, during any segment of route, fly at the appropriate altitude specified in the rule for that *particular segment*. The appropriate altitude in which-ever of the three is the highest in each given phase of flight: (1) The altitude or flight level last assigned; (2) The MEA; or (3) The altitude or flight level the pilot has been advised to expect in a further clearance. Now if holding instructions have been received, leave the holding fix at the expect-further-clearance time received, or if an expect-further-clearance time has not been received leave the holding fix in order to arrive over the fix from which the approach begins as close as possible to the expected approach clearance time. Begin descent from the en route altitude or flight level upon reaching the fix from which the approach begins, but not before the expected-approach-clearance time or the estimated time of arrival as derived from the flight plan or as amended by ATC.

If holding is necessary at the IAF for the destination airport, holding and descent to the initial approach altitude or initial penetration altitude/flight level for the execution of the penetration and/or instrument approach shall be accomplished in a holding pattern in accordance with the instrument approach procedure booklet. If no holding pattern is depicted, holding and descent will be accomplished in a holding pattern on the side of the final approach course to the fix on which the procedure turn is prescribed.

Aircraft, on a flight in which a delay en route is planned, will commence descent at the destination, at the estimated time of arrival (ETA) derived from the estimated time en route (ETE) plus any delay for which an ATC clearance has been received.

Q: One last question. You're approaching Travis approach control airspace. You're in your en route descent, passing through FL 260, descending to 12,000′, and you lose two-way radio communications. Now what do you do?

A: Adjust the transponder as indicated in our first answer. Then proceed to the initial approach fix/radio facility to be used for the approach or destination and execute the published approach. The altitude to be maintained, and from which the approach is to be executed, is the highest of the following:

a. The last assigned altitude.

b. The minimum safe altitude.

c. The emergency safe altitude if the point of communications failure or initial approach fix is more than 25 miles from the navigation facility for the approach.

Now we know it is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure. During two-way radio communications failure when confronted by a situation not covered in a regulation, you are expected to exercise good judgment in whatever action you elect to take. Should the situation so dictate, you should not be reluctant to use the emergency action contained in FAR 91.3(b). However, procedures have been established and you are required to comply with FAR 91.127. Air Traffic Control will be expecting you to follow appropriate two-way lost communication procedures.

What we have gone over are the procedures to follow for two-way radio failure in the CONUS. If you are flying in foreign airspace, use ICAO two-way lost communications procedures. These are also in the Flight Information Publication, IFR Supplement. ■

CAPTAIN

Gary L. Lechtenberg

CAPTAIN

William T. Malarkey

48th Tactical Fighter Wing

■ On 1 May 1979, Captain Lechtenberg, Aircraft Commander, and Captain Malarkey, Instructor Pilot, departed RAF Lakenheath on an in-theater transition flight for Captain Lechtenberg, his first flight in the F-111F. Approximately 75 miles north of Lakenheath, at assigned FL 150, .75 mach and engines stabilized, a left bleed duct light and left engine fire light illuminated with a simultaneous thump felt by the crew. Another thump which was later determined to be an explosion, followed within seconds. The left engine fire light remained on for 5 seconds. The aircrew then tested the fire warning system, and the system failed the test, indicating possible fire damage. While the extent of the fire damage was not known, the fire had already caused multiple failures in critical aircraft systems indicators. Readings critical to monitoring flight included wing sweep which read 60° when in fact the wings were at 16°; aft fuel quantity read 12,000 lbs which normally would indicate a severe CG problem; the flap indicator was frozen from which the crew could not confirm proper configuration for landing. Also, an inlet hot light was on, and all the caution lights associated with single engine emergency were illuminated. In addition to the in-flight fire and explosion, the crew now had nine different erroneous, critical indications to analyze to properly configure for an emergency landing. About 30 miles from the field, the left fire light came on again and remained on for approximately one minute. The crew configured for a single engine approach, disregarded the erroneous indications and confirmed landing configuration to the best of their ability visually. The weather was deteriorating with an existing ragged ceiling estimated at 500 feet and 2 miles visibility in rain and snow showers. The PAR was out with only surveillance radar available. A surveillance single engine approach was flown with confusing and severely limited cockpit instrumentation. During the last 2,000 feet of landing rollout, the left fire light again illuminated. As the aircraft turned off the runway, tower notified the crew that smoke and flames were coming from the left engine area. The crew cleared the runway, shut down and egressed from the aircraft. Emergency response equipment extinguished fires in the aft section which had resulted in fuel cell explosions, external panels blown into the vertical stab and general fire damage to the aft section of the aircraft. The superior airmanship, crew coordination, and professional response of Captains Lechtenberg and Malarkey prevented possible loss of life and the loss of a valuable aircraft. WELL DONE! ■

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UNITED STATES AIR FORCE

Well Done Award

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

MAJOR **David N. Peters** CAPTAIN **Edgar J. Bethart, Jr.**

9th Strategic Reconnaissance Wing
Beale Air Force Base, California

■ On 28 April 1979, Major Peters, Aircraft Commander, and Captain Bethart, Reconnaissance Systems Officer, flew an SR-71 reconnaissance sortie. During the recovery phase, the aircraft had two serious engine malfunctions. As the aircraft was descending through FL 300, the right engine experienced a series of compressor stalls. Major Peters decided to shut down the engine and make a single engine approach and landing to the recovery base. An emergency was declared and vectors were received to accomplish a PAR approach to the airfield. As the aircraft was descending to radar pattern altitude, the left engine oil pressure started to fluctuate and the oil quantity started to rapidly deplete. This was accompanied by power surges and a cockpit odor associated with heated metal. Faced with the impending loss of the left engine, Major Peters attempted a restart on the shut-down right engine. Although the restart was successful, the engine continued to compressor stall. It provided flight control hydraulic pressure, but little additional thrust. Major Peters terminated the PAR and made a modified visual approach, remaining high above the normal glide path and delaying gear extension until 5 miles on final. Approximately 1½ miles on final, the left engine began to surge and he placed the throttle to the cutoff position. He completed the landing and shut down the right engine to prevent an overtemp condition. The timely and decisive actions by Major Peters and the close and highly professional crew coordination between him and Captain Bethart resulted in the safe recovery of a valuable aircraft. WELL DONE! ■


TAKE
CARE
we
SHARE
the air