Flying Safety

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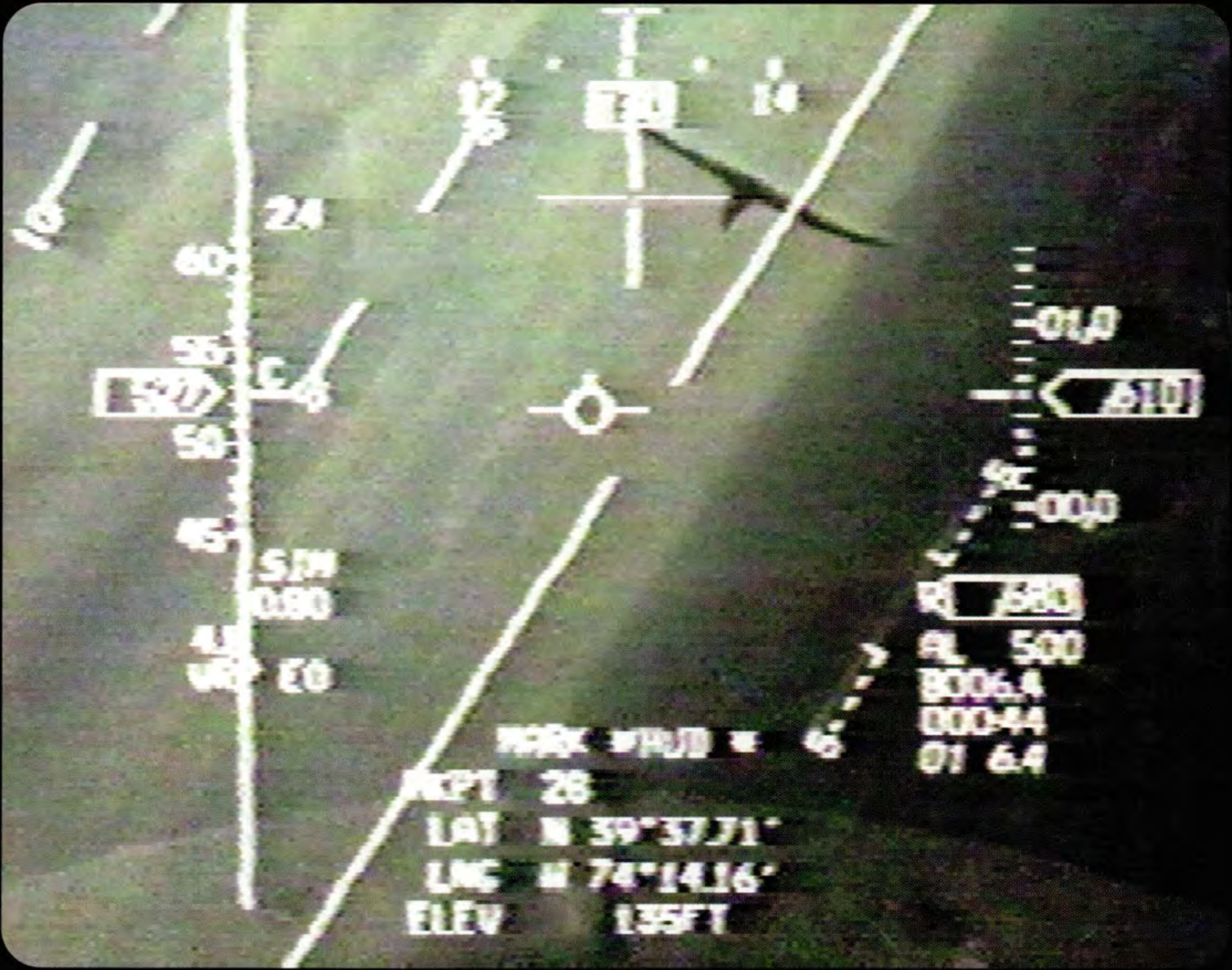

BIRDSTRIKE!

UNITED STATES AIR FORCE

Flying Safety

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Cover Photograph: A $22,000 gull coming in hot for its prey, a DC Air Guard F-16C canopy. From the HUD tape.

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FSFSFSM notams

The best aircrews in the world deserve the best equipment in the world. That's what the 74th Aerospace Physiology Flight at Wright-Patterson AFB, Ohio, is striving to provide in its custom life support shop.

The flight has the only shop in the United States providing Air Force, the other services, NATO, and NASA aircrews with custom-fitted oxygen masks.

Off-the-shelf, mass-produced masks work well for the majority of military fliers, but several hundred aircrew a year still need to be fitted with a custom-made mask from the shop, notes Harold Pool, a life support expert who crafts the masks from face casts sent in from around the world.

"If an aircrew member can't get a good seal on a mask, that's an obvious sign that they may need a custom mask made," says Pool.

Unfortunately, not all aircrews can recognize when there's a poor seal with their face mask which can lead to increased risk of hypoxia or fume hazards in the event of an in-flight fire.

"If an aircrew member doesn't have a properly fitted mask, there's the risk of oxygen deficiency, hypoxia, and smoke or fumes in case of a fire," adds Lt Col Susan Richardson, commander of the 74th Aerospace Physiology Flight. "It's a detriment not only to performance, but it could put their life at risk."

One sign to watch for, says Richardson, is if aircrew members are tightening their oxygen masks to the point of discomfort in order to get a good seal.

"One of the ways pilots or aircrews can compensate for a poor-fitting mask is by pulling the mask very tight," she notes. "And that increases the chance that crewmembers are going to fly at least part of the time without a mask. A lot of pilots and crew will put up with the inconvenience," agrees Pool.

"We tell crewmembers that their masks aren't supposed to hurt when they wear them," says Richardson. Crewmembers should be able to wear their masks for up to 6 hours without experiencing discomfort or so-called 'hot spots,' pressure points from tightening," she adds.

A properly fitted face mask is essential to crewmembers who use their masks continually, notes Richardson, especially instructors, fighter and bomber crews, as well as transport and cargo crews who fly high-altitude air drop missions.

If a crewmember's oxygen mask isn't fitted properly, Pool suggests first working closely with the squadron's life support shop to determine whether a standard mask can be fitted.

If the life support shop determines a custom mask is called for, they will make the recommendation to the unit flight surgeon. The flight surgeon then refers the crewmember to the local dental clinic which is responsible for casting a facial impression of the crewmember. That impression is forwarded to Wright-Patterson, where Pool shapes a latex mask to match the contours of the crewmember's face.

"This is the only place in the world where we make custom masks for the military," says Pool, who ships an average of 200 masks a year from the shop. It takes anywhere from 30 to 45 days to complete a custom mask.

Unlike the off-the-shelf silicon-based masks available to most aircrews, the latex-based custom masks are an older 5p design, and they can't be cleaned with alcohol solutions which can damage the masks.

Pool also notes that masks must be reordered if they begin to deteriorate, and regulations stipulate only one custom mask can be issued to aircrew members at a time. To reduce the turn-around time, mask molds are kept in storage for 6 years at Wright-Patterson.

In recent years, the physiology flight has teamed with the Air Force Research Laboratory to work on developing the next-generation custom mask design. That technology will ultimately provide for computer scans of a crewmember's face rather than using a plaster cast, and new oxygen mask designs will be compatible with the latest advances in life support systems.

Information on custom oxygen masks is available by calling Harold Pool at DSN 785-2709 or the 74th Aerospace Physiology Flight at DSN 785-4566.

Introducing t

Thirty years of data from over 10,000 locations throughout the country are evaluated and used as the basis for the model.

MAJ RUSSELL P. DeFUSCO, PhD
USAF Academy, Colorado

BIRD STRIKE!

Some of you happily go about your business without ever considering the possibility of a bird strike. "It's an act of God! Nothing I can do about it anyway," you say. Right? **WRONG!**

For some of you, these words strike fear in your heart. Perhaps you've experienced one, or perhaps you know someone who has and lived to tell about it. Sadly, many of us may know someone who didn't live to tell.

For those of you who have researched the issue (perhaps reading the pages of this very publication), you know we can do a lot to prevent bird strikes. You also know that a great number of strikes occur around our airfields where grounds maintenance and various bird dispersal techniques are a vital part of keeping our resources mission-ready and where they belong—in the air. You also know that the greatest threat of catastrophic bird strikes occurs on low-level and range missions where we have no control over the birds. Our only option here is to **AVOID THEM!**

This is where the Bird Avoidance Model (BAM) comes into play. Many of you have used the current BAM with great success over the years, but you know it's relatively crude and is incomplete in many aspects. In fact, a recent accident investigation concluded that a serious strike couldn't have been avoided because the current BAM didn't include the species struck in the model. Their recommendation was to wait until a new BAM was available and make operational changes with the new information, but continue as usual until that time came.

Well, there's good news. The wait is over. The new BAM is here!

The new Bird Avoidance Model is a Geographic Information System (GIS) based program that integrates historical information on bird distributions and abundances with various geographic and environmental factors. It creates graphic risk surfaces for determining the relative degree of hazard for any location in the Continental U.S. Data on bird populations and movement patterns comes from numerous government and private sources and is the result of literally millions of hours of field work from biologists, refuge managers, amateur bird watchers, and volunteers.

Thirty years of data from over 10,000 locations throughout the country are evaluated and used as the basis for the model. Interpolation algorithms fill in the gaps between the surveyed locations so that each square kilometer of the U.S. has a unique risk value assigned. This gives you much better resolution than previously available to make flight planning and route design decisions. At this resolution, routes or route segments may now be opened when the previous model blocked out entire regions as too hazardous to fly.

This version of the model includes over 50 species considered most hazardous to flight operations. Large birds, such as waterfowl and raptors, and flocking species, such as blackbirds and gulls, constitute the greatest threat. A risk surface is generated using the available data and is normalized by body weight for each species. This gives a relative measure of the airborne biomass (think of it as a measure of the pounds of meat in the air) without regard to the individual species. After all, you and your equipment don't really care if it is a duck or a hawk closing on you

the new BAM

at the speed of heat. The individual risk surfaces are then cumulatively added and a total risk calculated. Data is available for each 2-week interval of the year and for various daily time periods. A color-coded graphic display, in a GIS map format, is available for each data layer, and the scale of coverage can be selected by the user.

The user interface for the new BAM is a simple, menu-driven, PC-based program that allows flight planners, route designers, and aircrew to select the geographic location, time of year, and time of day they desire to fly a particular route. Relative risks for each operation can be assessed by comparing routes to each other or by comparing various temporal alternatives on individual routes. You can then select the safest times and locations to fly.

The model also has numerous geographic and environmental data sets that can be overlaid on the bird risk surface. For example, you can zoom in on a portion of the country, display the bird risk, and overlay roads, airports, aircraft operating areas, terrain maps, land uses, or a variety of climatic information such as temperature or precipitation on the computer display.

The model will be distributed by the Air Force Bird Aircraft Strike Hazard (BASH) Team to various users throughout the country. The team will begin training each command on the use of the model by the time this article hits your desk. While the program and data needed to generate the Bird Avoidance Model require enormous amounts of computer space, the products of the model will be available on CD for use at the unit level. It's anticipated that copies will be available to anyone with a PC and the commercial software needed to run the program. Don't worry though. The BASH Team will still provide assistance, advice, interpretation, and products to those who need more information than you can get in your unit.

The new BAM will provide a tremendous planning tool to reduce the incidence of bird strikes to aircraft. The new model will provide much more data and at a resolution orders of magnitude better than the existing models. Recognize that even this model allows us to only play the odds in our favor. We know some bird strikes will still occur. But at least you will be armed with the best and most current data available at this scale to reduce the hazard.

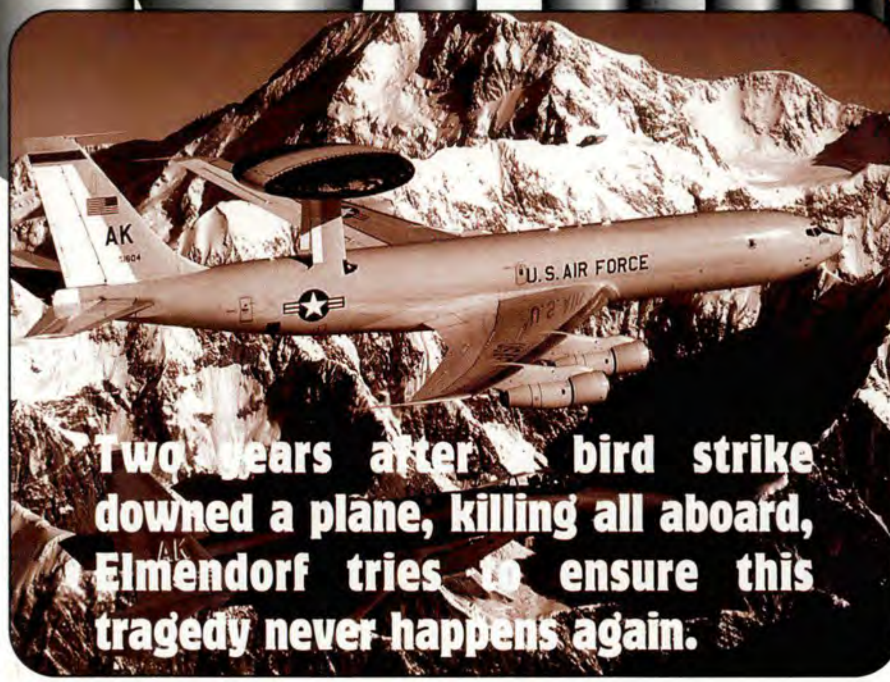
Our work is not done, however. We need to field test the model, refine some of the data layers, expand to areas outside the U.S., and ultimately provide near-real-time updates to the model using technologies such as doppler radars and satellite telemetry. A current collaboration is also under way to extend this technique to countries in Europe and the Middle East.

Your input and suggestions are not only welcome, but necessary as we continue to refine and update the BAM. As new information, data, and technology become available, the model will grow and evolve to make it the best possible tool for reducing costly and dangerous bird strikes. Ultimately, we hope to make the skies a bit safer for those who share them with the birds. ✈

Maj Defusco (Lt Col sel) is a former Chief of the Bird Aircraft Strike Hazard Team. He is currently an Associate Professor of Biology and Deputy for Research at the United States Air Force Academy. He has done his biology Master's and PhD research in the area of bird strike reduction. He is the principal investigator on the research and development of the new BAM at the AF Academy.

The user interface for the new BAM is a simple, menu-driven, PC-based program that allows flight planners, route designers, and aircrew to select the geographic location, time of year, and time of day they desire to fly a particular route.

Fowl Play



TSGT TIMOTHY P. BARELA
Courtesy *Airman*, Dec 97

In all the charred wreckage, perhaps the most grim sight became the growing number of tiny flags sullen cleanup crews sporadically stuck into the ground. Blue ones represented airplane parts; red ones, body parts.

On 22 September 1995, two dozen men from the 962d Airborne Air Control Squadron at Elmendorf AFB, Alaska, took off in an E-3B "Sentry," call sign Yukla 27. Packed with sophisticated surveillance equipment, the Airborne Warning and Control System aircraft is easily recognized by its distinctive radar dome that looks like a miniature flying saucer mounted on top of the plane. E-3Bs also boast a nearly spotless safety record—none had crashed before this day.

Witnesses say problems started for the doomed flight almost immediately. Halfway down the runway, flames shot out of the No. 2 engine, followed by a shower of sparks. Yukla 27 took off, banked left, then began a horrifying dive. The $200 million aircraft and its 24 crewmembers disappeared in the dense woods just beyond the runway. A huge fireball erupted skyward as the aircraft, loaded with 125,000 pounds of jet fuel, slammed into the earth.

Yukla 27's tragic end stunned the Elmendorf and Anchorage communities, as did the result of the accident investigation. Cause of the crash? A flock of Canada geese.

"We recovered 31 dead geese and 3 live birds on the flightline," said Allen Richmond, chief of conservation and environmental planning at Elmendorf. "Five birds had been ingested into the aircraft's No. 1 and 2 engines." A few seconds either way, and this accident doesn't happen.

"This [disaster] was a real wakeup call for the base and local community," Richmond said.

Out of the ashes, the base's BASH (Bird Aircraft Strike Hazard) program was reevaluated and upgraded, giving birth to one of the most active BASH programs in the world—a goose's worst nightmare.

To locate and disperse birds, the base has pulled out all the stops, employing everything from low-tech scarecrows and loud noises to sophisticated night-vision binoculars and infrared heat detection systems.

Taking measures that seem more appropriate to combat a third-world country terrorist threat, some might say the base has gone a little overboard simply to guard against geese and other wild animals.

"But there's at least 24 families out there who would wholeheartedly disagree," Richmond said somberly. "They lost sons, husbands, and fathers."

While many forms of wildlife can cause problems for air operations, geese have become a major focus for Elmendorf's BASH program. According to the Anchorage Waterfowl Working Group, in the past 25 years the number of Canada geese making their home in Anchorage has increased from just a few nesting pairs to 4,000 in 1996. Through disrupting geese breeding, the base would like to reduce that number to 1,000 over the next 5 years. The city is looking at a compromise of 2,000.

"We had a [flying safety] problem when the resident goose population hit 1,000," Richmond said. If the goose population continues to grow at the current rate for 10 more years, 15,000 geese would be calling Anchorage home by the year 2006.

"Over the years, we've gotten more lawns, parks, and golf courses around the city, and fertilized grass is one of the favorite foods for geese," Richmond said. "Plus, with all the lakes and ponds just a short hop from these feeding grounds, it's a perfect goose habitat."

Also, restricted hunting and few problems with natural predators in these public areas look good on any "waterfowl housing brochures," making Anchorage and Elmendorf a virtual goose Garden of Eden. But at least at Elmendorf, the poultry party is over.

First, a Commonsense Approach...

Squadron safety folks educated everyone on base about the BASH program. They even handed out wallet-sized cards which include a map of the 2,400-acre bird exclusion zone on one side and a bird hazard hotline number on the other—552-BIRD. Anyone seeing birds in the exclusion zone can call the hotline, which could lead to halted flying operations. Of course, that doesn't include the one caller who phoned in to say he spotted three pterodactyls circling the flightline.

Safety gurus also let everyone know that feeding wildlife on base is a no-no. "Anyone at Elmendorf caught feeding wild animals will be ticketed," Richmond warned. "Then those ticketed will be visiting their first sergeant and commander."

Richmond says people love to feed ducks and geese bread crumbs, but bread crumbs are waterfowl junk food. Not only is it bad for their diet, but anywhere they can score a bread-crumb meal will be busier than a McDonald's drive-through window at high noon.

continued on next page

USAF Photos by MSgt Dave Nolan, *Airman Magazine*

"Goose 1" patrol: Senior Airman Kevin Cusson, a 5th Fighter Squadron F-15C crew chief, spent 3½ months as a "goose guy," scaring birds and other wildlife away from the flightline. Officials posted no-bird zones throughout the base, along with a bird hazard hotline number, 552-BIRD. The number of geese making Anchorage their home is climbing at an alarming 12 percent per year.

"Anyone at Elmendorf caught feed Richmond warned. "Then those t sergeant and commander."

"Waterfowl accustomed to being fed will ignore their normal migration habits and stay through the winter," Richmond said. "And besides being an aircraft hazard, they leave an awful mess with all their droppings."

Next, a Scientific Approach…

"We radio-collared birds to study their movements," Richmond said. "We found that 80 to 85 percent of all the geese in Anchorage come to the base just to feed on grass.

"Next, we conducted experiments to find out what geese liked and what they didn't like," Richmond said. "Then we altered the base landscape."

Geese loved dandelions and lawn-type grasses—such as Kentucky blue grass—which was common around the base. But they hated a native blue joint grass, wild rye, and the poisonous lupine plant. For the geese, it was the human equivalent of going from munching fried chicken and hot apple pie to gagging down liver and Aunt Flo's fruitcake with arsenic extract.

"The native blue joint had another benefit," Richmond said. "It grows 3 to 4 feet tall and is very stiff. We can mow it off at 10 inches, and it feels like the end of a broom. Geese don't like to get poked, so they avoid landing in it. Also, tall grass disrupts flock communication and makes geese nervous because they can't see predators as well."

But isn't letting grass grow 10 inches tall taboo for the usually well-manicured Air Force base? "Not anymore," Richmond said. "Not when it comes to safety versus cosmetics."

Now the base mows once a year instead of once a month—a move grounds personnel certainly didn't oppose. The base also planted more trees in lawn areas to break up goose landing patterns.

A wily coyote? Sort of. This coyote scarecrow is realistic enough to help keep Canada geese from landing near the flightline.

Finally, the "Hammer" Approach

It seems every problem eventually can be fixed with a hammer. In this case, it was the "Sledge hammer."

"Using dispersal teams may seem like a real big hammer, but no one else lost 24 people," said SSgt Mark Sledge, 3d Wing NCO in charge of BASH, who was brought in to develop the most aggressive dispersal plan in the Air Force.

Dispersal teams, better known around base as the "goose guys," keep a not-so-silent vigil over Elmendorf 24 hours a day. They even have their own vehicle fleet marked Goose 1, 2, and 3.

Each group at the base has to provide five people to man dispersal teams. Those who volunteer spend 3 1/2 months away from their regular duties, keeping an eye out for wild animals wandering in the exclusion zone.

"You didn't have to convince me this program was important. I knew firsthand," said SrA James Olson, an AWACS guidance and control specialist for the 962d, who was on the launch crew for Yukla 27 and later volunteered for BASH. "I knew most of those peo-

ing wild animals will be ticketed,"
icketed will be visiting their first

ple onboard, so it left me in disbelief when I saw the plane dip below the tree line and turn into a fireball. It was tough on everybody here for a long time."

Before the crash, people used to come in to work and say, "Sorry I'm 15 minutes late, but geese were blocking the road," Olson said. "Now, you hardly see them on base."

Training for dispersal teams takes roughly a week, and the curriculum sounds like they're preparing for an episode of the "A-team"—driving course, handling infrared devices and night-vision binoculars, shotgun orientation, explosive safety, etc.

Fish and wildlife officials worried it would be open season on birds. "But we had to kill only 139 birds the first year [following the crash]," Sledge said. "The next year, we had to kill only seven." Using a lethal means proved necessary initially because the birds simply didn't see their human hosts as a threat.

Now when called out to disperse birds, geese usually take off at the sound of the truck engine. If that doesn't work, team members honk the horn. That's elevated to a nonlethal blast from a noisemaker. Then, if necessary, a deadly blast from a shotgun.

"We have to kill a bird every now and then or they get too used to us," Sledge said. "But that's a last resort."

Sledge said teams attempt to respond to 552-BIRD calls within 5 minutes. "The goal is to haze them before they fill their bellies," he said.

Using infrared and night-vision devices became necessary because geese seem to enjoy night life. "When your busy night-flying schedule includes frequent visits from Air Force One, that's a problem," Sledge said.

Since the dispersal teams can't be everywhere at once, they also use noise-making cannons located strategically around the flightline as well as life-size coyote scarecrows. "I've watched tourists pull over and burn up rolls of film on the fake coyotes," Sledge said, chuckling. "Then we tell them it's just a scarecrow, and they're embarrassed."

More important than turning tourists crimson, the effigies seem to fool the geese as well. "The key is keeping the birds from the flightline," Sledge said. "They've held planes in landing patterns. Just yesterday, a C-130 had to do a ground abort because we saw geese flying."

Does that mean all the measures to keep birds at bay aren't working?

"Absolutely not," Richmond said. "Last fiscal year we had to frighten off 14,356 birds through 1,232 dispersals." This year, 561 dispersals shooed away 3,263 feathered fellows—a 77 percent reduction.

"We'll never be able to eliminate the threat, but we'll do what we can," Richmond said.

Elmendorf officials will be satisfied with only a big goose egg—zero loss of life and aircraft to bird strikes. ✈

This cannon fires a "boom" to shoo away birds that venture too close to the flightline. Powering up the propane air blaster is SSgt Rob Redman, an F-15 crew chief from the 90th Fighter Squadron. The noise-making cannons are strategically placed around the airfield to keep a deadly threat at bay.

Ready to Taxi on a Moonlit Night

LT MARK RUSNAK
VQ-3, Tinker AFB, Oklahoma

It was just another warm winter night at Travis. The crew was milling about smartly, starting to ooze ever so slowly towards the door before the horn went off, talking to our buds from the other crew which has been flying banker hours, all deployment. To nobody's surprise, the horn sounded and we began our trot out to the aircraft.

"What's the number today?" I said.

"I don't know," came the reply. "Don't worry. Just let the engineers stay ahead of us."

"Scramble Checks." Salty 3P was on his fourth deployment and a senior AC in the front seats for a GSR (giant shot rotate). It was pitch dark, and I could barely see the linemen as we started the engines. Our buddies from the other crew could be seen in the light at the top of the ramp to the Det. The AC was copying down the clearance. T-handle sighted, engine starts complete.

"Okay, ground, check us in taxi configuration and you are cleared to board." Our buddies were standing, waving at us.

"Flight, ground. Aircraft is in taxi configuration. I'm coming up."

"Roger."

Clearance had been copied; the takeoff brief was complete. Man, this was going to be a long flight—a 12.0 with only three pilots. This TACAMO (Navy acronym for "Take charge and move out") thing was going to be great. The other crew was sending us off with a side of the moon we'd never seen before and would rather not see again.

"Ready to taxi," the nav shouted. About time.

"Push 'em up," the AC said. "We have to get out of here." I released the brakes and we started to slowly roll.

"You are clear on the right," the AC said. Everything looked good on my side.

"Do you see the fire bottle on your side?" I ask, a little confused.

"It should be on your side," was the response I got. Wham! I hit the brakes as fast as I could.

"It's not on my side," was my reply as the plane jerked to a halt.

"Set the parking brake," the AC says. "Hey, eng, go over and see where the fire bottle is, will you?" As the engineer headed down to look for the bottle, our farewell salute was completed, and the other crew was heading up the ramp.

The engineer returned to the flight deck and said, "I found it. It was sitting about 18 inches in front of the nose gear!" We were 1 second away from running over it. ✈

If you can't take the time to do it right the first time, when will you have time to fix it later?

Mishap Report Writing 101

MAJ PHILLIP P. TABER
HQ 8 AF
Barksdale AFB, Louisiana

Preface

The mishap final report is the document which culminates a mishap investigation. This report is the preeminent mishap prevention tool of the USAF Safety Community. A mishap report should cover ***all*** aspects of a mishap and the subsequent investigation. Sloppy or incomplete mishap reporting could indicate that the investigation was less than thorough or professional.

How many times have you heard someone say, "What's the big deal? It's only a Class C...." **REMEMBER—Most Class C mishaps are Class A or B mishaps that didn't grow up.** There is no such animal as "just a Class C." You should view a Class C mishap as having just dodged a bullet.

Dare to Make a Difference

A *World Class* Mishap Report

You get only one first impression.

A world-class mishap report starts with a *comprehensive* mishap investigation. Once an investigation is complete, with the ***root cause or causes*** identified, the fun AND paperwork have just begun.

A mishap report can initially be broken down into two distinct parts: Part one is the narrative, and part 2 contains the findings, causal findings, and recommendations.

A well-written narrative should discuss the mishap sequence and subsequent investigation in great detail. ALL questions concerning the mishap should be addressed in the narrative.

However, the most important part of a safety investigation is determining the findings, causal findings, and recommendations. This is the *ACTION* section of a mishap report, which should focus on precluding mishap recurrence. This section specifically identifies mishap causes and their respective "fixes." Oftentimes, the findings, causal findings, and recommendations are completed as an afterthought to the report.

How many times have you said, "If I were king for a day..."? Well, in a mishap prevention sort of way, you are *The King* as the primary mishap investigator. As the author of the mishap report, YOU have the opportunity and responsibility to make a difference in mishap prevention!

Who Is Your Audience?

The information contained within a mishap report can prevent a similar mishap from occurring in the future. The report must be written to the level of the reader/audience. Not everyone has a "depot-level" understanding of *your* mishap. The mishap report writer must assume (yes, I said ASSUME!) the reader is not familiar with the subject matter of the report and write appropriately. Spell everything out—leave nothing to the imagination.

Report or Detective Novel?

A mishap report should be straightforward. The reader should not be forced to fill in the blanks or read between the lines. The narrative section of the mishap report should tell the "story" or sequence of events leading

continued on next page

up to the mishap. Here are some tips for a good narrative:

◆ Use a **lead-in statement** at the beginning of the narrative (e.g., F-16 engine shutdown in flight). This gives the reader the subject/end result of the mishap sequence.

◆ Discuss the **chronology/sequence** of the events leading up to the mishap. Include all known parameters (e.g., flight parameters, weather, aircraft configuration, etc.)—*just the facts.* TECHNIQUE: Do not address conclusions/causes in the narrative.

◆ Use **subsections of the narrative section** to address each aspect of the mishap or investigation. These subsections can address such areas as a specific item or part, a portion of the investigation or background information on the mishap. Examples:

7.1.2 FCF TRAINING PROGRAM.

7.1.3 TECHNICAL ORDER DATA.

7.1.4 DEPOT ANALYSIS OF FLUIDS.

◆ Don't stop asking **why** too soon! Did you find the **root cause(s)** or just the result/physical manifestation of a root cause? Were **all** possible contributing factors considered? Often you cannot see the trees for the forest. In other words, a "fresh set of eyes" can often provide a different perspective on the information/facts discovered during the investigation.

◆ TECHNIQUE: **Go five "whys" deep.**

◆ **Do the facts support the conclusion?** Do not let "hidden" agendas or special interest/concerns cloud the real root causes or conclusions. Does the conclusion pass the commonsense test?

◆ TECHNIQUE: When possible, you should discuss any **research data, PQDR results, or technical assistance** used during the investigation. Referencing this material should strengthen your conclusion(s).

◆ Do not be afraid of using the conclusion/cause: **UNKNOWN**. On a rare occasion, unexplainable events transpire which result in a mishap. However, UNKNOWN should not be used until **ALL possible avenues** have been exhausted.

What Is a Finding?

The findings are simply a series of chronologically based, concise statements of events or conditions which led to the mishap. It is similar to a line of dominos. If you remove a domino from the line/string, the chain reaction of the falling dominos will be stopped.

Findings:

- Are arranged in chronological order (developing this historical sequence could require in-depth research)
- Are essential steps/events which sustain the mishap sequence.
- Should have a *logical* connection to the preceding and following findings
- Are carried through to the logical conclusion (i.e., damage, injury, or recovery of aircraft by the crew).
- Should *not* reveal **NEW** information. **ALL** findings and information should have been discussed previously in the narrative.
- Are commonly written in an "actor, action, result" format.

Findings are *NOT:*

- Bullets/quotes taken directly from the narrative section. DO NOT rewrite the narrative in the FINDINGS section!
- Necessarily all causal.

How to Develop Findings

Start at the beginning of the *time line* and identify specific factors that *may* be findings.

1. Determine WHY it occurred. Get to the **root cause.**
2. Continue until ALL **events** and **conditions** that *sustained* the mishap sequence are listed.
3. Draft your findings and apply:

THE FINDINGS TEST

1. Is it related to the specific, brief event?
2. Is it a correctable event in the sequence?
3. Is it a single event or condition?
4. Is it specific enough without including supporting evidence?
5. Does it logically connect to preceding finding?
6. Is it really relevant, or simply interesting to the reader and better explained in the narrative?
7. Is it simply a possible alternative, existing merely because it cannot be eliminated?

Is It a Causal Finding?

This question can be difficult to answer. This discussion can often degrade into the proverbial "Which came first, the chicken or the egg?" A causal finding is simply a finding that describes a deficiency or decision which, if corrected, eliminated or avoided, would likely have prevented or mitigated damage or significant injury. Findings sustain the mishap sequence; causal findings are the source of damage or injury. One way to simplify this process is to apply the cause *litmus test.*

Revisit your findings now applying this test:

THE CAUSE TEST

1. Is it a clear and simple statement of a single condition or event?
2. Most are correctable by commanders, supervisors, or individuals.
3. If it is an effect or the natural result of a previously identified cause even though it is inclusive, it is not causal.
4. Apply *reasonable person concept:*

   a. If performance or judgment was reasonable considering the circumstances, do not assign cause. However…

   b. Human limitations (physiological or psychological) may be causal even if they are reasonable.

   c. Environmental conditions may be causal if they were not reasonably avoidable.

5. Findings that sustain the mishap sequence, but are normal to the situation as it developed, can be labeled not causal. These are unavoidable effects of a preceding

cause.

6. Did you stop asking **why** too soon? Was the root cause discovered or just the result/physical manifestation of the root cause?

Once a causal finding is identified, meaningful recommendations can become quite obvious.

The Category-Agent-Reason

Now that you have correctly uncovered the cause(s) of the mishap, determine who or what is the responsible party/agency. Each cause shall identify an ACCOUNTABLE CATEGORY, a RESPONSIBLE AGENT (along with a Command Level and a Functional Area) and a REASON for the deficiency. The CATEGORY-AGENT-REASON (CAR) table, found in AFI 91-204, offers very specific categories. Occasionally, you may have a cause that does not easily fit into one of the CAR categories. This is why the category UNKNOWN was developed. When in doubt, CALL someone for guidance/clarification. Make the staff pukes earn their "staff bucks."

Will It Prevent Another Mishap?

To this point, you may have conducted an investigation which would bring a tear to the eye of Sherlock Holmes and written the *perfect* Pulitzer prize-winning report. You left no stone unturned! And yet, without making meaningful recommendations which could prevent a similar mishap or reduce its effects—IT'S JUST IMPRESSIVE QUEEP!

Recommendations:

• Do not necessarily need to be *tied* to a specific cause, but must be *related* to the causes of the mishap.

- Every cause does not require a recommendation

• Must be *feasible*. Redesigning an entire airframe to accommodate a stainless steel coffee cup holder is probably going to get the big NONCONCUR from higher headquarters or the ALC/SPO.

- Do not confuse feasibility with cost. In other words, if it will cost the USAF $2.6 million to prevent the crash of a $43 million dollar aircraft—you do the math.

- Don't tell them how to fix it—tell them what needs to be fixed.

- It is your job to make valid recommendations. Let the *experts* at the MAJCOM worry about cost versus risk assessment.

• Should *identify the correct agency* to be responsible for the recommendation.

- Rule-O-Thumb: Do not "target" a specific office to "work" the recommendation. Leave it to the MAJCOM to assign an OPR.

- If in doubt as to the responsible MAJCOM—ASK (*DSN is free*).

- As per AFI 91-204, you should attempt to precoordinate the recommendation with the identified agency. If in doubt as to whom to contact—ASK (sound familiar?).

• Should be *valid* and *not* require such action as "Brief all personnel" nor "Disseminate the information." These are "do your job" recommendations.

- AFI 91-204 specifically forbids this type of recommendation.

• Should address specific close-out actions.

- Open-ended recommendations that cannot be closed cannot be "acted on."

• Should have a specific idea of how to prevent the next mishap and spell it out in plain English.

- Let the ALC/SPO determine specific language.

What Do We Do With This *Other Stuff* We Discovered?

In the course of an investigation, you may uncover issues which may not be directly relevant to the mishap. This *other stuff* is referred to as OTHER FINDINGS OF SIGNIFICANCE (OFOS).

OFOS are in a separate section which follows the Recommendation section. An OFOS can address ANY issue discovered during the course of the investigation. When applicable, an OFOS can also have associated recommendations. These recommendations should follow the same guidelines as discussed previously.

Hidden Agenda or Mishap Prevention?

Do not let "hidden" agendas or special interests cloud the real root cause, CAR, conclusion, or recommendations. There will come a time when we will be tempted to "look the other way" when we cannot stand the answer to the question we just asked. Integrity is paramount to any investigation and subsequent report. A compromise in the integrity of the mishap reporting system would undermine its designed intent of mishap prevention.

If all mishap causes could be corrected "in-house" without airing our dirty laundry, then why did the mishap occur in the first place?! Additionally, if it could happen in your organization, why couldn't the same condition/situation exists in a similar unit?

Safety works directly for the commander for a reason—to minimize outside influence. Do not compromise the integrity of the safety system.

Integrity is doing the right thing when there is no one around to hold you accountable.

What Difference Can Any of This Possibly Make?

Our commission within the safety community is the protection of Air Force combat assets/resources, primarily **people and equipment,** to ensure they are readily available to take the fight to the enemy!

The potential to make a real impact on **the combat capability and mission success** of the Air Force exists every time you begin a mishap investigation. Your mishap report can make a significant impact on the way we do business.

FLY SMART—FLY TACTICAL
FLY SAFE!

Instructor Pilots: Becoming F

LT COL CHARLES J. UNICE
AFROTC, Brigham Young University
Provo, Utah

Congratulations! You just passed your initial IP check ride and are one step closer on the path of pilot progression. You showed Stan/Eval you could fly and talk at the same time. Now you are on your own. Did your training prepare you for the "real world," and are you **truly** ready for that first student sortie? Can you efficiently use scarce flying time to accomplish the sortie objectives, have a backup plan when the sortie does not go as planned (does it ever?), reconstruct the mission for an accurate debrief and critique, grade the student to reflect his ability against the course standard, and write a factual summary in the grade book?

Why develop a philosophy of teaching? Getting philosophical means developing an *understanding for yourself and your students* on what makes a good IP, why do I want this job, and what can your student expect from you. Call it a personal mission statement of your IP role. What does it take to create a philosophy about teaching? More on this later.

No one said it would be easy. Is anything that's truly worthwhile easy? In our evolution as instructors, we develop technical skills, Dash One knowledge, and "golden hands." But what really makes you an *instructor* pilot?

The following is an excerpt from Charles Lindberg on the art of being an Instructor Pilot.

"I soon discovered that I was learning as much about flying as my students. A pilot doesn't understand the real limitations of his craft until he's instructed in it. Try as he may, he can never duplicate intentionally the plights that a student gets him into by accident. When you're flying yourself, you know in advance whether you're going to pull the stick back, push it forward, or cut the throttle. You think of a maneuver before you attempt it. But you're never sure what a student is going to do. He's likely to haul the nose up and cut the gun at the very moment when more speed is needed. If you check his errors too quickly, he loses confidence in his ability to fly. If you let them go too long, he'll crash you. You must learn the exact limits of your plane, and always keep him far enough within them so the wrong movement of a control will still leave you with the situation well in hand. You must learn not how high the tail should go in take-off, but how high it can go without disaster; not how to avoid a wind drift when you're landing, but how much drift there can be when the wheels touch, without a ground loop or blown tire resulting. And after you've learned how to keep a student out of trouble, you find that you've become a better pilot yourself. As you instruct your student in the primary art of flying, he instructs you in its advanced phases...But you can't pass on all of the wisdom you have gained. A student absorbs only part of what his instructor tells him; often it seems a terribly small part. Cost what it may in damage or injury, the rest must be learned by trial. Possibly much of human progress stems from a refusal of the student to accept rules laid down by the instructor."[1]

So the role of an IP has not changed much since the 1920s (except for the speed at which things happen).

Let's develop your teaching philosophy. As you generate ideas, write them down. It will not become reality unless written. First, much of your philosophy stems from who you are and your life's experiences. Why did you join the Air Force and become a pilot? What makes you angry/happy? How do you react to unfavorable circumstances? Students will put you in adverse situations. Knowing how you will react to those situations in ad-

Philosophical About Teaching

vance will greatly aid your IP development and student learning.

Second, the Air Force has provided us with an exacting standard to measure ourselves. It is the United States Air Force Core Values. *"The Core Values exist for all members of the Air Force Family...The Core Values are much more than*

Official USAF Photo

minimum standards. They remind us what it takes to get the mission done. They inspire us to do our very best at all times. They are the common bond among all comrades in arms, and they are the glue that unifies the force and ties us to the great warriors and public servants of the past."[2] Read "The Little Blue Book" and incorporate these values as your own.

Third, your philosophy is fashioned from the experiences you have had with instructors in your professional flying career. Your IPs from civilian flying, UPT, advanced schools, and your operational squadron have helped mold you into the pilot you are today. What techniques, good and bad, of the art of flight instruction have you learned? Review Air Force and Command regulations and policies that affect your job. Examine the training syllabus, grading standards, and Stan/Eval notes for tips and techniques you have previously missed. Make a list.

Fourth, learn about teaching and learning. Develop new ways to introduce ideas, to involve the student in active learning, and to assess student progress. There are differences between knowing your subject for your own use and knowing your subject for teaching. Flying skills are learned progressively. You master contact flying before instruments, instruments before navigation, two-ship formation before four-ship. Knowing a subject for teaching requires a much broader understanding of how that knowledge connects with other knowledge and how those skills are acquired by the student. *"The idea behind this concept is that in order to teach a given content efficiently, it helps to know what the students will experience as they learn. This includes knowing where the bottlenecks in understanding are likely to occur and how to break through them. It means knowing several ways of organizing and illuminating the content; then, if students don't understand it the first time you can do something different instead of just saying it again louder."*[3]

Now that you have defined, refined, and purified your ideas and experiences, write them as your IP mission statement. Whether you are an academic platform instructor or flightline IP, spend some time with your students discussing your teaching-learning philosophy. Give each student a copy of your mission statement. Review with them what they can expect from you and what you expect of them.

We are entrusted with two priceless Air Force assets, the students in our charge and the equipment and resources with which we train. It is the instructor's challenge to assist the students to reach their full potential. *"Being an IP requires an understanding of human nature, an eye for painstaking detail, and physical stamina...It is a life of coping with routine mixed with no small amount of frustration. There are no special decorations for IPs, the make-or-break pilots of the whole training program, but there is the reward of seeing a promising student fulfill your every expectation..."*[4] ✈

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[1]Charles Lindberg, *The Spirit of St. Louis* (Charles Scribner's Sons, 1953) p. 278.

[2]United States Air Force Core Values, 1 January 1997.

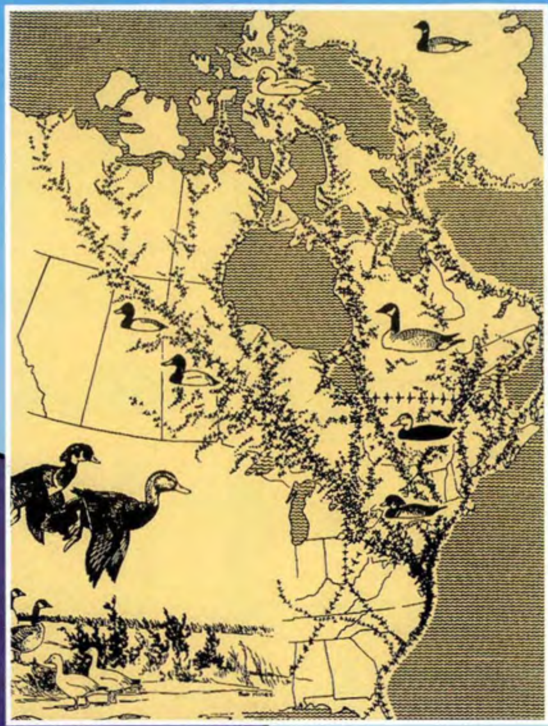
[3]Marilla Svinicki, PhD, "In Order to Teach, All You Need to Know Is Your Subject?" - *Focus on Faculty,* (Volume 5, No. 1, Fall 1996)

[4]Herbert Molloy Mason, Jr., *The New Tigers,* (David McKay Company, Inc., 1973) p. 141

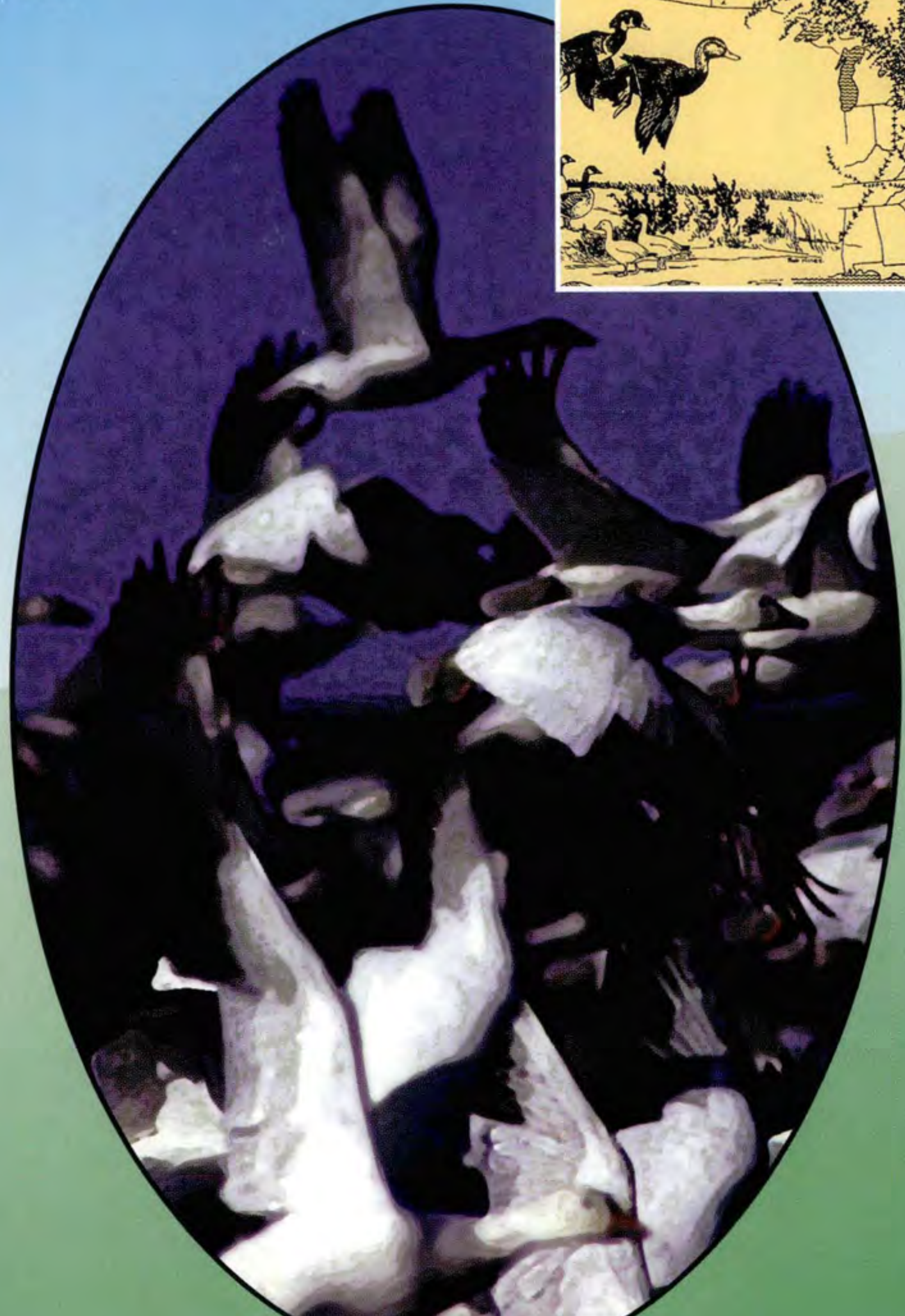
For the first 6 months of 1997, the Navy and Marine Corps reported 18 mishaps involving bird strikes. Here are a few:

A T-45 encountered a flock of sea gulls on the takeoff roll. Feeling several hits, the pilot aborted. A Hornet took a large bird down the port engine just after liftoff, and the pilot made a single-engine arrestment. Flying at 500 feet AGL and 120 KIAS, a Sea Knight pilot tried unsuccessfully to avoid a 7-pound loon. The bird went through the center windscreen.

Atlantic Flyway



Mississippi Flyway



USAF Photo by MSgt Perry J. Heimer

Where

Ducks, geese, and swans, collectively 5 percent of the bird strikes to USA substantial threat to military aircra feeding flights. The USAF lost an aircraft struck Canada geese at Eln use information about waterfowl migration, schedule training flights during low-risk period strikes.

Migration

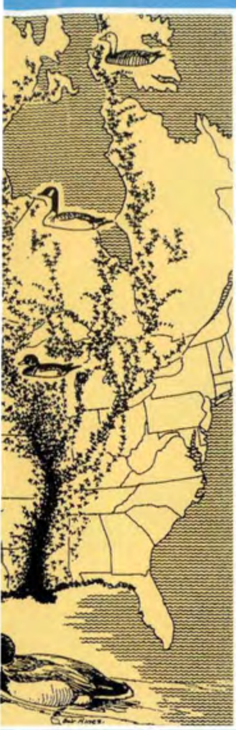
Ninety percent of migratory flights occur be ry waterfowl have been reported as high as 2(terfowl fly at altitudes that depend on terrain higher the altitude).

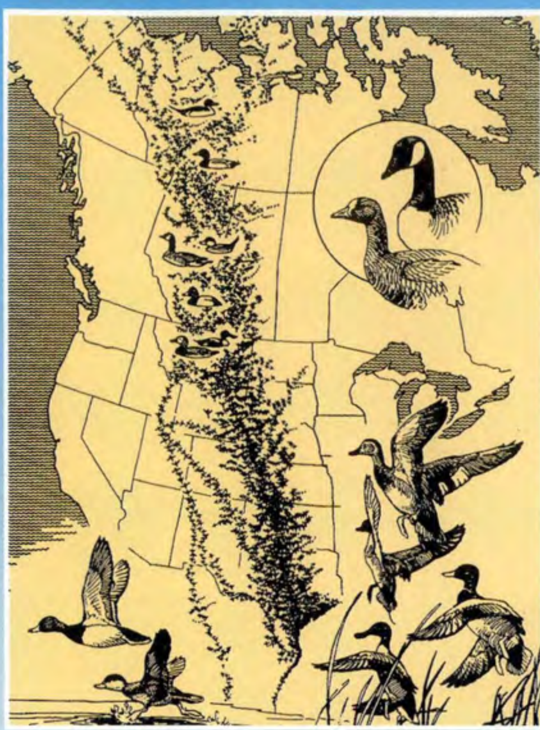
The fall and spring are the two peak periods fowl migrate. Fall migration is far more notice tions tend to move in large flocks to wintering migrations are slower and more irregular. De may begin as early as August and run into De early as February and run through May. Peak vember, and March-April.

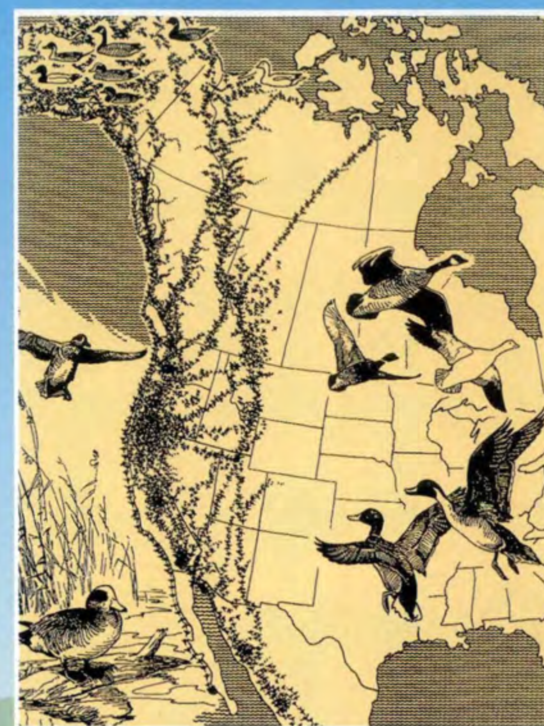
Many factors influence migration; changes i fluence migration the most. If food is plentiful, til they deplete their food supply. Also, weath and magnitude of migrations. Large-scale mig incide with major weather fronts that produce

Waterfowl tend to feed and build up fat rese to migrate mainly at night. Many species will f to their wintering grounds, while others will breeding and wintering grounds. For example, Central Flyway

Pacific Flyway







the Birds Are

CHARLES D. LOVELL
Courtesy *Approach*, Sep-Oct 97

known as waterfowl, account for only
F aircraft, but these large birds pose a
ft during migration periods and daily
E-3 AWACS and 24 crewmen after the
endorf AFB in September 1995. If you
movement, and activity patterns to
s, you can reduce the risk of waterfowl

ow 5,000 feet MSL; however, migrato-
,000 feet MSL. During migration, wa-
and distance (the longer the flight the

during which North American water-
ble than spring migration. Fall migra-
areas in a short time, whereas spring
ending upon latitude, fall migrations
mber; spring migrations may begin as
months of migration are October-No-

the amount of daylight probably in-
many species will delay migration un-
r conditions influence the onset, delay,
rations, especially in the fall, often co-
favorable wind patterns.
rves for migration during the day and
y directly from their breeding grounds
eriodically stop to feed between their
now geese migrate both nonstop from

Hudson Bay to the gulf coast of Texas, and on occasion, stop to replenish fat reserves to continue their flight.

There are four major migratory flyways in North America—Atlantic, Mississippi, Central, and Pacific. Results from the 1996 midwinter waterfowl survey conducted by state wildlife agencies and the U.S. Fish and Wildlife Service tallied more than 27 million waterfowl in the U.S.

The Mississippi flyway contained the largest number of birds (11 million), followed by the Pacific (6.5 million), Central (5 million), and Atlantic (3 million). Most of these migratory waterfowl winter in national and state wildlife refuges in southern and coastal states where water doesn't freeze. In coastal areas, large "rafts" of sea ducks and other waterfowl species will gather in bays, like the Chesapeake Bay, and along the coast.

Movement and Feeding Flights

During the winter, waterfowl rest in areas in which they feel safe from danger. They start flying at dawn to search for food. Once the birds find it, they will spend most of the day feeding at that location. As the sun sets, they again take to the sky to return to a safe roosting area. In general, birds fly below 1,000 feet AGL to and from food sources.

Avoiding Waterfowl Strikes

Because weather patterns vary, there is no set day when migrations start. It helps to keep in close contact with refuge or state biologists about the status of migratory waterfowl in areas where low-level flights occur. These biologists often provide specific information about daily waterfowl-flight patterns between roosting and feeding areas. This information helps determine the specific start or end of migrations for a particular year and aids in scheduling flight-training missions and avoiding bird strikes.

Mr. Lovell is a wildlife research biologist with the National Wildlife Research Center in Sandusky, Ohio.

Been There, Done That, Got The T-Shirt

Highly experienced, respected aviators are not immune from mishaps. Your superior ability to fly the airplane can also be your Achilles' heel.

LT COL EZEQUIEL PARRILLA, JR.
HQ ACC/SEF
Langley AFB, Virginia
Courtesy *The Combat Edge*, Nov 97

We were on an instrument approach on the last sortie of instructor pilot (IP) upgrade training for an IP candidate. It was not a good day for the home team, and I was in doubt whether the candidate was ready to pass the course. He had been critiqued on long landings on prior sorties, so I figured his pattern work may wind up as the tiebreaker. As we got on short final, we started getting more on the "Three red, one white" lower area of the Precision Approach Path Indicator (PAPI) glide path instead of the nominal "Two red, two white."

As we approached the overrun, we descended into all red in the PAPIs, and I realized I was lifting my feet away from the floor (NOT A GOOD SIGN!). My first impulse was to take the jet and go around, but I figured, "I've got almost 5,000 hours (2,000 of them in the Bone), and my hands are next to the throttles. I'm so good I can take this around before we hit anything, so I'll let him continue to see what corrections he makes." The only reason those did not become "famous last words" is because even though I was being stupid, it was not time for me to go yet. Fortunately, we did not get any wind shear or flight control/engine malfunction, and the candidate held power long enough that we landed about 500 feet down the runway, still short of the desired 1,000.

As I was writing the corrective training requirements for the candidate the next day, it really bothered me that in my overconfidence I allowed another pilot to place me where I could have bent a jet and maybe even hurt someone. I got away with it. However, many other old heads have not fared so well when they let their guard down. Of the last 37 ACC/ACC-gained Class A mishaps, 15 had an aircraft commander with over 2,500 flying hours. In FY96, 9 out of 15 Class A mishaps had operators as a factor. In four of those, the pilot had over 2,500 hours.

Some mishaps with experienced aviators go back to the very basics of airmanship:

• A junior wingman watched as a highly experienced lead in an emergency fuel situation overlooked suitable airfields, used excessive descent rates, and eventually ejected too late, resulting in injuries.

• More than one highly experienced and respected pilot was so hasty in shutting down a malfunctioning engine that they inadvertently shut down a good engine.

• A highly experienced and respected fighter pilot stalled his aircraft during a too tight final turn. This top aviator was well known for flying "Tiger" patterns, but no one had ever told him to back off.

• A relatively inexperienced crew sat quietly and watched as a senior instructor pilot made a series of errors in the approach leading up to a hard (make that extremely hard) landing.

• A highly experienced flight examiner with a long history of overaggressive/nonapproved maneuvers disregarded instructions to "tone down" and overbanked the aircraft at low altitude, impacting the ground.

The "rogue aviator" problem is one that we do not usually have to face, but it does happen. This can be especially painful if the rogue is an experienced aviator who thinks of himself or herself as the best and is out to prove it at every opportunity.

• Another highly experienced flight examiner with an experienced crew descended early below Minimum Descent Altitude (MDA) in a night/low ceiling situation, eventually impacting the ground.

All these mishaps involved highly experienced aircraft commanders. In some cases, they had reputations for being overly aggressive. But in others, they were very respected and were considered conservative aviators. Does this mean that the older, more experienced fliers are more dangerous? No. But it does mean that they are just as likely as less experienced fliers to encounter serious aircraft malfunctions, and when they do, they too make mistakes.

As we gain more experience and our bag of tricks gets heavier, our limits keep expanding, and we find we can fly the airplane better and can do things with the airplane we could not do before—such as tighter patterns, better bombing, etc. Our situational awareness also improves to where we can see things developing before others do. This may be due in part to having done something before or being familiar with weather patterns, local traffic, etc. In spite of this (or maybe because of this), some of the mishaps involving experienced aviators took place when the pilot was doing something that he was familiar with and was within his capabilities.

Sometimes things happen that can overtask or distract pilots from what they are doing and then become that last connecting dot for the mishap sequence. This may be an aircraft problem such as an engine/flight control malfunction or a caution light; weather phenomena such as turbulence, wind shear, or crosswinds; traffic; visual illusion/spatial disorientation, or something as simple as a radio call. If the airplane is already closer to the edge because the pilot knows he/she can handle it, it may not take much to get into a situation where even the experienced aviator's bag of tricks is not big enough to handle the problem.

One of the problems with the expansion of your limits as you gain more experience is that you can get into the "Do as I say, not as I do" routine. This is not a good thing. Reality is, you are going to have a hard time convincing some of the young lieutenants (with their hair on fire) that yes, indeed, you are that much better than they are. Many of our restrictions have a flier's blood attached to them. DO NOT allow yourself to expand your limits to the point that you are treading a fine line with tech orders, command guidance, or plain old common sense. If you do it, others are going to feel they can do it too.

Shortly after I traded in my helmet and checklist for a pocket protector, a wraparound modular desk, and a laser pointer (Did I mention how much I love staff work? No? Good!), we had two mishaps where a pilot in my age group jettisoned a jet from his back only to have a less than successful Parachute Landing Fall (PLF). This made me wonder if I had ever sat back during our life support class with an attitude of "I've been there, done that, got the T-shirt. Airman, just wake me up when it is time to do my demo, and be thankful I showed up." ...NAAH, surely I wouldn't have done that, would I?

Complacency is one of the insidious dangers facing us as we gain more experience and get set in our ways. This can include such things as being in a state of complete relaxation during a class or being less than prompt in updating pubs with the new changes. It can also affect the fliers around you who may assume that you must know what you are doing. Have you ever had someone tell you, "If it had been anybody else, I would have taken the jet!"? That, my friend, is about as clear a wakeup call as you'll ever get.

The "rogue aviator" problem is one that we do not usually have to face, but it does happen. This can be especially painful if the rogue is an experienced aviator who thinks of himself or herself as the best and is out to prove it at every opportunity. Peer pressure may not help much here—it is more of a leadership issue. However, peers need to speak up in flight and in the debrief. Supervisors need to step in ASAP. The best fix for this species is to hunt them down and eliminate them from the pack. The sooner, the better, before they take themselves out (and who knows how many more).

Fatigue and stress are things we all have to deal with. In the case of the experienced flier, supervisory responsibilities add even further to them. Do you, as a

continued on next page

Highly experienced, respected aviators are not immune from mishaps. Your superior ability to fly the airplane can also be your Achilles' heel.

squadron supervisor, squeeze in the very last second available before going into crew rest and then take work home with you? How long can you do this before it starts affecting your flying?

Another stress factor is the likelihood of experienced aviators getting the pre-"hangar queens" during aircraft generations. These aviators know more about the aircraft and are probably better equipped to handle a problem, so they are the logical pick to mitigate the risk. However, the handicap posed in this case must be taken into account both by the flier and supervisors.

Pressure to succeed can affect an old head just as it does a second lieutenant. How much does it affect you when you know that the aircraft in front of you landed but you are at MDA and still in the clouds? How hard are you willing to pull through the final turn before you decide "This is stupid," and go around? Unit culture is a big influence. Does a flier have to buy the rounds or take verbal abuse for taking a bad pattern around, or is that seen as a good decision to take after an initial mistake?

Highly experienced, respected aviators are not immune from mishaps. Your superior ability to fly the airplane can also be your Achilles' heel. Do people know when you are in the traffic pattern just by looking at how aggressively you are pulling the jet around? It is not so hard to develop bad habits or practices that could lead to mishaps when another unforeseen factor is added to the equation.

As a senior aviator, you are looked up to and may be setting the stage for others to get themselves into trouble by following your lead. Fellow fliers owe it to the senior aviator and our taxpayers to point out when standards are not being met or guidance is not being complied with. Some old heads may not like it initially and may even point out how they have more time in the walkway of the jet than you have total flying time. But in the long run, we will all be better aviators for it. FLY SAFE! ✈

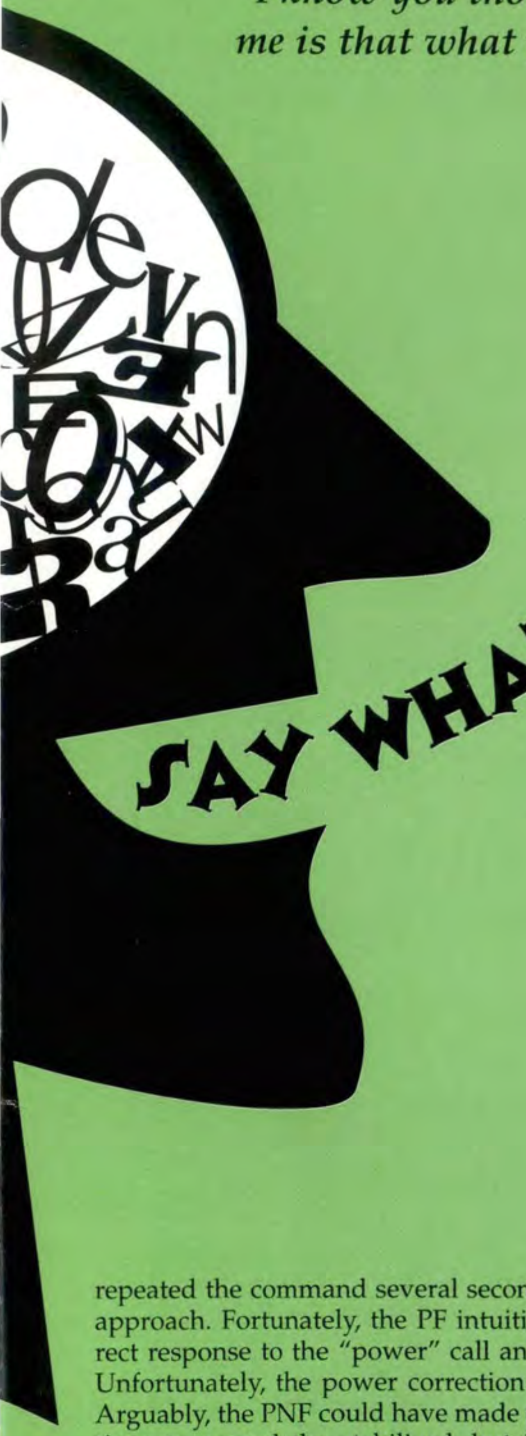
MAJ JEFF THOMAS
HQ AFSC/SEFF

Recently the USAF experienced a Class A mishap when a large transport aircraft landed short of the runway threshold resulting in gear door, wheel, and tire damage. While reviewing the aircrew testimony, it was noted both pilots observed the aircraft was below the glideslope during the final phase of the approach. In order to correct to the glideslope, the pilot not flying (PNF) correctly instructed the pilot flying (PF) to add power. However, the correction was not sufficient, and the crew continued the approach, ultimately landing short.

What caught my attention about this event was the terminology the PNF used to verbally coach the PF. The PNF, upon realizing the aircraft's approach had stabilized with an aimpoint/ touchdown point short of the intended landing surface simply stated "Power," then

"I know you thought you understood what I said; but what bothers me is that what you heard is not what I meant."

SAY WHAT YOU MEAN!!!



repeated the command several seconds later during the approach. Fortunately, the PF intuitively made the correct response to the "power" call and increased power. Unfortunately, the power correction was not adequate. Arguably, the PNF could have made other verbal corrections to amend the stabilized, but incorrect, situation. However, for purposes of this discussion, the focus is on aircrew communications—specifically, "saying what you mean!"

Most aviators have likely heard the old war story about the captain who called for "Takeoff power" at the initiation of a missed approach only to have the first officer abruptly reduce power. Then there's the captain who, during an engine malfunction, instructed the copilot to "Feather one," to which the copilot responded, "Which one?" Or how about the captain who said "Feather four." You can probably guess the copilot's response—"All at once?" While sounding like an Abbott and Costello routine, these events, whether true or folklore, do point out problems encountered by not saying what you mean.

Effective communications among flight members, crewmembers, or the aircraft and air traffic control have always been an essential component in the concept of crew coordination and safety of flight. An Aerospace Safety and Reporting System study, undertaken in the mid 1980s, found that fully 70 percent of the reports in the database involved some type of communication problem related to operation of the aircraft. Broken down, the study identified 10 generic types of communication problems. Among the problems were garbled phraseology, message not transmitted, recipient not monitoring, and (surprise!) incomplete content and ambiguous phraseology.

These communication difficulties aren't confined to only the cockpit. For example, in 1972, an Eastern Airlines L-1011 went down in the Florida Everglades with the loss of 99 passengers and crew. The flightcrew was preoccupied attempting to resolve a landing gear malfunction caused by a burned out indicator light which showed the gear was not down and locked. The problem captured the attention of all three flightcrew members to such an extent that no one on the flight deck noticed the autopilot became disengaged and the aircraft started a shallow descent from its holding pattern. An Air Traffic Controller monitoring the aircraft noted it was losing altitude and queried the flightcrew by asking, "How's it going out there?" They responded that everything was all right, probably believing the controller was inquiring about their gear problem. Obviously, this mishap can't be laid at the feet of the controller, but had he clarified the intent of his inquiry, i.e., "I see you've started a descent. Are you ready for the approach?" this incident may have been avoided.

Not to get too bogged down in psychobabble, but according to researchers, communication is effective only if the sender achieves the intended purpose; i.e., the receiver not only understands but responds as desired. This may seem relatively simple, but in actual practice, as demonstrated above, communicating effectively can be very difficult.

One method to overcome these problems is to "say what you mean." Think before keying the mic. What do you want to convey? What is the desired outcome? Obviously, pulling the power off at the initiation of a missed approach because of a command's ambiguous content is a less than desirable outcome!

Prowler With an

LT JOE GADWILL
Courtesy *Approach*, Jul-Aug 97

"What a great day to be in naval aviation," I thought as I stepped out onto the flight deck. The weather was CAVU, the temperature was mild, and there was only a hint of the afternoon haze that seemed to envelop the Adriatic every day. We had briefed an opposed strike on a constructive target defended by a division of air wing Hornets.

A mixed division of Tomcats and Hornets would provide High Value Asset (HVA) CAP, protecting us so we could wield our HARM and trons. Our flight had another good deal—we were a relatively junior crew, so we all were looking forward to a good time.

The man-up (45 minutes early under the boss's watchful eye), start-up, and taxi to the cat all progressed without a hitch. We knocked out the before-takeoff checklist and stopped short of the JBD, where we sat and waited our turn for the E-ticket ride.

As the JBD came down, my pilot double-checked the configuration and gauges, reiterating, "Slats out, flaps 30, stab shifted, trim zero, zero, six point five." I rogered his mantra, called the checks complete, and reminded him we would need a left clearing turn (what would they do without us?).

The shooter put us in tension while my pilot ran 'em up, wiped out the controls, checked instruments, and saluted. Off we lumbered down the cat. With a good stroke, I continued to focus on the engine instruments as he brought the gear up and began the clearing turn. I called, "Three moving," and started looking for 185 KIAS in anticipation of the "Flaps, slats" call. Although I noticed he was really having to work the trim button, I didn't give it a whole lot of thought.

Up, clean and isolated at 500 feet, I gave my pilot STAB AUG somewhere around 300 KIAS. The input as good, but he came up on the ICS saying, "Something's wrong with the trim. I've got a lot of back-stick and can't work it out."

He immediately looked down at the stab-trim gauge, saw it at 11 units, nose up (max travel is 12 units), and hit the Automatic Flight Control System (AFCS) emergency disconnect.

"We've got runaway trim."

We were now about 5 miles out on the Case I departure, and he started to slow down to 250 KIAS to relieve some of the stick force. With the problem identified, I said, "All right, let's continue out to seven miles, then we'll climb to 12K overhead mother and take a look at the PCL." Our squadron's rendezvous altitude was 12,000 feet.

We made the climb, checks were complete; then I checked in with the E-2 controller and told him we wouldn't be able to play today. I broke out the PCL and ran through the steps, but they didn't offer much help. My pilot had completed the bold face with the AFCS disconnect, and the remaining steps were only pertinent if you were lucky enough to notice an insidious runaway condition. The trim was already full nose up, and the damage was done.

I explained the situation to the Boss and asked for a rep. My pilot dropped the flaps, increasing the angle of attack to reduce the back-stick pressure. Even though NATOPS states that the Prowler is completely controllable in this configuration, it can be tiring for the pilot. We were still pretty heavy, and the constant force he was applying was starting to take its toll.

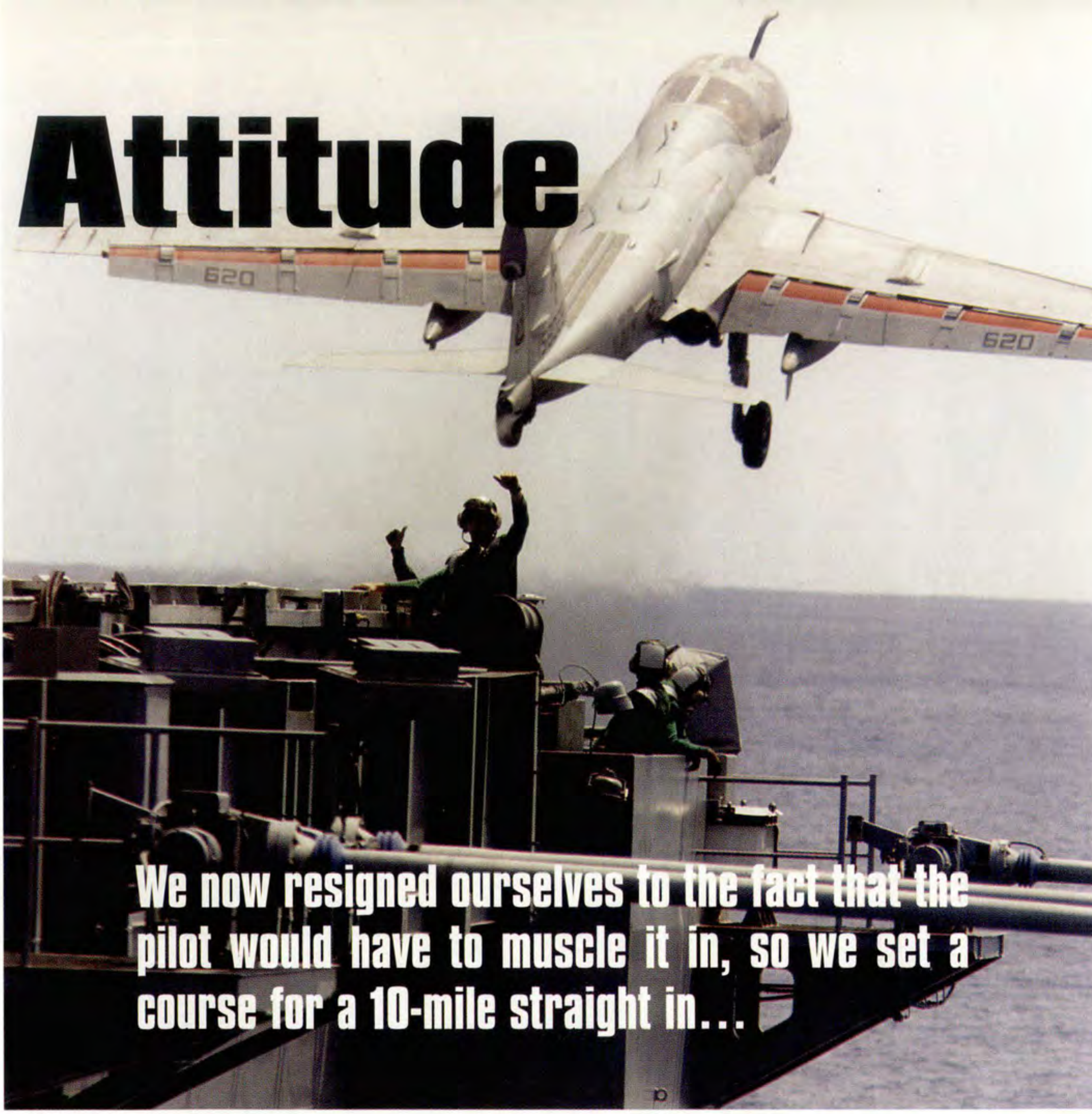
Our only other option at this point was to engage the AFCS in the altitude-hold mode and see if the aircraft would trim itself. Our rep confirmed this procedure, but we had no luck after several tries. We decided to get beyond 10 miles, descend, and go dirty to see if that would have any effect. My pilot now had some serious doubts he would be able to land at the ship because holding altitude was getting harder. He had to fly with two hands on the stick, or alternately switch hands and shake out the fatigue in the free arm. He also began to feel the pistol grip and trim button on the stick heat up (no, he wasn't squeezing black juice out of it, but it didn't help that his glove was worn through on the forefinger and thumb).

Our rep told us the Boss would take us at the end of the recovery, so we set up a bingo to Brandisi that would give us three looks at the deck.

We tried engaging the AFCS in the dirty configuration several times with no effect. A senior pilot in the squadron suggested releasing all stick force and then trying to engage it. We tried this a couple of times, but it only led to a severe pitch-up, and we quickly decelerated through 120 KIAS. Departing dirty, at 5,000 feet, would be a bad thing.

We now resigned ourselves to the fact that the pilot would have to muscle it in, so we set a course for a 10-mile straight-in, descended, and got the dumps on. We called out the descent checks and started taking another look at the PCL when I thought, "This is just how people fixate on something and end up flying into the water." I was just about to key the ICS to call for eyes out of the cockpit when I looked at 3 o'clock and saw a gear-down Hornet about to pass less than 200 feet over us. As I called the traffic, my pilot said, "Here comes another one."

Passing from 9 o'clock to 5 o'clock in about a 4-G turn (nice vapes) was a second Hornet. The first Hornet took station on our 9 o'clock and asked if we needed help. We were confident of our configuration so we said, "No, but thanks." Turned out the second Hornet had been vec-



tored by his GCI on the Strikex and was coming to shoot us down! A kill's a kill, I guess.

Abeam the ship at 10 miles, we asked our rep if we could get a Mode II. We secured the dumps slightly below max trap. Now aft of the ship, we got lock-on at 8 miles. The ACLS needles were a real bonus because they gave the pilot something to focus on and let him catch deviations quickly (he was still having to fly two-fisted). He flew an excellent Mode II to the ball call at three-quarters of a mile, then released his left hand and took control of the throttles. We trapped with a 2-wire and an okay underline.

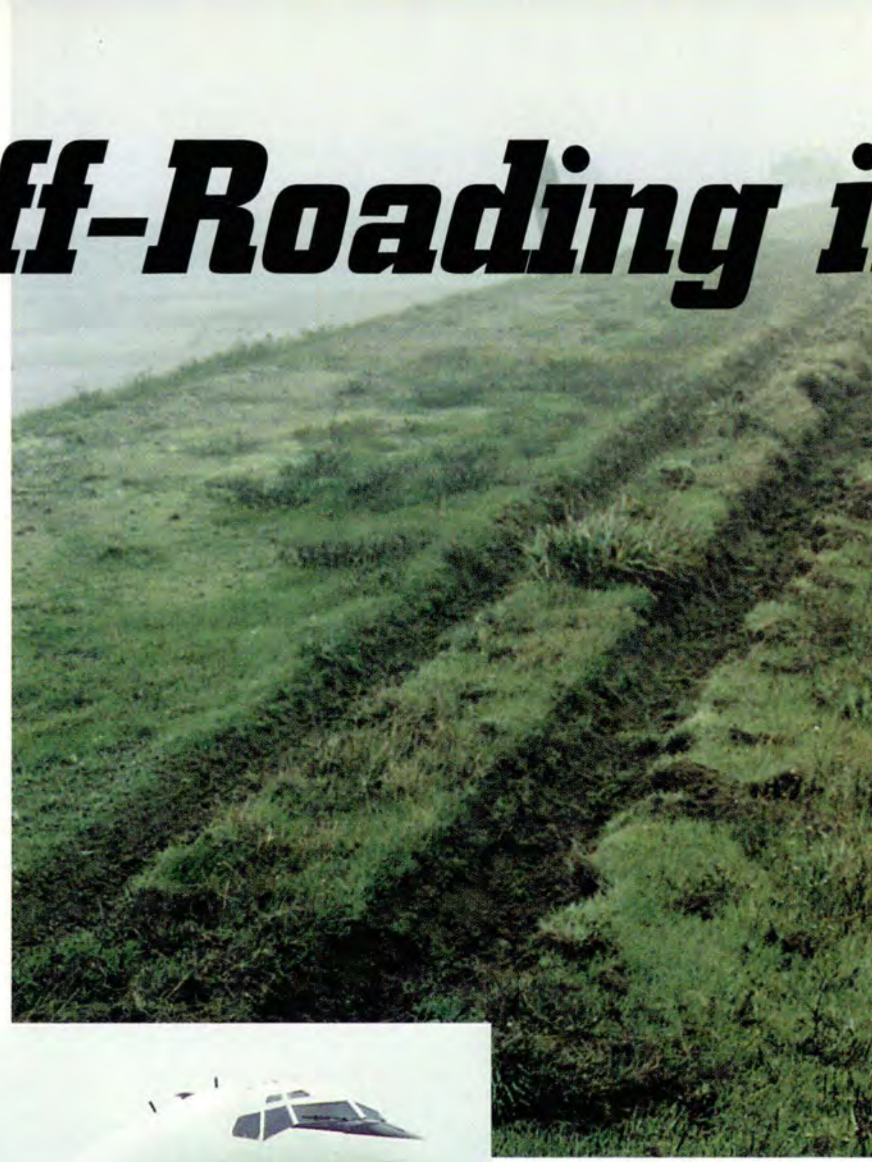
In retrospect, we could have tried a few other things to get the AFCS to engage. Instead of releasing the stick force in level flight, we could have gained more altitude, then unloaded the aircraft and tried the engagement while the jet was leveling out and climbing on its own. My pilot could have also tried releasing the stick grip and controlling it by grasping the metal post below the grip. This would have released pressure on the AFCS sensors internal to the grip without having to deal with the pitch-up. As it turned out, however, the trim/AFCS wiring in the stick grip was crushed and shorted out (accounting for the heat buildup). Either way, we had done everything we could think of, and the press was on to make the recovery.

Lessons Learned

Fly the aircraft first. If you have an emergency off the cat, focus on gaining airspeed and altitude. When troubleshooting a problem, exercise all your options, but make sure you don't put yourself in more trouble. Keep an eye on the big picture and always keep looking around. It doesn't do much good to kill all the snakes in the cockpit when there could be one waiting to bite you just outside. ✈

Off-Roading i

ANONYMOUS



Photos via Author

We had a crew flying a 12-hour mission from noon to midnight, complete with an orbiting wire-out communications evolution and an aerial refueling with a KC-135. The flight hours weren't too painful, and the overall mission went well with the exception that there was growing tension between the aircraft commander (AC) and the copilot.

The troubles began when the aircraft was level at 5,000 feet and established in holding for Runway 21L, Travis AFB, California. The airborne aircraft was waiting for a relief aircraft to launch, but RVRs of 1,200 to 2,400 feet were keeping them on the deck. The weather had been deteriorating all evening—no surprise for Travis in January—but Metro said it was fluctuating from above to below mins. From 5,000 feet over the field, it looked like a thin layer of fog was positioned directly over the airfield.

The AC had already briefed the approach, but there was still a healthy discussion about what to expect and what the options were if a landing wasn't possible. It was expected that once down in the goo the lateral visibility would be minimal, at best. Metro reported RVR a little better at midfield, so the approach was switched to the VOR to 21R. The AC then said he wanted to go down to the missed approach point and "have a look."

The new approach was rebriefed, but it was never mentioned that Runway 21R doesn't have centerline lighting as does 21L. For this reason, the left is the primary instrument runway and the runway used by the squadron most of the time. Without thinking about or briefing the difference in lighting between the two runways, habituation took over the thought process. In the goo, after a long mission and tension on the flight deck, this proved to be a costly mistake.

The primary and backup instrumentation for the approach was monitored, and the approach was right on black line as the aircraft passed the missed approach point. The AC called "Field in sight" and started to transition to a landing attitude. At around 50 feet AGL, the copilot called *"Go around!"* From inside, looking out, a bright row of lights extending out the nose of the aircraft was clearly seen. Normal landing picture, right? The copilot didn't think so, and believing the approach was made only to "take a look," was aware the aircraft was off center. The engines never spooled up for the go-around. At about 20 feet AGL, the copilot repeated, ***"Go around! Go around!"***

The aircraft landed. The touchdown was normal, but the rollout wasn't. For one thing, it was way too bumpy. At this point, the flight crew realized what had happened. They had landed exactly on the right edge of the

n a Heavy Jet

runway, half on and half off. The nose gear came down exactly on the right lights of the runway (which had been perceived by the AC to be the centerline lights), taking out the first three. The aircraft then began drifting right, further off the runway, as the right main mounts continued to dig into terra firma. A 2- by 2-foot ditch was left in the soft mud next to and halfway down runway 21R, as well as two dead jackrabbits which were also unbriefed as to the nonstandard arrival.

As the aircraft rolled out, it was forced back onto the pavement when the right main truck hit a perpendicular taxiway. Once fully stopped, the AC requested and executed a 180 to back taxi but stopped short of parking to inspect the plane. The FE reported the underside of the plane was sprayed with mud and debris, a flap was punctured, and the wheel wells were covered with hydraulic fluid. The plane was shut down, and the crew called for chocks and a tow tractor.

Inside the aircraft, gear was scattered all over the place (secure loose objects…), ceiling panels had fallen down, and there was a serious adrenaline rush throughout the plane.

This unbriefed experiment "proved" the E-6A *can* perform soft-field landings and earned the plane (Buno. 162784) the nickname *"784x4."*

One hour later, a little civilian twin engine that couldn't find a place to land due to the fog, crashed 200 yards from the base perimeter, and killed both people on board.

Three things need to be said of this experience that should be understood by all multicrew aircraft.

- First, pay attention to CRM in the airplane. This is a perfect scenario for revealing the importance of CRM. In this case, the copilot was not aware the approach would be continued to a full stop and was then ignored on a go-around call. Preventing this type of communication breakdown is the very reason we have CRM. We teach it nonstop in the command, but when the rubber hits the road (or hits the mud), it comes down to the individuals choosing to listen and act. "Go around" means "GO AROUND." This phrase is there for a reason, and if adhered to in this situation, could have saved a lot of money, trouble, and embarrassment.
- Secondly, it *can* happen to you!! Attention to detail, especially after a 12-hour flight and bad weather, can pay big dividends. This way of thinking is nothing new to people in Naval aviation, but it can't *ever* be stated enough to those involved in this line of work.
- Finally, respect your crew's opinions even if there is tension, conflicting personalities, or communication difficulty. They may be trying to save your life—or at least your career.

Was this accident preventable? Of course it was. Hopefully, in the future it will be. ✈

This article is presented by the VQ-3 Safety/NATOPS Department.

Basic Area Navigation

What It

MAJ PATRICK J. ZELECHOSKI
HQ AFFSA/XOPA

First, the term Basic Area Navigation (BRNAV) simply refers to a required navigation performance (RNP) equivalent of ± 5 NM from course centerline, 95 percent of the time. Secondly, it's nothing new! Most USAF aircrews have already flown some type of area navigation and are familiar with the procedures. BRNAV is just a more formal style of RNAV and requires some special considerations on the part of the aircrew.

Why is BRNAV necessary at all? Isn't the current system good enough anymore?

Traffic capacity is severely restricted over parts of Europe, and the only way to increase the capacity is to minimize or eliminate the bottlenecks. Airways are like a highway system on the ground—only it's in the air. Unfortunately, also like highways, at intersections with lots of crossing traffic, someone is going to get stuck waiting for the light to change (holding).

The current system of land-based navigation requires overflight of certain VOR sites and intersections and one-way airways to organize the flow. By creating airways independent of the geographic location of a ground navigation aid, those airways (and more, newer ones) can be spread out. Spreading the traffic out increases capacity and safety! So now you can see why this is an important improvement to European traffic management. And no, the old way just doesn't serve the population anymore.

Is and Why Do I Need to Know About It?

BRNAV is mostly—but not all—an aircraft capability and is only part of the solution to the capacity problems of the European airspace. With the flight management, inertial, and GPS navigation systems on most aircraft, the application of BRNAV is nothing more than ensuring coordinates are correctly entered into the navigation system. The navigation equipment is easily capable of the navigation tolerances required. But remember, "It will accurately fly to the point you tell it to—right or wrong!"

So what's the big deal then? Well, the aircrews must adapt to the concept of flying to a point in space with no reference to a ground-based navigation facility. In theory, the system will do that with no problem. But what happens when the system malfunctions or fails and the crew must revert back to VOR, DME, or NDB navigation? Everyone plans for the worst case, but is anyone really ready when it happens?

Ensuring RNAV airway compliance will require increased vigilance by the aircrew. Cross-checking ground-based navigation aids to ensure the RNAV equipment isn't driving the aircraft away from the desired course will require aircrews to work harder. Plotting DMEs and radials isn't something most aircrews are used to doing, and it may require some quick thinking or reaction as navigation errors are realized.

Problem 1. Most INS certifications are limited to 2 NM per hour drift from the time they are placed in the navigation mode. By definition, BRNAV is maintaining a course of ± 5 NM of centerline. That isn't hard. In the U.S. and most other ICAO member nations, VOR airways are designed as ± 4 NM from centerline already. But area navigation isn't based on ground-based navigation aids, and it can be difficult to recognize a drifting RNAV system without continuously monitoring the aircraft relative position.

We have already stated that flight management systems designed around INS will steer the aircraft on course—but that could possibly be 2 miles off course for every hour of operation. "The computer says I'm on course, so I must be," isn't a proper response to the controller who asks to "verify your position." If the system automatically updates to maintain accuracy, this wouldn't be a worry. But that is a **big** if! Most updates of commercial FMSs are DME/DME based and completely automatic. Those systems pass the test for BRNAV approval and use. Even if the aircrew has to "hold" and select a station for the system to use to update, it's okay.

Manually entering coordinates to update a navigation system is NOT good enough for BRNAV approval and use. In this context, manually updating means those fat fingers entering wrong latitude/longitude coordinates. So those aircraft that complete the long overwater crossing to get to Europe and can't "automatically" update the system—you've got a problem. If all you've got to do is select which stations to update from, well, that's okay. Ideally though, the system should be selecting the NAVAIDs and making the updates without user input. But there is a fix.

Global Positioning System (GPS). The new guy on the block—very accurate, worldwide, but let's not forget the limitations of the system as well. How do you know it's not giving you a bad navigation position? Let's take this a step at a time.

Problem 2. In VOR navigation, you get an off flag. Doesn't GPS have the same thing? Well, yes, it does. On those systems approved to the FAA specifications of Technical Service Order (TSO) 129A or better, Receiver Autonomous Integrity Monitoring (RAIM) will allow the system to cross-check itself for a *satellite* malfunction. But it will just as happily let you keep on flying with that bad information. What!? RAIM just indicates there is a problem with the satellites, not which one, not why, not an "OFF" flag.

Fault Detection and Exclusion (FDE) is the next level up from RAIM. It checks each satellite against the other, and when it finds a problem, it excludes the "bad" satellite from the navigation solution. "Yes. Give me FDE!" Whoa, back the truck up a minute! Very few of the aircraft in the fleet have that capability yet. RAIM, maybe, but not FDE—at least not yet.

So where does that leave the aircrews? The math is easy when you round it off. Flying in BRNAV airspace is limited to 2 hours without an automatically updating navigation system or a TSO 129A compliant GPS. Keep an eye on your position, notify ATC of any loss of navigation capability as always, and, oh yeah, indicate compliance with BRNAV with a "/R" on the flight plan.

Remember, the target date for starting BRNAV in Europe is now 23 April 1998. Get ready for it now by brushing up on your navigation procedures and techniques. Fly safe. ✈

OPS

Hey, Grebe! Duck!

The "Beagle" was snooping around on a low-level at 700 feet above the southwestern desert when it decided to auto flyup at 4 Gs. The crew was given an "obstacle warning" announcement at the same time. During the flyup, the aircraft passed through a flock of birds, striking at least two of them.

Damage included the LANTIRN pod, the center fuselage, and the right aux fuel tank. After a control check, the aircraft returned to base for a safe landing.

The birds, which the Beagle hit, turned out to be western grebes according to the state department of wildlife. The wildlife folks had some additional words for the safety officers looking into the incident.

"Due to the exceptional spring rains across all of the southwest, there is an increase in insect life which many birds will be feeding on throughout the summer. Later, you can expect an explosion of plants to result in a higher natural seed production which will continue to attract ducks and other shore birds like the grebes. With lots of birds in the areas where you fly, the problems won't be over for quite a while."

Official USAF Photo

Traditionally, Air Force aircrews associate bird hazards with spring and fall seasonal migrations. This might be a good year to keep bird hazards near the top of your list every time you go out to fly.

Fill 'er Up, Way Up

Just how low is low? When you ask about fuel quantity, "low" is affected by many factors. Like, how accurate is the gauge, or how far do I have to go, or what do the regulations say? Notwithstanding all these, fuel is low when your aircraft can't make it back to the airfield and taxi back to the chocks.

Recently a fighter completed a mission without declaring "Bingo," even though his fuel was 300 pounds below the briefed Bingo amount. On the way back to the field, headwinds at altitude and on final were stronger than expected. The pilot configured the aircraft for the approach a little early and then used numerous throttle movements to counter gusty winds during the approach.

Upon landing, fuel was down to 400 pounds remaining. (The pilot never declared a minimum or emergency fuel status.) After clearing dearm, located at the farthest point on the airfield from the hot refueling pit, the pilot elected to taxi to the hot pits for fuel. Despite the fact the local directives order a bypass of the fuel pits with less than 600 pounds remaining, the pilot pulled into the pits.

The pilot, now looking at a gauge showing 100 pounds of fuel remaining, urged the pit crew to work quickly. As soon as they had pinned the APU, they brought the refueling hose to the aircraft. While the hose was just inches from the jet, the engine flamed out.

The jet was impounded, checked, and refueled with 2,500 pounds of JP-4. It has run fine every day since, as expected, so long as there's fuel in the tanks.

We all know there are many factors worked into planning Joker and Bingo fuels. These aren't factors set in stone. Other things may occur which require closer management of the remaining fuel for a safe recovery. Sometimes, it may take the little bit of help you receive when you declare a minimum or emergency fuel status. "Low" fuel exists anytime you have less than you planned at any time in the flight. It's something you need to know. Check it often!

TOPICS

What...Me Worry?

If things start moving from the boring to the exciting, when is it time to worry? And how much worrying will you do before you actually declare an emergency?

The flight in a single-engine airplane started routinely enough. It was nothing more than a pleasurable cross-country flight. The pilot of the Aero Club airplane had even filed an IFR flight plan. After 2½ hours of monotony, things started happening.

Specifically, the engine began running so rough, the whole airplane shook violently. A call to Air Traffic Control brought a vector to the nearest airfield. The engine kept running long enough for the pilot to make a safe landing. Although there was no emergency declared, the pilot hinted one might be called in a few moments.

After landing, maintenance opened the engine cowling. The No. 3 cylinder was almost completely loose from the engine block. Only one of the eight bolts was still attached. The mechanics estimated there were only 5 minutes, maybe 10, of life left in the engine before it "ate" itself. The engine was found to be beyond economical repair due to damage sustained during the last moments of the flight.

Let's try to figure out why the pilot didn't declare an emergency. He was flying a single-engine airplane on top of an overcast deck. The engine had only four cylinders. The only engine began to shake violently, possibly indicating it was going to quit. The pilot had been flying solo for over 2 hours on an IFR flight plan. The nearest airfield had neither a control tower nor a precision instrument approach. Other aircraft on IFR flight plans would have received priority over this simple "divert." There was a high probability the engine, shaking as badly as it was, would quit in a matter of minutes.

Hmmm. All of those seem like pretty darn good reasons to declare an emergency with the whole world. The sooner a pilot with a problem declares an emergency, the sooner the pilot will get help to put the airplane safely on the ground.

More Low-Level Hazards

The list of hazards to pilots flying low-level routes is well known—birds, other airplanes, turbulence, changing weather, and wires. A mining engineer wrote to complain about low-level airplanes and to add two more hazards to the list.

This engineer works with open pit mines and has seen airplanes, civilian and military, flying less than 500 feet over the mines. And while the mine might appear to be abandoned, chances are it is empty because blasting operations are about to begin. The explosion will throw rock fragments more than 500 feet high and more than 1,500 feet horizontally. Ouch!

Lest you think yourself safe because most of your low-level flying is over the ocean, read on. Many of the "supertankers" carrying liquid gas will vent the vapor buildup as they approach the coast for changing cargo or in an emergency. The gas is vented under high pressure to clear the crew quarters, and it can easily reach 500 feet above the sea.

Now, when plotting out the hazards for your next low-level, you can add open pit mines to your list of traffic patterns, towers, and turkey farms. ✈

Maintenanc

F-16 Missing Axle Spacer

The F-16 pilot aborted at end of runway for an equipment hot light. While taxiing back to his parking spot, he felt a thump followed by a severe nosewheel vibration. He stopped the aircraft and shut down the aircraft on the taxiway.

Examination of the nosewheel revealed the axle nut had backed off, allowing the nosewheel to come loose. Prior to the attempted flight, a crew chief removed and replaced the nosewheel assembly, and a 7-level technician signed off the red X. Not only was the spacer installation step in the T.O. skipped, but a local in-progress inspection (IPI) had also been overlooked. Once the wheel assembly is installed, there is no way to determine if the spacer is in place—until the pilot feels a thump followed by a vibration during taxi!

Last year, another Falcon pilot heard a thump, only his unusual sound happened during gear retraction after takeoff. With a red light in the gear handle, he gave a heads-up to his flight leader. After lowering the gear and seeing three green lights, he was told by the lead that the nosewheel assembly was missing. Through skillful maneuvering, the mishap pilot slid the F-16 along the runway for 6,000 feet, stopped, and stepped out of the jet safely. Here was another spacer that was left off during a previous nosewheel change, allowing friction to back off the axle nut and the wheel to fall off.

Once again, it's the small things that contribute to mishaps—a missing spacer, a skipped IPI, no last look before leaving the job. When you finish a task, take that extra minute to think: Did I follow the T.O.? Is everything in place? It'll be one of the most important, profitable minutes you'll spend all day.

Another failed IPI

During the postflight walk around, the tanker pilot discovered the No. 1 tire had deflated. When the wheel and tire were removed for repair, the crew chief found the inside of the wheel and the face plate severely scored and metal shavings throughout the entire assembly. Other damage included the axle and No. 1 brake assembly damaged beyond limits.

A review of the maintenance records showed the wheel and tire were replaced during the graveyard shift just prior to the flight. Although the task was performed by a qualified crew chief, he had inadvertently failed to reinstall the inner bearing when installing the wheel and tire assembly.

And, although an in-process inspection was accomplished by a qualified seven-level, the inspector failed to notice the missing bearing and signed off the aircraft forms. When performing routine maintenance such as tire changes, complacency can be an insidious trap. The cost of this oversight was nearly $16,000.

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e Matters

Spare FOD

Already 20 minutes late for takeoff, the Eagle pilot aborted the primary aircraft and went to a spare. The crew chief had just returned to the spare aircraft as the pilot arrived. He and an assistant hurriedly prepared the aircraft for flight. After reviewing the forms and a quick walkaround, the pilot climbed into the cockpit and proceeded with the launch.

Except for the sense of expediency, engine start and taxi preparation seemed normal. But when the pilot applied power coming out of the chocks, the ground crew heard a loud bang and noticed sparks coming from the augmentor of the right engine. They notified the expediter who, in turn, notified the EOR crew.

At the end of the runway, the aircrew was told to shut the engines down. Shining a 6-volt lantern down the intake, they found the intake plug lodged against the first stage of the right engine compressor. The aircraft was towed back to the ramp where further inspection revealed the pip pin, the remove-before-flight streamer, and the cable had been ingested into the right engine causing extensive damage.

An investigation by QA revealed that in the rush to make the mission range time, the ground crew failed to remove the intake plug from the right engine prior to engine start. The pilot also missed the plug during his hasty walkaround. As a result, not only was the mission scrubbed, but the right engine received $18,000 in damage.

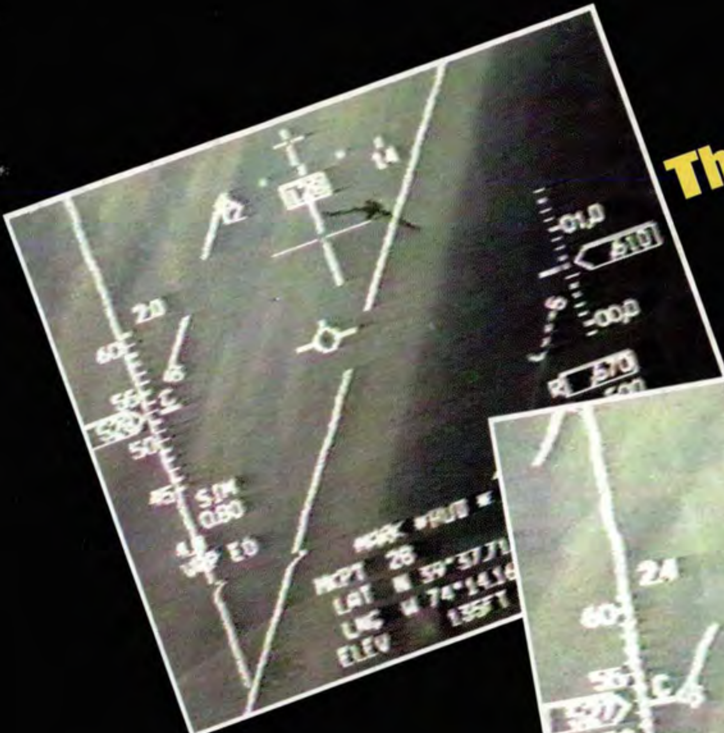
Terminal Fire

During a routine phase inspection, a tanker crew chief found a broken wire on the pilot's window heat terminal. An environmental systems specialist was called to replace the terminal lug.

During climbout on the first flight after the inspection, the flightcrew heard a loud pop followed by 2-inch flames and black smoke coming from the pilot's window. The crew immediately turned off the window heat and the flames disappeared. The pilot declared an emergency, dumped fuel, and made an uneventful landing.

A maintenance team had no trouble determining the cause of the fire—a short between the window heat electrical terminal and one of the window bolts. A closer look revealed the terminal lug installed by the environmental specialist was the wrong part number. It was too long and arced against an adjacent window bolt.

To preclude surprises like this on your jet, always verify the part number with the tech order before installing a part. Don't simply match the old part with the new one. It could be that the old part had failed because it was incorrect to start with. Take the time to check the T.O. for the right part every time. ✈



Three...

Two...

One...

From out of nowhere...

Wham!!

it happens that fast!

Result...One very dead seagull and $22,000 worth of canopy damage. Luckily, no injuries to the pilot. The flexible canopy withstood the strike.