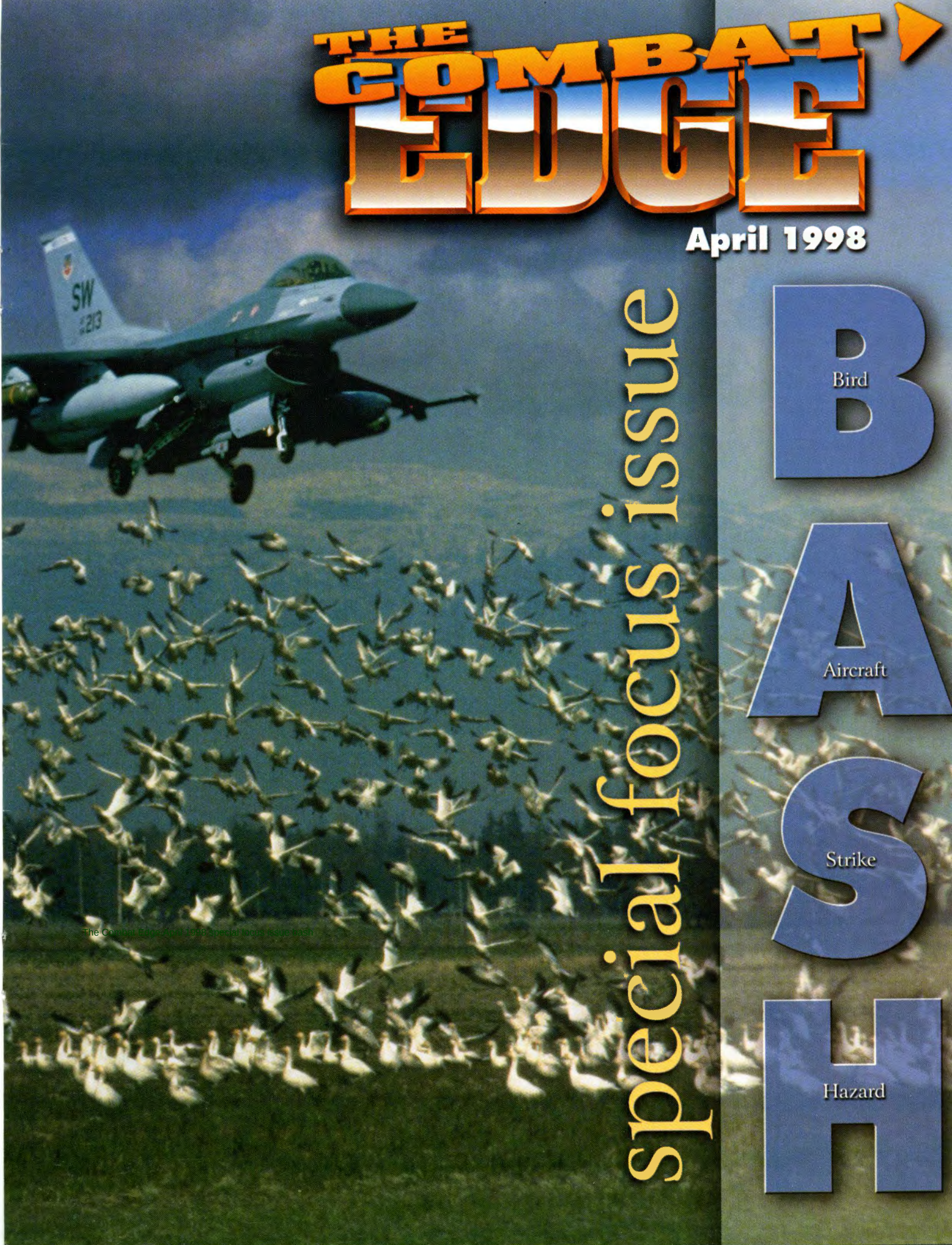
THE COMBAT EDGE

April 1998



special focus issue

BASH

Bird

Aircraft

Strike

Hazard

THE COMBAT EDGE

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CONTENTS

APRIL 1998
ACC SP 91-1 VOLUME 6 ISSUE 11

FEATURES

DEPARTMENTS

ACCent on Safety

It's springtime, and we all know what that means ... Right, the return of the birds! As you read this, the annual northbound migration should be well underway. Not only will there be several million of our little feathered wingmen on the move, but the hawks, vultures and other soaring raptors will be putting in overtime flight hours working the spring fields in order to feed their new hatchlings. This adds up to lots of added risk opportunity and the reason this month's magazine focuses on the hazards of bird strikes.

Certainly, one of the most tragic bird strike mishaps in the Air Force's history was the 22 September 1995 crash of an E-3 AWACS at Elmendorf AFB AK. The tale, as retold in the article *Tragedy at Elmendorf* (page 26), is a vivid reminder of the dangers to aviation posed by these creatures. The article is frank and pulls no punches in recounting the events of the mishap and the subsequent investigation. Reading it is a cathartic experience, but, like an old-fashioned "blood and guts" training film, it solidly hammers home the need for strong measures to address the risks that birds pose to our flight operations.

As good as the E-3 article is, I was initially hesitant when the EDGE's editors told me they wanted to run it. I questioned whether we needed to reopen a wound that time was just beginning to heal. I thought that we could tell the dangers of bird strikes without rehashing the details of those people whose actions were held accountable by the accident investigation. In the end, what persuaded me was a newspaper article, one of many which have recently assailed the Air Force's mishap investigation process as being shallow, unprofessional, and mostly interested only in exonerating a self-serving "band of brothers." I think the Elmendorf mishap clearly shows that we do have a system which holds people accountable for their actions and responsibilities and ultimately strives to prevent any reoccurrence of a similar tragedy.

Ya'll fly safe ... and keep your distance from our feathered friends!

Colonel Turk Marshall
Chief of Safety

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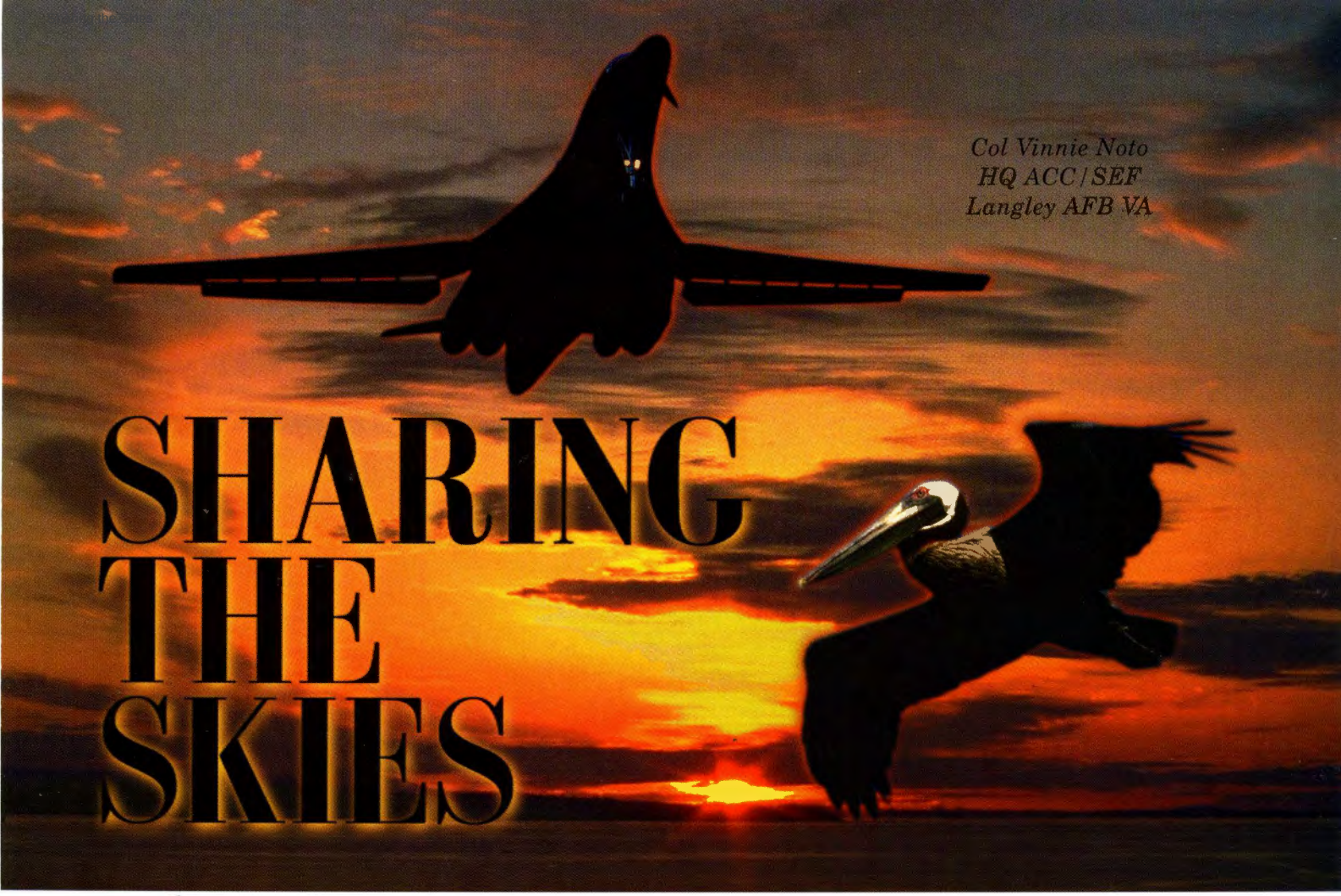


SHARING THE SKIES

Col Vinnie Noto
HQ ACC/SEF
Langley AFB VA

As aviators, we know we share the sky not just with other aircraft, but with our feathered friends as well. Most of the encounters with our feathered friends are painless, but some can be deadly. Three events stand out for me whenever I talk about bird strikes and what they can do. I've had many encounters in 26 years of flying, but these three bird strikes are the most unforgettable.

Strike #1

"How in the world did you ever hit a bird that big? I thought you flew so slow that birds could actually land on your wings." I vividly remember the Deputy Commander for Maintenance (DCM) yelling at me for damaging one of his B-52s. He was an F-4 driver and could never understand how a plane that big, slow, and unmaneuverable (his opinion) could get damaged by a bird.

We had been flying out of Loring AFB on an exercise called GLOBAL SHIELD. The mission was long, but we all enjoyed the flight because it was still winter up north — spring was in full bloom down south. The low-level route took us over some beautiful southern Louisiana countryside ... lots of water, green landscape, a beautiful day. It felt warm just looking outside. We weren't thinking much about birds, although we had seen some. Having successfully completed our bombing run, we were just enjoying the ride.

All of a sudden, I saw a small gray dot appear in the center of my window. It got real big ... real fast. Then "wham," it hit! The only reaction I had was to duck. Something hit and hit hard, maybe just below my window. The copilot and observer's reaction also was to duck. After I got control of myself and the aircraft, we climbed to route abort altitude, calmed down the rest of the crew, and followed the Dash 1 guidance. We found only minor problems to the radar and the EVS; we were even still pressurized. We did the big crew conference — we call it Crew Resource Management (CRM) now — and decided to go home where we landed uneventfully. On postflight, damage was discovered to the radome, and the area under my window. There was a lot of sheet metal to repair and a new

radome to install ... not the type of repair action you want done on your jet in the middle of a very big exercise. Hence, the DCM was not a happy camper to say the least.

Did I do enough? What did I learn? Well, to begin with, I now had a healthy respect for what a bird could do and counted myself very fortunate. If that crane had hit just a bit higher, I'm not sure what would have happened. I had already removed my mask and visor. I had never encountered a hit like that before. Oh, I had seen lots of small smears on our huge flaps in the past, but this really scared me. Had we as a crew really prepared and talked about this? Could we have avoided this mishap? The fact remains that we had to take a good jet out of the line-up for this critical exercise. Deep down inside, I knew we hadn't done a detailed job in assessing the risk of a bird strike during mission planning; we just depended on the "big sky theory" more than anything else. Well, for me ... things would change now.

Strike #2

My second bird strike story is worse than the first. I had flown in the La Junta low-level route endless times in both Buffs and Bones. I never really noticed the two lakes we flew between just prior to the target area — an old dirt triangular runway intersection. Yet everyday for years, birds (thousands of them) flew from one lake to the other directly across our route of flight. As the investigating officer, I got to see firsthand what a 17 to 21 pound inland pelican can do to a B-1B going about 560 knots true air speed (TAS). This bird strike resulted in three fatalities, a destroyed aircraft, shattered families, and a lasting impact on how the B-1B would be flown and its crewmembers trained. It's strange; we just took those birds for granted. I guess in 1987 we didn't manage risk very well. I know we can do better today.

Strike #3

It was a beautiful west Texas spring day. As the Deputy Operations Group Commander, I was doing the paperwork drill when my "brick" began to speak to me. A transient T-38 had a serious problem, and we needed to "Get out to the flight line ... now!" The other deputy and I both got into the staff racer. Using all the electric gear in the car, we determined the T-38 had taken a bird strike in the front cockpit while flying low level; the back-seater was in the process of trying to land the aircraft on our runway.

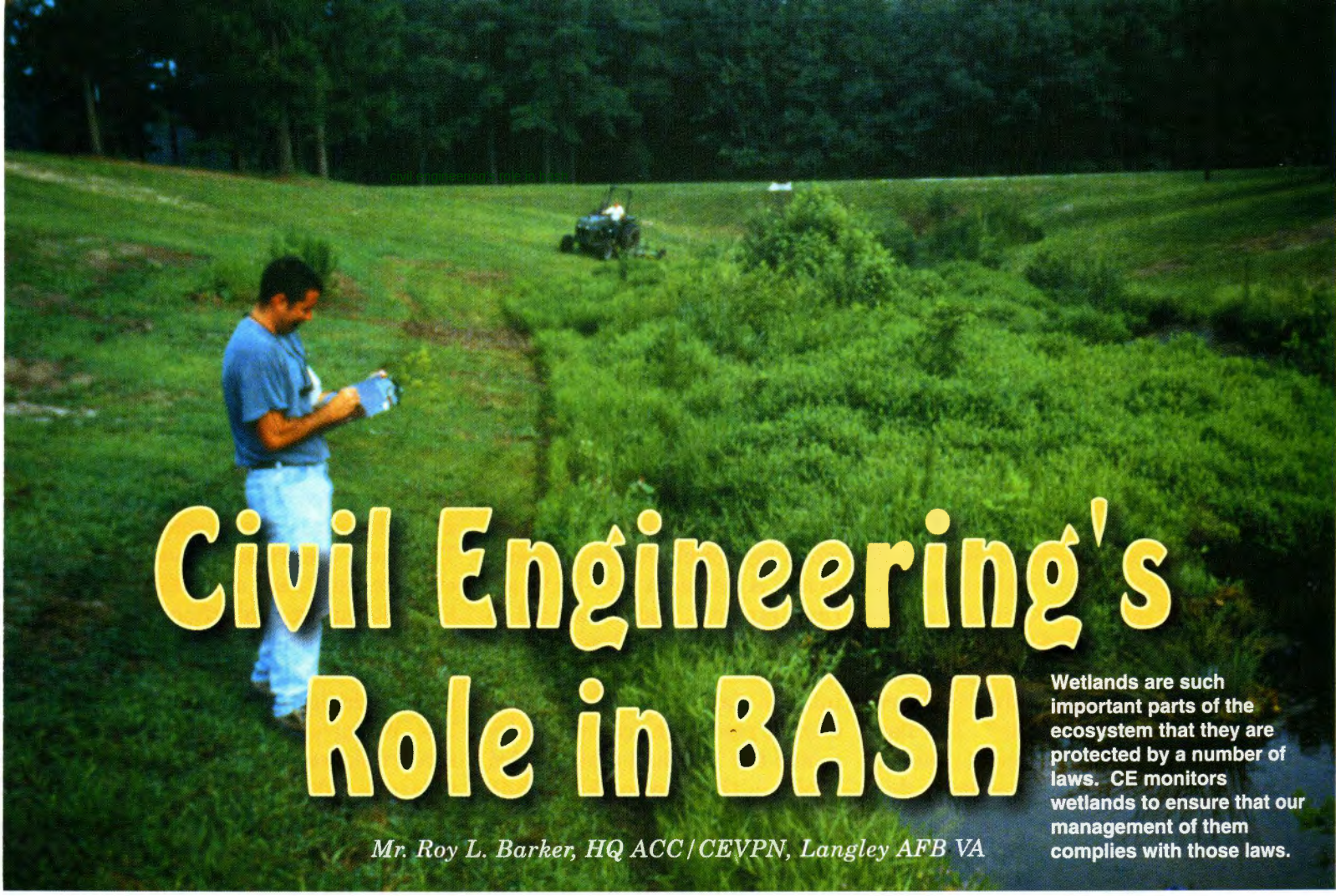
We all watched (with fingers crossed) as he made a perfect landing — despite what I'm sure he knew had happened to his partner in the front seat. Moments before, they were just two young Instructor Pilots (IPs) honing their flying skills. Then an instant later, they were confronted with disaster. As he turned off the runway, the fire trucks, ambulance, and flight medicine folks immediately went into action. It was a very sad scene.

I remember being handed the front-seater's helmet. It was intact, but very bloody. I will never forget his eyes and his death face as I watched him being gently removed from his seat. I remember thinking a bird had just taken the life of yet another fellow pilot. The back-seater was beside himself; his buddy was a fatality, and the reality of the events were now unfolding in front of him. Not much we could say; we told him he did all he could and accomplished a remarkable feat of airmanship getting the jet on the ground so quickly. I know these events are very somber in their message, and I didn't mean to be morbid.

Risk Assessment

These three instances all have a point. Birds aren't selective. They are creatures driven by other forces. They are creatures of habit, but we can't afford to be that way. Bird damage can range from a few dollars for a simple dent to the loss of an aircraft or life. We have so many more bird strike risk assessment tools available to us today than we did years ago. Do you use them? Do you know where to find them or even what they are? All these instances make me look much differently at birds. As a youth, they were my inspiration to fly. Today, their existence provides me with a healthy understanding of what they can do when we share the skies with them.

Next time you prepare to fly, make sure you have planned your mission completely by identifying potential bird hazards and taking appropriate risk control measures. If you are a scheduler, ensure you know when and where bird hazards exist in training airspace and use other airspace during those times. Commanders need to ensure both their aircrew and schedulers are aware of these hazards and taking appropriate measures. Remember, today's near miss could be tomorrow's mishap. ■



Civil Engineering's Role in BASH

Mr. Roy L. Barker, HQ ACC/CEVPN, Langley AFB VA

Wetlands are such important parts of the ecosystem that they are protected by a number of laws. CE monitors wetlands to ensure that our management of them complies with those laws.

Even though the Flight Safety staff on base (SEF) is the Office of Primary Responsibility (OPR) for the Bird Aircraft Strike Hazard (BASH) Program, concerns for aircrew safety and mission support cross all organizational lines. The hazards associated with bird strikes are significant. As a result, any individual or organization having the capacity to contribute to controlling BASH should become actively involved in the bird strike risk reduction effort. For example, the Civil Engineering (CE) offices throughout ACC are responsible for many activities that directly affect the local bird strike hazard throughout the command. And besides our feathered creatures, CE is also responsible for the hazards posed to aircraft by wildlife on the ground. Sometimes an animal roaming on the flight line that is struck by an aircraft during takeoff or landing can cause the same disastrous results as if the aircraft hit a seagull at an altitude of 5,000 feet. Aircraft collisions with birds and other airfield wildlife cause millions of dollars in aircraft damage each year. More importantly, however, these hazards can also cause the loss of aircraft as well as the lives of aircrew members. For any personnel that take to the sky, it is a serious problem to deal with.

The purpose of this article is to explain the role that CE has in a local, base sponsored BASH program. To begin with, CE is one of the few organizations on base with the resources and capabilities to change the ecology of the installation. This occurs when they build new facilities, manage natural resources (it's required by law), or design stormwater drainage systems. And if CE doesn't have the in-house equipment to turn the dirt, they know how to get in touch with a contractor that has a bulldozer big enough to get the job done.

CIVIL ENGINEERING BASH PROGRAMS

Base Civil Engineering offices have long recognized that they have the potential to do good (or evil) when it comes to BASH.

They have a high level of concern to make sure that all CE actions are BASH-friendly. This is one reason why they are usually the only base organization staffed with natural resources professionals that have the know-how needed to analyze BASH conditions and consequences. But the story doesn't end there — CE has a number of programs that bring more to the BASH issue than just scientific advice.

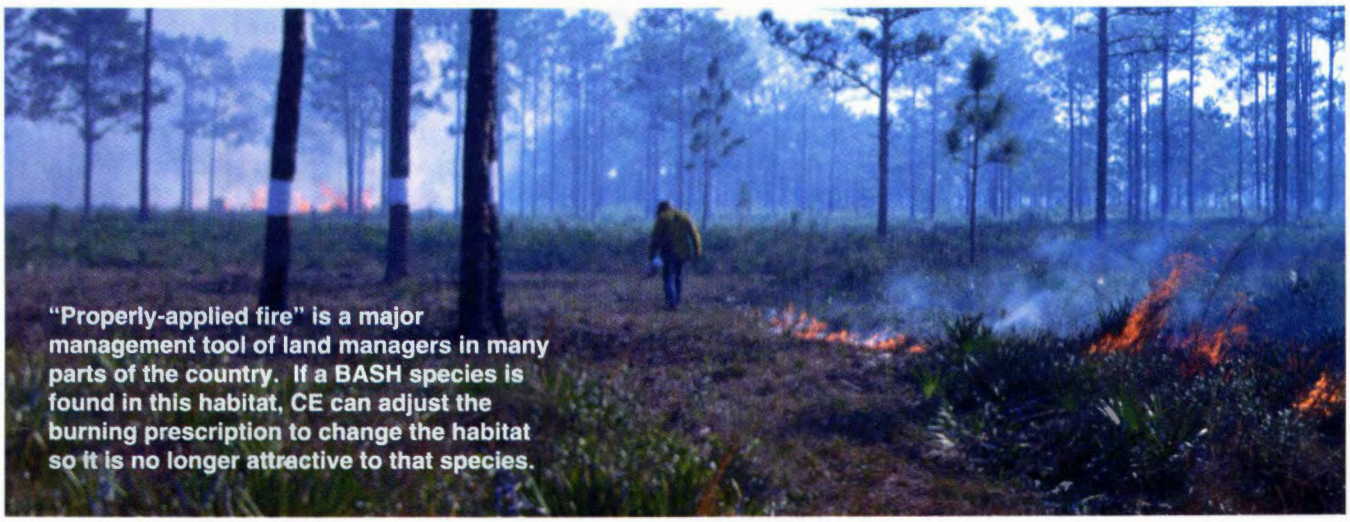
Ornamental landscaping can play an important part in managing BASH. Landscaping near the runway can be developed to be unattractive to BASH species, while landscaping at more remote sites can be developed as magnets, actually attracting birds away from the runway area.

The Endangered Species Program

This program incorporates the design and performance of biological studies and monitoring projects that provide data useful to improving the local Bird Avoidance Model (BAM). It also contributes to increasing the awareness and local understanding of the bird strike hazard. It has been said, "knowledge is power." When we're talking BASH, local knowledge is where the "real power" lies. You can only get so much BASH guidance from a book. After that, you have to know: (1) what species are creating the local bird hazards, and (2) where, when, and under what conditions the hazards are occurring. The CE personnel responsible for the Endangered Species Program either have that information readily on-hand or are able to obtain it for you by locating someone who does have it. Why? Well, this is because endangered species laws require them to keep up-to-date on the local ecology. And while we're talking about laws, the CE folks — especially those working the Endangered Species Program — are very familiar with the rules governing what we can and cannot do to the many species protected by law. Keep in mind that it can become a very delicate legal matter when a protected species is also a local hazard to flying aircraft.

The Hunting Program

This program is intended to manage problem game/BASH species. It accomplishes this by harvesting them and by managing their habitat to reduce attraction to species that cause bird strike hazards. As part of this program, another method of managing the strike hazard is by attracting species that control the BASH species.



"Properly-applied fire" is a major management tool of land managers in many parts of the country. If a BASH species is found in this habitat, CE can adjust the burning prescription to change the habitat so it is no longer attractive to that species.

The Forestry Program

This program can change the composition of forested areas and minimize their attractiveness to BASH species through modification of harvesting schedules and prescription burning procedures. (Note: By the way — despite what Smokey Bear says, "properly-applied fire" is a major management tool of land managers in many parts of the country.) Harvesting timber as a logging operation adjacent to runways in support of BASH can reduce the overall cost of a standard land clearing operation and provide income to the program.

The Land Management Program

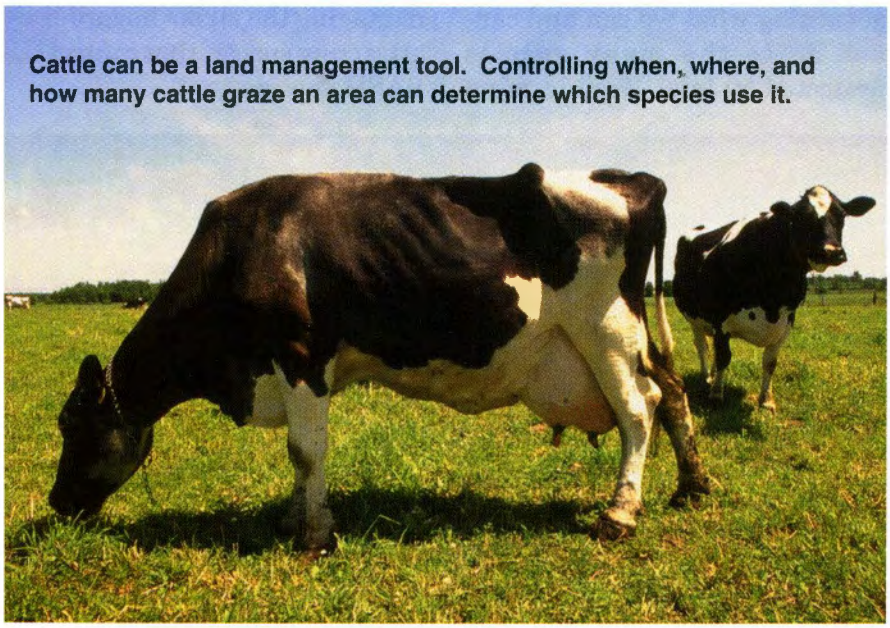
This program can select landscape plant species and grounds maintenance prescriptions that reduce BASH. It also can even attract problem species away from the airfield and toward parts of the base where they will not add to the bird strike hazard. Successful Bermuda Grass Release Programs (developed through herbicide use and seeding) at selected installations have reduced BASH problems and reduced grounds maintenance cost.

The Pest Management Program

This program can develop efficient control programs for nuisance species. CE personnel working the Pest Management Program are already set up, trained, licensed, and registered to control the species that annoy base residents. They bring a lot of knowledge to the BASH effort because they know what does and does not work in certain situations and how to implement controls safely and legally.

While Flight Safety's Bird Aircraft Strike Hazard Reduction Plan is the focus of installation BASH control, CE's Integrated Natural Resources Management Plan (INRMP) establishes how natural resources (including birds) are to be managed on the installation. Obviously, there is overlap here. Both plans deal with the same land and the same wildlife; and where there are overlapping responsibilities, there is need for close coordination. Specifically, Civil Engineering personnel must be involved in the development of the BASH plan, and Flight Safety personnel must be involved in the development of the INRMP. The simplest way to make this happen is to ensure that CE is represented on the Bird Hazard Working Group (BHWG) and to make sure that both plans are reviewed by members of the working group. As reflected in Air Force Pamphlet 91-212, Bird Aircraft Strike Hazard (BASH) Management Techniques, the BHWG should consist of "representatives from flight safety, airfield management, base operations, air traffic control, civil engineering, aircraft maintenance, and any other organization concerned with bird hazards." The group should meet regularly to assist the Safety office in drafting and implementing the Bird Aircraft Strike Hazard Reduction Plan.

There is still one more BASH area where Flight Safety and Civil Engineering paths cross. The National Environmental Policy Act requires that all proposed federal actions be analyzed for environmental impacts. This is a CE responsibility. The BASH plan (and the INRMP, as well as everything else done on the base — right down to mowing the golf course, flying planes, and painting crosswalks) must pass through the CE's Environmental Planning function for impact analysis before it can be implemented.



Cattle can be a land management tool. Controlling when, where, and how many cattle graze an area can determine which species use it.

BASE LEVEL BASH MANAGEMENT

Now, so much for the broad-brush stuff — let's talk about details. Here are some of the activities that CE staffs at ACC bases are currently performing and which may have direct benefit to base level BASH management. It's in bullet format to make it easier for you to pick and choose the actions that might be most useful in solving the BASH problems confronting your base.

BASH is more than just removing birds. Many people consider the birds a valuable part of their environment, and laws strictly control how birds can be managed. Any BASH program must carefully consider and address these issues.

- **Identify, evaluate, and monitor BASH problem sites.**
  - Conduct biological surveys (i.e., population surveys, habitat studies, wetland delineations, and ecological studies).
  - Identify ecological factors affecting BASH conditions.
  - Provide instruction on how to monitor hazard conditions.
  - Develop a bird identification book for your local area.
  - Identify bird strike remains.

- **Develop and maintain a database of problem species on base.**
  - Prepare reference maps of BASH species' habitats.
  - Extract and disseminate BASH-relevant data from existing wildlife studies.

- **Perform direct control of pest animals.**
  - Develop and manage a hunt program to control pest animals.
  - Conduct and advise on controlling non-game pests.
  - Design and install exclusion devices (e.g., fences, cattle guards, etc.)

- **Advise on habitat "manipulation" methods (which are usually more cost-effective than "control" methods) that can manage BASH.**
  - Manage wetlands to control waterfowl use (year-round or seasonal).
  - Manage wildlife habitat to control problem species use.
  - Develop attractive habitats away from airfield.
  - Develop landscape plan for minimal BASH.
    * *Use plants and/or turf varieties that do not attract BASH species.*
    * *Lay out landscape to reduce attractiveness to BASH species.*
    * *Prune and maintain vegetation to reduce attractiveness to BASH species.*

- **Work compliance issues associated with BASH activities.**
  - Environmental impact analysis.
  - Wetlands modification permits.
  - Trapping permits.
  - Hunting permits.
  - Depredation permits.

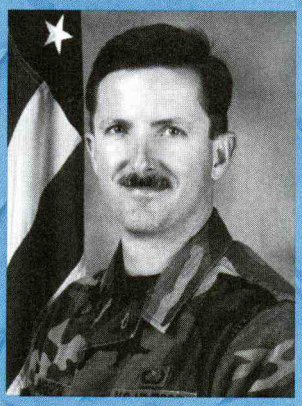
- **Develop Public Relations materials such as news releases explaining the need to manage pests/animals and interpret the Air Force's program to the public.**

- **Network with other natural resources professionals and organizations to ensure Air Force programs are based on the most up-to-date information and ideas.**
  - Form a regional land manager information exchange network to develop a constant, real-time picture of the BASH situation in the region.

The Bottom-Line

When all is said and done, BASH management is too important and complex a challenge to be a unilateral effort. The installation Bird Hazard Working Group was set up in recognition of that situation. It is designed to coordinate the BASH control effort and ensure that all base activities are BASH-friendly. Civil Engineering brings a lot to the table in both areas and contributes significantly to the success of the bird strike program at any base. ■

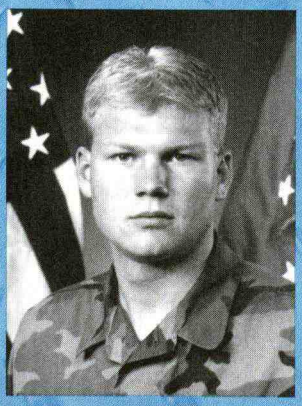
Monthly Awards



CREW CHIEF SAFETY AWARD OF DISTINCTION

SrA Kurt H. Jungwirth
57 AGS, 57 WG
Nellis AFB NV

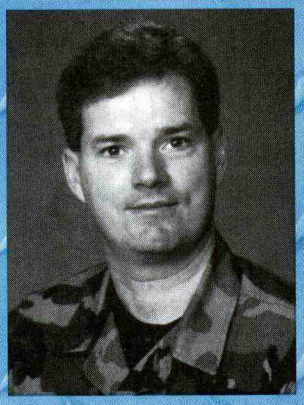
At approximately 0900 on 28 Jan 98, SrA Jungwirth was performing a pre-launch inspection on an F-15C aircraft. During this abbreviated inspection, Amn Jungwirth pushed side to side and up and down on the radome. Although this is not a required inspection procedure, Amn Jungwirth performed this check because his experience had led him to know that this check would reveal a loose radome, if it existed (a rare discrepancy). While pushing on the radome, he detected a slight movement and a faint "clicking" sound. He immediately notified the Expediter and Production Superintendent. Panels #3 left and right were opened to gain access to the radome mount bolts. All four mount bolts were found to be extremely loose. Had this condition gone undetected, an in-flight loss of the radome and possibly the radar antenna would have occurred. Serious damage or loss of aircraft and aircrew would have followed. Amn Jungwirth's attention to detail, commitment to safety, and willingness to do more than required prevented serious damage or loss of an aircraft and loss of life.



FLIGHT LINE SAFETY AWARD OF DISTINCTION

SrA Jerry L. Shepherd
33 MXS, 33 FW
Eglin AFB FL

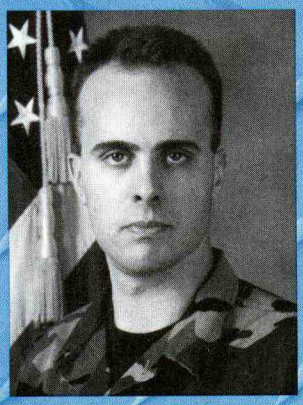
While deployed with the 58th Fighter Squadron and assigned to the 347th Air Expeditionary Wing, Shaikh ISA AB, Bahrain, SrA Shepherd prevented a catastrophic mishap involving an explosive loaded aircraft. On 10 Jan 98, while performing duties as swing shift flight line driver, Amn Shepherd was dispatched to the flight line to transfer AGE equipment. After connecting the equipment to the bobtail, Amn Shepherd noticed what he thought was someone pushing an MC-7 air compressor across the aircraft parking ramp. Upon further observation, he realized the air compressor was moving under its own power unattended. He immediately jumped from the bobtail, ran 60 feet to the moving equipment and applied the parking brake on the front of the unit. The forward momentum of the air compressor dragged him approximately 12 feet before coming to rest under the wing of an adjacent F-15, just inches from the aircraft fuselage. Were it not for the alert actions of Amn Shepherd, a catastrophic mishap would have certainly ensued. The air compressor would have struck the centerline fuel tank and a live air-to-air missile, potentially starting an explosive chain reaction that could have destroyed all of the aircraft on the crowded parking ramp. The quick thinking and assertive actions of this airman not only prevented the destruction of valuable combat resources, but loss of life as well. Truly outstanding, Amn Shepherd is most deserving of this award.



GROUND SAFETY INDIVIDUAL AWARD OF DISTINCTION

SSgt Gary R. Papera
388 MXS, 388 FW
Hill AFB UT

On 1 Oct 97, SSgt Papera was inspecting a General Electric F110-100 engine, serial number 5155, sent into maintenance for suspected damage to the High Pressure Turbine (HPT) blades. After accessing the suspected damage, the blades were found to be within serviceable limits. However, due to the possibility of further damage to the turbine rotor, Sgt Papera continued his inspection of the HPT. During this extensive borescope inspection, he discovered a small and almost undetectable severe defect with the HPT disk. This defect had gone unnoticed by others; but because of his extensive knowledge, he was immediately able to identify bulging in the HPT disk platform. In addition to the HPT disk platform bulging, he found two aft section pieces of the HPT disk post broken off. His investigation went beyond tech data and TCTO requirements. Sgt Papera provided OO-ALC engineers with digital pictures of the HPT disk for further analysis. This engine was damaged in a manner similar to a previous 388 FW F-16 Class A mishap in SWA which led to engine failure and loss of aircraft. His early detection of the F-16 damage allowed the HPT to be removed from the engine prior to catastrophic failure of the HPT disk. Sgt Papera's technical expertise and meticulous inspection techniques revealed a critical deficiency and corrected the situation without further damage. The actions taken by Sgt Papera prevented imminent engine failure and the loss of a valuable Air Force asset.



WEAPONS SAFETY AWARD OF DISTINCTION

SSgt Steven R. Valentine
57 LG, 57 WG
Nellis AFB NV

SSgt Valentine is a dedicated and energetic NCO who sets the example and endeavors to ensure a safe environment for fellow workers. He is directly responsible for all weapons qualification and certification training for over 75 weapons load crew members. His responsibilities cover two separate mission design series and 17 different munition items for the largest and most diverse Aircraft Generation Squadron in the USAF. He trains explosive ordnance disposal personnel on standardized safing procedures on all munitions loaded on the F-16 and A-10 aircraft. Always one to set the standard, he integrates weapons safety into every aspect of training to ensure quick and accurate response to a potential accident or incident. He has provided corrective actions to over 215 weapon loads. On 21 Nov 97, Sgt Valentine discovered existing conditions that may have resulted in a destroyed A-10 gun system, aircraft, or loss of life if not corrected. He noticed wear marks indicating excessive movement of the gun during firing; suspecting recoil adapter failure, he investigated further. Upon further observation, he discovered the following: loose hydraulic drive mount bolts, chaffed wire harnesses, broken clamps, and missing parts. Upon completion of his investigation, he determined that a malfunctioning lower recoil adapter was allowing the gun housing and drive gears to contact the aft gun mount which was shearing the gear mount bolts and cutting into the mount. Failure to identify and correct the noted deficiencies would have resulted in catastrophic gun failure and severe damage to the airframe. A "seasoned" veteran on the A-10 aircraft, Sgt Valentine reviewed the proper technical data and repaired the problem himself. His impeccable attention to detail, persistence, and use of mishap scenarios has made safety awareness an integral part of the load crew environment. He's an absolute key to zero weapons mishaps on the busiest flight line in the USAF. Sgt Valentine's actions to prevent accidents are representative of his daily performance.


Fleagle
TINY ONE...TINY ONE. BE AWARE OF NUMEROUS MIGRATION ACTIVITY AT YOUR PRESENT ALTITUDE. OVER.
DO THEY REALLY THINK I'M GONNA GET ALL SWEAT SOAKED AN' SHAKEY OVER A COUPLE OF TWO POUND BIRDS?
ME WHO HAS FLOWN THROUGH FLAK, STORMS AND TH' DARK OF NIGHT WITHOUT CONCERN.
WHEN THEY GET ONE LOOK AT MY SIZE IT'S THEM WHO WILL BE GETTING OUT OF TH' WAY.
WHA... WHAT'S THIS...?
GOOD LORD!!
BASH!
SPLAT!
BUMP!
SMASH!
HIT!
OUCH!
SCRATCH!!
TINY, IT SEEMS YOU IS PACKIN' A FEW EXTRA FEATHERS, OLD BUDDY.
SHUT UP.
HARRISON

DEBRIEF

When It's Not So Obvious

Major Mark "Rhino" Ronco, USAFR
303d Fighter Squadron
Whiteman AFB MO

Can you recall your days in initial training and the dreaded Emergency Procedure (EP) of the Day? Do you remember when the StanEval instructor pilot called your name and you knew it was your opportunity to excel in front of your classmates and instructors, impressing all with your emergency procedures knowledge? You probably began by reciting the three basic rules in every emergency situation: **Maintain aircraft control ... Analyze the situation ... Take the proper action.**

All the while, you were desperately trying to remember the boldface or memory item for that emergency. After regaining your composure and confidently stating the boldface, you gathered all the indications and cues given to you and dutifully went to the appropriate checklist. Having covered yourself in glory so far, you then expounded on all that the Dash One had to say about that emergency — repeating every note, warning, and caution ever written. By now you were sure you had aced the scenario and saved the jet, becoming legendary in your own mind. Do you remember how it turned out? More times than not, people got it wrong (or only partially correct) and sat down to a chorus of howls from their classmates. It's funny now ... but back then, it was a nightmare!

For many of us, the above daily ritual in pilot training was the beginning of how we learned to deal with emergencies in the air. Today, as a flight examiner, I administer emergency procedure evaluations based upon obvious indications and known failure modes in the A-10. I tend to spend most of my time thinking about the obvious and not the abstract when it comes to aircraft failures. In the story that follows, you will see that the obvious does not always exist. In order to maintain control of an aircraft, sometimes it can require all of your skill and experience. Nothing is obvious in

the black of night; and just maybe, there may not be any published procedure for what is specifically wrong with your aircraft.

It was January 1997 ... I was the instructor and flight lead on a night vision goggle upgrade sortie for a young wingman in my squadron. After a straightforward brief covering tactical execution using Night Vision Goggles (NVGs), we departed into the darkness to make our planned takeoff time approximately 1 hour after sunset. On departure, I had just snapped my NVGs into my helmet and was answering departure control when all of a sudden ... my aircraft began to violently shake and make a loud, deafening noise. My first thoughts were that I had a compressor stall on one of the engines, but a quick look at the engine instruments showed normal operation and parameters. I continued to climb to about 4000' Mean Sea Level (MSL), called a "knock-it-off" to my wingman, and directed him to rejoin from his trail position. I began a turn to a downwind pattern to stay close to base and remain underneath the overcast. As I looked inside the cockpit at my instruments during the turn, I noticed that I had zero airspeed, my altimeter was indicating below field elevation, and the vertical velocity indicator was wildly fluctuating plus or minus 1000 feet per minute (FPM). A quick check in the Head-Up-Display (HUD) confirmed that it was not a gauge problem. All I had was the attitude indicator, heading select indicator, velocity vector in my HUD, and an aircraft that felt like it wanted to come apart due to the excessive vibration. To say that the roots of confusion were taking hold is an understatement.

Maintain Aircraft Control

The deafening noise and vibrations — along with the lack of normal flight instruments — were enough to bring me to the basics that I had learned so many years ago ... fly the jet first! I set a power setting that I knew would keep me flying considering the full fuel load and used the Angle of Attack (AOA) gauge to make sure I was in the ballpark for airspeed. The Attitude Direction Indicator (ADI) and HUD would suffice to maintain straight and level flight, but I had to reduce the vibration and noise. The instrument panel was shaking so violently I could barely read the instruments.

Analyze the Situation

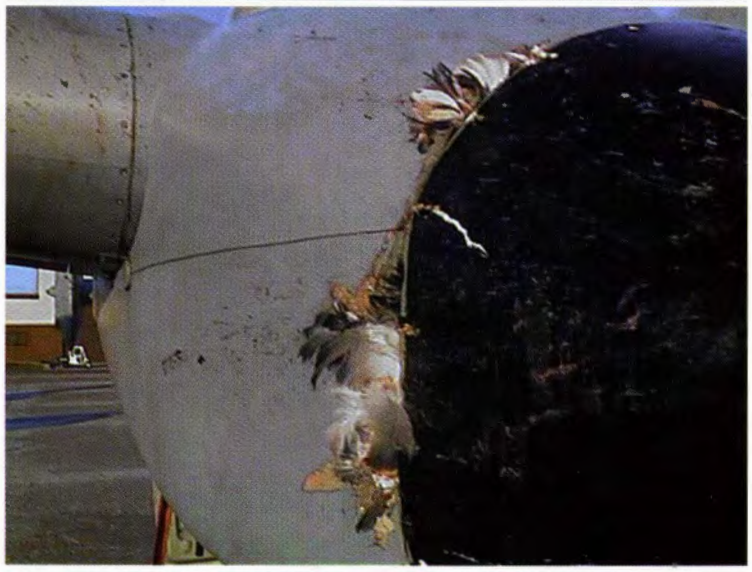
As I leveled at 4000', I pulled the throttles back slightly to maintain the AOA setting. I noticed a slight reduction in the vibration ... a clue ... I've got some kind of engine problem. Even though both engines were matched up and reading normal on the gauges, I decided to pull the right throttle back. As I did that, the vibrations and noise were significantly reduced. I tested the left throttle in the same manner with no change in vibration; so I retarded the right throttle to idle and the vibrations and noise subsided to a minimal level. Of course, it now required a moderate amount of rudder correction to maintain coordinated flight. As my wingman rejoined, I had him check my aircraft for damage using his NVGs, but he could detect nothing unusual. Now I felt more in control and finally had a moment to contact the Supervisor of Flying (SOF). After a short consultation with a Functional Check Flight (FCF) pilot, we decided this problem was outside the scope of any published Dash One procedure. No one could make a connection between the multiple problems I was experiencing ... least of all me. I still had no clue why any of this was happening.

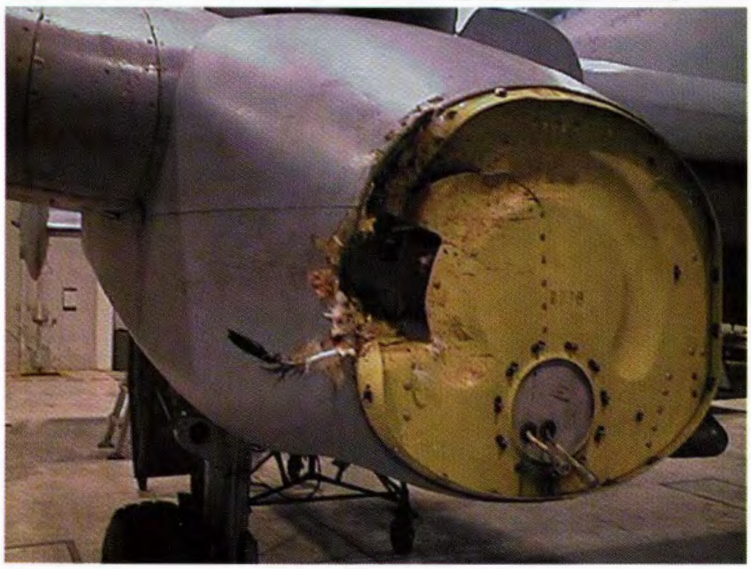
Take Proper Action

The Dash One for the A-10 mentions using sound judgment and common sense in conjunction with a full understanding of all aircraft systems when dealing with emergency/abnormal situations. Since I had no clue why all this was happening I decided the time for analysis was over. I knew I had a sick jet, and it was time to put it back on the ground. I had my wingman read the only pertinent checklist — the engine failure procedure. It was now time to adapt, innovate, and overcome. The plan was to shoot a single engine Instrument Landing System (ILS) approach with my wingman acting as the talking airspeed indicator and altimeter. We accomplished a modified controllability check and got ready for the approach. The ILS worked fine, and the only surprise was how much rudder it required to maintain coordinated flight once it was configured. The landing was uneventful, and I rolled into the dearm and shutdown procedure.

I climbed down the ladder and noticed a few bird feathers on one of the pylons. Only after I walked to the right side of the aircraft did I realize the extent of the damage and what had happened. My Warthawg had sustained massive bird strikes from at least five Canada snow geese. Two geese went down the right engine de-

These photos below depict the damage incurred to the right gear pod cone and front housing cover plate structure.





stroying numerous fan blades in the fan section, continued on to tear out a 4-foot section of sheet metal next to the compressor section, and finished by destroying the engine tailcone. Two more geese met their fate on the right gear pod and leading edge of the right wing, severing both pitot-static lines exactly where they run through the leading edge of the wing. Another goose hit the left slat and terminated itself on the fuel drain underneath the left engine, barely 2 inches below the intake. All in all, it was not a good night for the geese ... or me.

Safety Lessons Learned

1. Migratory waterfowl fly at night and are in their highest concentrations 1 hour before and after sunset. I think about that now when I fly at night.

2. Air Traffic Control's radar can see large flocks of birds, but cannot report them unless visually confirmed by a pilot — which isn't gonna happen at night. So now I always ask them before I takeoff if they see anything unusual.

3. What is totally obvious in the daylight can be totally invisible in the dark. Most of the confusion and unknowns that exist at night would have been easily resolved by visual cues during the day. In fact, this incident would most likely have never happened in the daytime; I probably would have been able to see such a large flock of birds and avoid them.

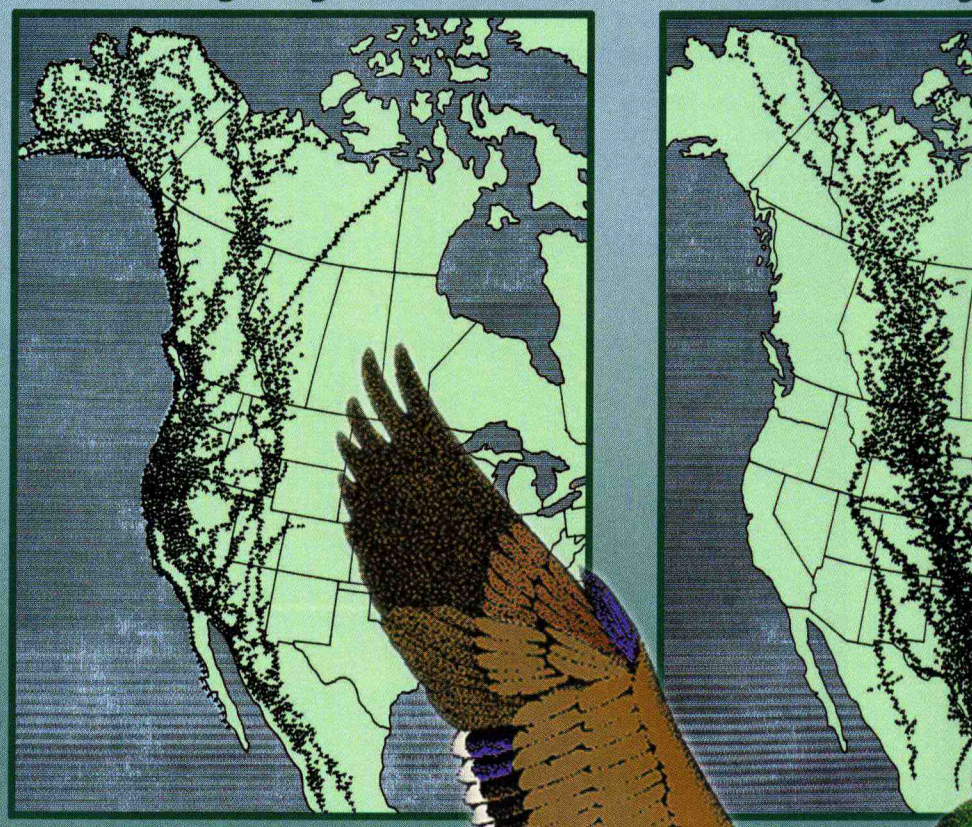
4. Operational Risk Management (ORM) definitely plays an important part in night operations; the risks are not the same as for day operations and need to be assessed accordingly when planning your night missions.

5. The three basic rules of emergencies always work, don't forget them!

Finally, we all know of other aircraft in the inventory that have been brought down by bird strikes and other unusual problems. I was very fortunate that night. The threats are out there as we continue to increase our night operations. Think about it, plan and brief it, and be ready for the "not so obvious" to happen. Fly safe! ■

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.



U.S. Fish and Wildlife Service

Designed by Laurinda Minke and reprinted with permission from Approach, Sep-Oct 97

by Charles D. Lovell

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Migration- Ninety per
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the flight, the higher the a

The fall and spring are
fowl migrate. Fall migration
tend to move in large flock
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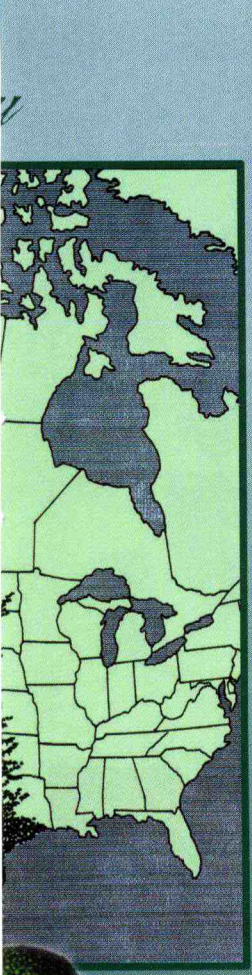
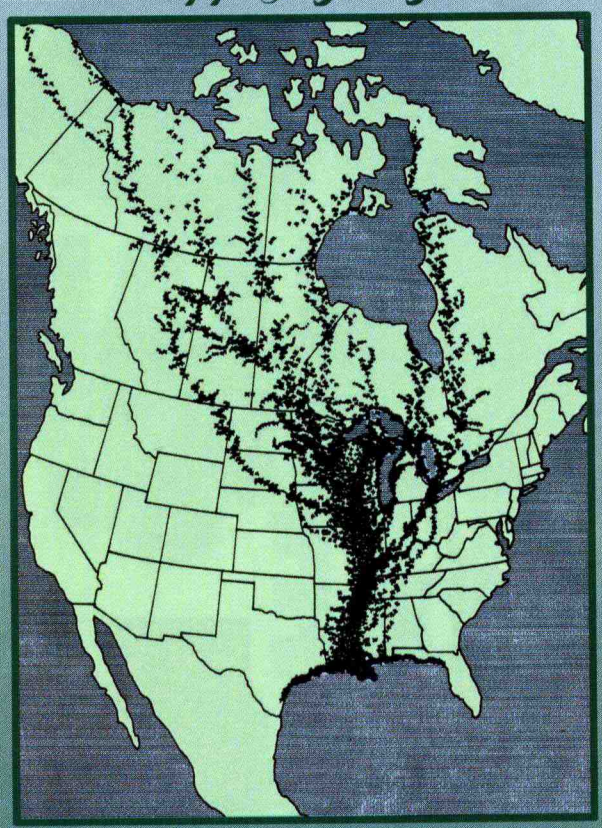
begin as early as August
early as February and r
November and March-Apr

Many factors influenc
influence migration the m
until they deplete their fo
delay, and magnitude of
often coincide with major

Waterfowl tend to feed
to migrate mainly at night
to their wintering grounds



Mississippi flyway



Atlantic flyway

Where the Birds Are

eese, and swans, collectively known as waterfowl, account 5 percent of the bird strikes to USAF aircraft, but these ds pose a substantial threat to military aircraft during mi- eriods and daily feeding flights. The USAF lost an E-3 AWACS wmen after the aircraft struck Canada geese at Elmendorf mber 1995. If you use information about waterfowl migra- and activity patterns to schedule training flights during reduce the risk of waterfowl strikes.

cent of migratory flights occur below 5,000 feet MSL; how- have been reported as high as 20,000 feet MSL. During altitudes that depend on terrain and distance (the longer titude).

the two peak periods during which North American water- is far more noticeable than spring migration. Fall migrations s to wintering areas in a short time, whereas spring migra- e irregular. Depending upon latitude, fall migrations may and run into December; spring migrations may begin as n through May. Peak months of migration are October- il.

e migration; changes in the amount of daylight probably ost. If food is plentiful, many species will delay migration od supply. Also, weather conditions influence the onset, migrations. Large-scale migrations, especially in the fall, weather fronts that produce favorable wind patterns.

and build up fat reserves for migration during the day and Many species will fly directly from their breeding grounds , while others will periodically stop to feed between their breeding and wintering grounds. For example, snow geese migrate both non-stop 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.

Push, Pull, Do Nothing, or maybe Duck!

The Debate Goes On

Colonel Vinnie Noto
HQ ACC/SEF
Langley AFB VA

Major "Duck" Donalds, our ACC Bird Aircraft Strike Hazard (BASH) expert gave me an old article to read by then Captains Russ Defusco and Russ Turner (*TAC Attack*, April 1986). The article, "Dodging Feathered Bullets," was about pilot reactions when seeing one of our feathered friends while flying. Duck wanted to include this old article in *The Combat Edge* magazine; he asked us, the Flight Safety Branch, for our opinions — probably the wrong thing to do.

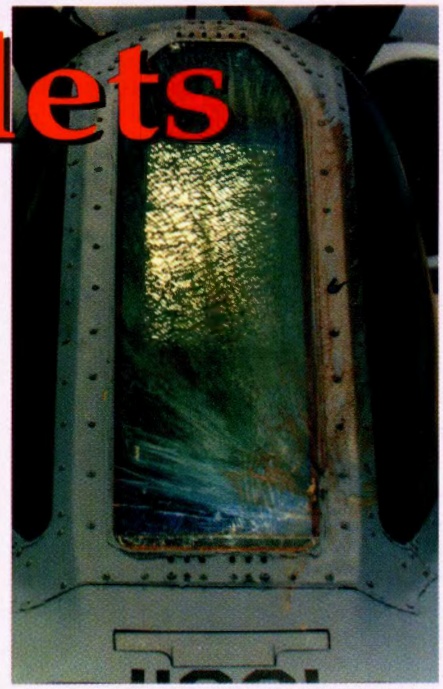
The debate on what a pilot should do in reaction to a bird threat was much greater than I expected. In fact, I was quite astonished by the number of opinions and lack of consensus I got. I had always thought either a climb or doing nothing were better choices than a dive. There were several who said aircraft type with inherent vulnerabilities (i.e., windscreen type and strength, engine position and number, other crew members, seating positions, etc.) makes the decision more complex than I had originally thought, and in reality it does. Our F-16 guy, Ron Kuriger, said he would rather (in most cases — speed dependent) take a strike on the windscreen or top of the aircraft than in his single engine. Duck, our F-15E guy, said he would rather climb in most situations (two engines, canopy not as strong, guy in back), all things considered. Rock Parrilla, our B-1B guy, said descending was certainly a choice due to the forward strength of the windows and limited stuff on top of the aircraft: the bottom has engines, antennas, bomb bays, fuel tanks, etc. Our maintenance guy, E.T. Moore, said he didn't care — the mess had to be cleaned up either way and the damage fixed. This was a bit eye-opening for me because I almost always climbed.

Is there a correct maneuver? In his article, Russ Defusco said — in most cases — climbing or doing nothing were better

choices than descending. The Pk for hitting the ground was usually 100%. I'm not so sure now whether there is a best maneuver. If I'm doing a ridge crossing at 300 ft AGL and 560 knots, pushing over may not be an option; but at 3000 ft AGL in the traffic pattern, pushing over or even doing nothing may be a better option. Okay, so I don't have an answer anymore. If you expected one, you're wrong! What I'm trying to get you to do is THINK about what YOU would do. Relive those close encounters you've had, and determine if what you did in the past was correct. Did your post-flight tell you that just maybe you did the wrong maneuver? Did you weigh all those factors I talked about before you reacted? Did you have a plan? Do you know your aircraft's vulnerabilities as well as its capabilities?

Do you know where in your local pattern you're more likely to encounter birds, or even better, where on your local low level routes/military operating areas your unit has had the most encounters? Do you know what types of birds are most common and how they react when threatened? Do you know what to do when the local bird watch conditions change? Have you done a risk assessment on what you would do to prevent a bird strike, or has your squadron done one for your low level routes or traffic pattern operations? Food for thought and action! Remember, we share the sky; and bird strikes cost us plenty every year; after reading the following article by Russ and Russ, I'm sure you'll agree. ■

Dodging Feathered Bullets



Capt Russell P. DeFusco
BASH Team
Tyndall AFB FL

Capt Russell A. Turner
USAF Hospital
Tyndall AFB FL

Reprinted from April 1986 Issue of TAC Attack

A recent accident investigation board determined that the loss of an A-10 was partially a result of improper pilot response in an attempt to avoid hitting a flock of birds. The pilot pulled his aircraft down and away from the birds, striking high tension lines and causing the loss of the aircraft. Fortunately, he escaped without injury. The question many of you may have is, "What is a proper pilot response for avoiding birds?" The question is more complicated than it may appear on the surface and specific guidance has not been available.

The bird strike problem is a serious one, costing the Air Force approximately $20 million each year. Nearly 2,300 bird strikes are reported to the Bird Aircraft Strike Hazard (BASH) Team annually. While many of these strikes are unavoidable, a reduction in the hazard is possible by a variety of means; not the least of which is pilot response to an imminent strike. The effectiveness of a maneuver to avoid birds is dependent on a number of factors including human physiology, the decision process, and aircraft response to pilot inputs.

Pilot reaction studies should be considered in determining proper pilot response. The average pilot requires 0.10 seconds for sensation of an image to travel from the eye to the brain. Focusing on the sensed object requires an addition 0.29 seconds. Perception, or recognition of the object, takes another 0.65 seconds for the average pilot. Each of the above factors will vary between individuals and in differing situations. Object size and color, relative motion, background color

and composition, contrast, and light intensity level all greatly influence the amount of time required to perceive an object to be avoided. The problem doesn't end there though, as the average pilot requires 2.0 seconds to decide to act on the perceived situation. Decision time varies with experience, level of concentration, and situation awareness, but is significant in all cases. Once the decision to react is made, 0.4 seconds are required to operate the flight controls (i.e., pull back on the stick).

The response of the aircraft to control inputs varies among aircraft. Larger aircraft generally require significantly more time to react. The average USAF aircraft requires about 2.0 seconds to respond to flight control inputs. Within the fighter community, the F-15, for example, is capable of an instantaneous pitch rate of 22 degrees per second with maximum control deflection. With a 0.5 second aircraft response to control inputs and a 5,000 foot turning radius at 450 knots, 0.52 seconds are required to move the aircraft 20 feet to avoid a bird strike.

So, it requires approximately 4 seconds from the time of initial object sensation until the aircraft has moved sufficiently to avoid a bird strike. In other words, at 500 knots, a bird must be sensed from a distance of at least 3,342 feet, or 0.63 miles, to avoid colliding with it (see Figure 1).

Frequently, it isn't possible to maneuver to avoid birds; and the strike is inevitable due to the birds' proximity. A recent F-111 Class B investigation board found that, "When one considers mental reaction time and the time that it takes for a control stick input to actually move the aircraft, it is unreasonable to assume that the pilot could have avoided hitting the bird." In situations like this (i.e., when the bird is within the gray region of the chart in Figure 1), it is best to remain level, possibly duck your head, and take the strike. Maneuvering within this region may only create additional problems such as pilot disorientation, loss of control, unusual aircraft attitude, or increased damages following the bird strike.

When birds are perceived outside the minimum distance required, maneuvering the aircraft to avoid the birds may prevent a strike. In most cases, birds will tuck their wings and dive if they perceive an oncoming aircraft as a threat. There are exceptions: Gulls, for instance, often turn and attempt to outrun the oncoming threat and are often struck from the rear as a result. Although a few birds maneuver laterally to avoid danger, it is very rare that a bird climbs. Since you don't have the time to categorize the bird and its possible reaction, climbing makes sense. That gives you the best chance of avoiding the bird. It also gives you altitude and time for coping if you do take a hit.

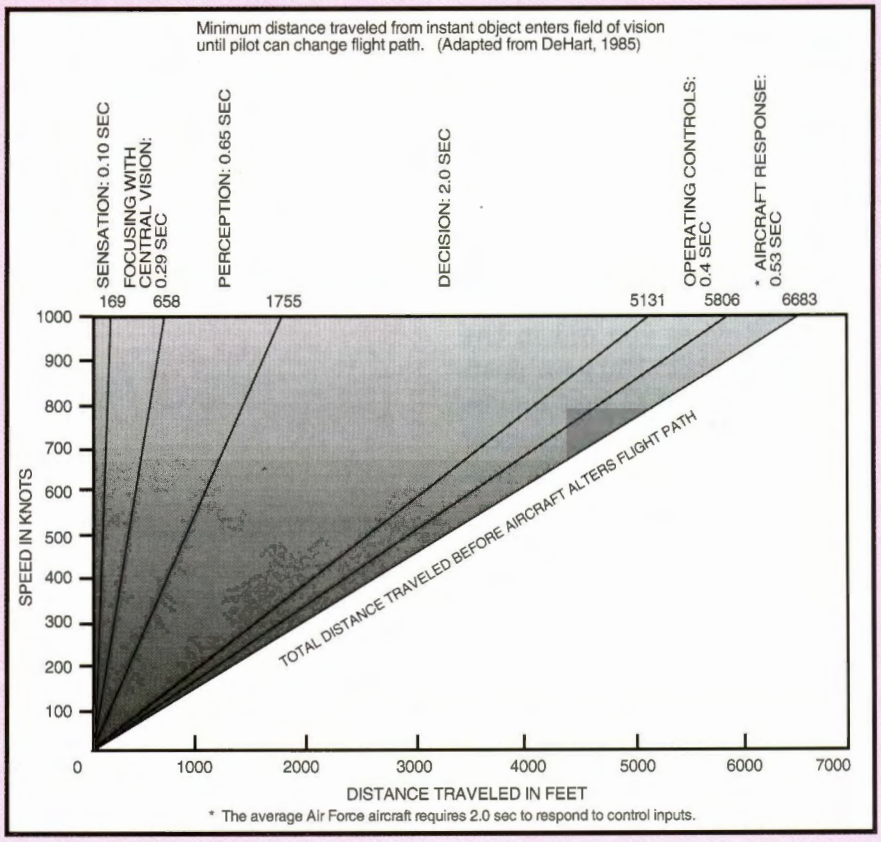


Figure 1

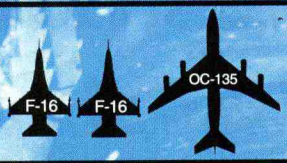
By pulling up, the pilot may be able to protect more vulnerable parts of the aircraft such as the canopy or engines by taking a strike on the undersurface of the aircraft. Most importantly, by pulling up, the possibility of collision with the ground or other structures is greatly reduced.

Since bird avoidance is rarely a practiced maneuver, you — as a pilot — should have an idea of what to do before you encounter a "feathered bullet" in your airspace. In a two-seat aircraft, crew actions in the event of a bird strike should be briefed or reviewed before every flight. Remember that there are times when a bird is too close to avoid. Remaining straight and level and protecting your face in this situation is best. When you can respond, pull up to avoid damage to your aircraft and possible injury to yourself. ■

Flight Safety Stats

ACC & ACC-Gained Losses for FY 98

1 Oct 97 - 28 Feb 98
Class A Flight Mishaps

8 AF	
9 AF	
12 AF	
AWFC	None
CANG	None
CAFR	
Aircrew Fatalities	None

Class A - Fatality; Permanent Total Disability; Property Damage ≥ $1,000,000

"Not a single sortie we fly is worth compromising the integrity of an aircraft or the life of an airman."

Feathered Frien

Captain Jeff Kindley, 509 BW/SEF, Whiteman AFB MO

A flock of more than 125,000 redwing blackbirds began roosting at the waste water treatment facility at Whiteman AFB MO in the middle of November 1997. This facility is located approximately one-half mile from the flight line. Whiteman is the home of the B-2 Stealth Bomber, and flight line operations there also include the T-38, A-10, and Missouri Air National Guard Cobra helicopters. Obviously, the birds became a severe hazard to local flying operations.

The flock of redwing blackbirds took roost in the cattails near the waste water treatment facility during a regular migration pattern south for the winter. "Blackbirds are communal birds, so they travel in large flocks; and the number of blackbirds roosting at Whiteman has climbed to the hundred-thousands making a very dangerous situation for our pilots," said Noel Myers, base wildlife biologist from the United States Department of Agriculture. To ensure the safety of our pilots and aircraft, the flock needed to find a new roosting area.

The wing flight safety office worked closely with Mr. Myers to plan the removal of the birds. First, coordination with various agencies on base was accomplished; some of which included the security forces, fire department, operations group, and wing commander. The local Sheriff's Department was also notified due to the close proximity of civilian homes. In addition, the flying schedules were adjusted to ensure that no flying occurred during the periods of scaring the birds. To move the roost without harming

"Blackbirds are communal birds, so they travel in large flocks; and the number of blackbirds roosting at Whiteman has climbed to the hundred-thousands making a very dangerous situation for our pilots."

ds Take Flight

the birds, a small crew was coordinated with from the base Civil Engineering office to fire pyrotechnics at the flocks as they descended on their roost at night.

"The object of the pyrotechnics was to scare the birds and convince them that this was a bad place to roost," Myers said. "We have done the same thing for other bases and airports with success, so we were hopeful about this mission." The team went out to the roost at 5 P.M. each night for a week just as the flock arrived to roost for the night. There was an overwhelming number of birds in the air when they returned to the roost. Portions of the sky were literally black." The first night was the hardest," remarked A1C Beau Wagner, an entomologist assigned to the 509th Civil Engineer Squadron. "However, by the second and third night, there was a huge reduction in the number of birds trying to roost here," he said.

As an additional measure, the Flight Safety Office experimented with the use of a radio-controlled aircraft. The idea was to fly around the area and harass the birds to enhance the pyrotechnics effort. This process was an innovative idea (not to mention a lot of fun). Although several minor problems need work for future use, the radio-controlled aircraft was a success at keeping the birds from entering the area. The bird removal was a success, and not a single bird was harmed!

Myers expected the birds to continue south after being scared away; but he doesn't consider the battle over by any means. "I imagine the birds will return to the same spot next year, and we will have to do the same thing," Myers remarked. "Blackbirds are creatures of habit and the cattails provide excellent protection for them." ■

The various environmental factors that draw birds to airfields, as well as the hazards presented by birds, can be very different at each Air Force base. Depending on local conditions (i.e., changes in agricultural activities, landfill operations, and other means of land usage), bird strike hazards at your base may be seasonal or all year round. The key steps for reducing aircraft damage — as well as the loss of aircraft and aircrews — due to bird strikes are identifying the conditions and events that present the highest bird strike risk and taking action to eliminate, reduce, or control that risk. Although the potential for aircraft collisions with birds can never be totally eliminated, the extensive number of bird strikes experienced each year by ACC pilots can certainly be reduced. This can be done through a dedicated, well planned program using proven methods and other innovative ideas in bird dispersal, bird avoidance procedures, and land management techniques. For further information, see Major Tom Donalds' article "ORM for Airfield Wildlife Hazards" in the December 1997 issue of THE COMBAT EDGE and Air Force Pamphlet 91-212, "Bird Aircraft Strike Hazard (BASH) Management Techniques." They serve as excellent reference guides for implementing an effective bird strike risk management program.

-Ed.

ASK ORVILLE!

The question (or should I say challenge) of the month comes from Nellis AFB, near that famous gambling capital – Las Vegas. Our inquisitive combatant writes:

Dear Orville:

In younger days, from time-to-time my parents would tell me, "Do as I say, not as I do." While it was a great method for keeping me in line while masking my parent's reluctance to follow their own advice, the approach also generated some mental resistance within my young mind. Now, in my more mature days in the military, I find that from time-to-time I can't help but wonder if that same logic is being used in regards to new initiatives like Operational Risk Management (ORM). Putting it bluntly Orville, we in the field are being asked to embrace ORM; but could you give me an example of the staff using ORM to conduct their work?

MSgt Thomas M. Doubting

Dear MSgt Doubting:

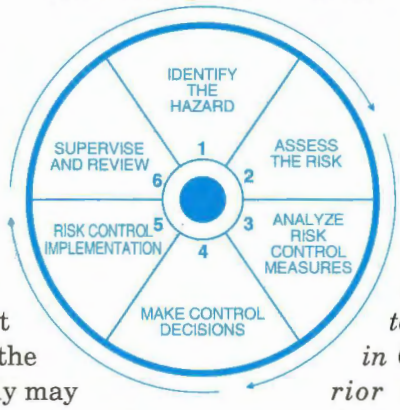
Your letter could not possibly have arrived at a better time. This issue of *The Combat Edge* focuses on bird strike avoidance. Therefore, it affords me the opportunity to answer your question while bragging on one of my fellow action

Colonel Ronald L. Garhart
HQ ACC/SEO
Langley AFB VA

officers in the ACC Safety shop. Major Thomas J. Donalds, nickname "Duck," is responsible for the Bird Aircraft Strike Hazard (BASH) program in ACC. That's right Tom, we have "Duck" in charge of the "bird" program. (Who says safety doesn't have a sense of humor?)

Well, to make a short story even shorter, Duck used the 6-Step ORM Process to help solve his tasking to beef up the BASH program Air Force-wide. The success of his efforts was clearly captured in two previous *Combat Edge* articles; Nov 97 - *ORM and Low Level BASH*, and Dec 97 - *ORM for Airfield Wildlife Hazards*. WARNING: Some pictures could be disturbing to Bambi lovers and members of the Audubon Society — read articles at your own risk!!!

USAF 6-Step ORM Process



Sgt Doubting, getting people to try the ORM process is one thing; but if those users find that ORM is actually superior to other alternatives that they relied on in the past, then we really may be on to something. Therefore, after reading Duck's articles, I invited him in for an interview; you know, to try and find out what he really thought after employing the highly touted USAF 6-Step ORM Process. Here is what Duck had to say:

Quack!!! {not really -Ed.}

First of all Orville, I was tasked with improving the BASH program. No one told me how to go about it; no one directed that I use any particular process. ORM or no ORM, I had a job to do. So I thought, "What the hey — what have I got to lose? Let's give the six steps a shot." I couldn't believe the results. It's as if ORM was created explicitly for solving my BASH dilemma. The six steps organized my thought process and helped focus my energies from beginning to end.

I think that the most helpful step was the first, Hazard Identification. I mean, if you don't know what the hazards are, how are you going to reduce them? Now you're probably saying, "Duck, how dense can you be? The hazard is obviously the birds." But it isn't quite that simple. You see — in the BASH business, the hazards are really those conditions that attract birds. In most instances, if you can identify the conditions that attract birds, then you are in great shape to identify and choose among control measures that either eliminate those conditions or avoid the areas where the conditions exist. I found the hazard identification tools and techniques available in ORM to be far superior to any method I previously used.

And speaking of selecting the right control measures, I found that because many bases did not understand their BASH conditions, they tended to choose broad control measures that were unnecessarily restrictive — even to the point where it negatively impacted their operations. For example, if the bird hazard and associated risk is between points "b" and "c" on the Gizmo-420 low level, following a cold front, in the first week of October, there are many options short of canceling all low level flying on the East Coast for that month ... and ORM will help you identify them all.

I could go on with other illustrations of how useful the ORM tools and techniques were in helping me to accomplish the assigned task, but permit me to drive one point home. ORM was not something I did in addition to my original tasking. I was given a job to do, a mission to accomplish. ORM is simply the process and tools I chose to help me accomplish my task.

Well, there you have it, Sgt Doubting. Another satisfied user of the six steps to success, and a staff action officer to boot. The next time you have a tasker thrown your way and you have no idea where to start, try ORM; you'll like the results. And remember, just because you live near Vegas, you don't have to be a gambler. Take the chance out of your decisions; use ORM to ensure you choose effective, efficient, and appropriate solutions. ■

Keep those cards and letters flying in folks,

Orville R. Mudd

ORM Dogfight Veteran
ACC Office of Safety

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Tragedy at Elmendorf

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Directorate of Flying Safety
Australian Defence Force

On 22 September 1995, geese brought down a USAF E-3B AWACS aircraft shortly after lift-off, killing all onboard. The following account of the accident has been extracted from a report published in the U.S. Flight Safety Foundation magazine *Accident Prevention*. This report, in turn, was prepared from the *USAF Aircraft Accident Investigation Report: E-3B Aircraft No. 77-0354, Assigned to 3d Wing, Elmendorf AFB, Alaska, 22 September 1995*.

The crew of a U.S. Air Force E-3B, a modified Boeing 707 equipped with sophisticated airborne warning and control systems (AWACS), was holding short of Runway 5 at Elmendorf AFB, Alaska. As the crew waited for takeoff clearance, a C-130 Hercules that was departing Runway 5 disturbed a flock of Canada geese that were roosting in the infield adjacent to the runway. A controller in the Elmendorf control tower saw the geese become airborne but did not notify the E-3 crew or Elmendorf airfield management.

The E-3 (call sign Yukla 27) was cleared into position on Runway 5. Approximately 2 minutes after the C-130 had departed, Yukla 27 was cleared for takeoff at 0745:30 hrs local time and the crew began the takeoff roll. As the aircraft rotated for liftoff, the senior tower controller observed geese take flight and turn directly into the path of the E-3. Numerous birds were ingested into the aircraft's No. 1 and No. 2 engines, resulting in a catastrophic failure of No. 2 engine and compressor stalls in No. 1 engine.

At 0746:43, the copilot radioed, *"Elmendorf tower, Yukla 27 heavy*

has an emergency. Lost No. 2 engine, we've taken some birds." Witnesses then observed the aircraft enter a slow, climbing turn to the left. Six seconds later, the captain called for the dumping of fuel. Shortly after, the stick shaker activated and stayed on for the remainder of the flight.

At 0746:56, the copilot radioed, *"Yukla 27 heavy's coming back around for an emergency return."* Ten seconds later, the copilot radioed, *"27 heavy, emergency."* This was followed shortly by a transmission on the tower frequency, *"Roll the crash, roll the crash."*

At 0747: 11, the AWACS captain said, *"We're going down."* The aircraft impacted a hilly, wooded area on the base, less than 1 NM from the departure end of the runway (Figure 1). The aircraft broke up, exploded, and burned. All 24 crewmembers were killed in the accident.

The USAF accident investigation report concluded that the accident was directly caused by the ingestion of Canada geese into No. 1 and No. 2 engines. Furthermore, two factors substantially contributed to the accident. First, the [3d] Wing lacked an aggressive program to detect and deter geese; specifically, the Bird Hazard Reduction Working Group (BHRWG) did not adequately prepare for the migration season, airfield management's efforts to detect and deter geese were inadequate; and an earlier safety agency Staff Assistance Visit (SAV) had [misled] the Wing to believe that [the Wing] was prepared. Second, the tower controller failed to notify the [accident] aircraft or airfield management that geese were present in the infield.

The ingestion of the geese into the aircraft's engines caused a loss of thrust that rendered this aircraft incapable of controlled flight. The accident flight was a scheduled 6.2 hr routine training mission. The accident occurred during twilight and in Visual Meteoroglical Conditions (VMC). Weather was not a factor in the accident; sunrise on the day of the accident was 0742.

Engine Damage

All four engines on the accident aircraft were recovered and examined. No. 1 engine was found to have experienced a bird strike (one major-size hit and two minor-size hits) seconds after rotation. Within 4 seconds, the engine was operating at diminished power (approximately 50 percent of takeoff power). It then stalled four or five times and struck a tree upstream of the initial engine ground scar.

No. 2 engine was found to have experienced a bird strike (three major-size hits) seconds after rotation. Within 8 seconds, this engine lost enough first-stage fan blades to severely damage and then fragment the IGV [inlet guide vanes] case. The nose cowl was then free and flipped up over the wing and departed the aircraft. Then the engine either fell to a "hung" operating condition or flamed-out and windmilled to ground impact.

There was no evidence to suggest that either No. 3 or No. 4 engines had experienced a bird strike. Both engines continued operating at takeoff conditions until being pressed to a higher thrust condition by the crew within 8 seconds after bird strikes on the two left engines. This operating condition continued until ground impact.

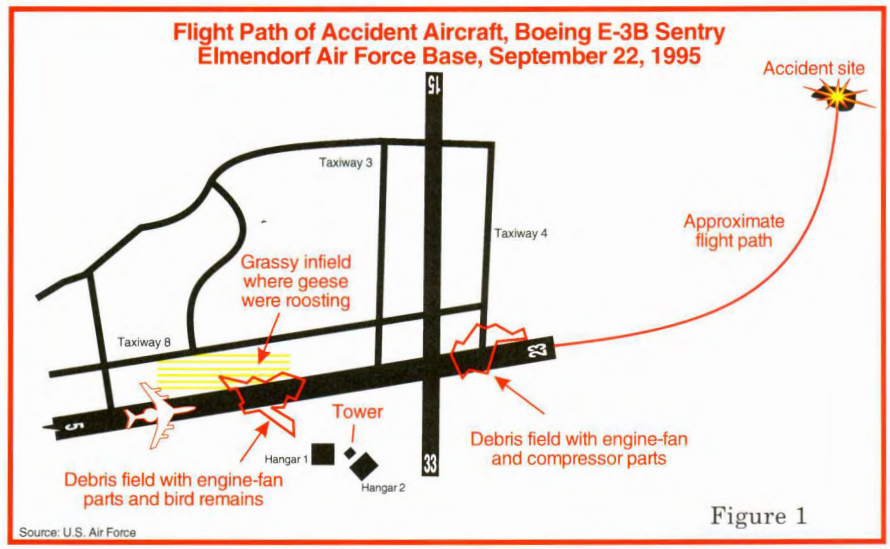

Figure 1

Flight Data Recorder (FDR) Cockpit Voice Recorder (CVR)

Because of the limited FDR data, investigators were able to determine only the following about the accident flight:

- The aircraft lost power on No. 1 and No. 2 engines within 6 seconds after rotation.
- The aircraft was airborne for approximately 42 seconds after takeoff and 37-39 seconds after losing power to the engines.
- The maximum altitude the aircraft achieved above the runway

elevation was approximately 250 ft.

The Local Bird Problem

Investigators reviewed the USAF regulations and the threat of bird/aircraft strikes at Elmendorf AFB. Air Force Regulation [AFR] 127-15, *The Bird Aircraft Strike Hazard (BASH) Reduction Program*, gives policy and guidance for implementing an effective BASH reduction program. It designates the USAF agencies that are responsible for carrying out the program and evaluating its effectiveness. It outlines procedures for developing a Wing-level BASH program and establishes requirements for its operation.

USAF personnel have counted the goose population at Elmendorf AFB since 1990 which has increased from 1,000 geese in 1990 to 2,700 geese in 1995. On the day of the accident, there were approximately 900 geese on the base, the report said.

In reviewing safety data, investigators found that the only recorded incident of geese striking an aircraft at Elmendorf occurred in September 1993, when a C-130 aircraft struck several geese on the runway after landing.

During a 2-week period preceding the accident flight, Elmendorf base operations and wildlife personnel had dispersed geese from the infield areas of Runway 5 and Runway 33 on several occasions. Clearly, [the] 3d Wing was on notice that geese were indeed locating in infields as well as on hard surfaces such as runways and taxiways, the report said. On two occasions, conservation personnel had to kill geese with shotguns in order to disperse the flock. The geese were beginning to establish themselves, and occasional dispersal was not deterring them from returning.

Investigators reviewed the efforts of the BHRWG at Elmendorf as required by USAF regulations. The BHRWG did not formulate a concrete plan to deal with changing bird activity levels or the presence of geese in the airfield, the report said. [The] 3d Wing had an effective OPLAN [operations plan], but the BHRWG was responsible for ensuring that the implementation of this plan resulted in effective geese detection and deterrence at all times of the year. The efforts of Elmendorf airfield management personnel to detect and deter geese were reviewed. Roosting infield geese went undetected because airfield management had no controlling plan to locate them, the report said. It was evident that personnel knew geese posed a danger to aircraft, and they acted to disperse them on several occasions; but their efforts to detect or deter infield geese were inadequate. Few, if any, of the suggested patrol and deterrent methods suggested by AFR 127-15 were in place, the report said.

The efforts of Elmendorf airfield management personnel to detect and deter geese were reviewed. Roosting infield geese went undetected because airfield management had no controlling plan to locate them, the report said.

The report noted that airfield management did not sufficiently check these infield areas for the presence of geese. Base operations personnel and supervisors of flying [SOFs] were engaged in little other than vehicle sweeps of runways and taxiways. A cursory glance at the infield would not result in the detection of geese. These patrols were effective, if at all, during daylight hours only. Prior to the accident, there was no illumination of infield areas before first light. The report noted that the last runway check occurred nearly 3.5 hrs before the accident aircraft began its takeoff roll.

Investigators found that the worst possible combination of circumstances existed: there were infrequent patrols of the airfield, almost no checking of infields and no placement of static deterrents. Those aircraft that began their takeoff roll at or before dawn were at risk that geese would move into their flight path, as happened in this accident.

An Air Force BASH Team conducted a SAV at Elmendorf AFB in July 1995 when the goose population was low, the report said. This team emphasized habitat management, but did not discuss the particulars of the 3d Wing's plan for migration season. The team did advise airfield management personnel to prevent geese from establishing themselves in the airfield.

The Elmendorf AFB airfield manager was interviewed during the investigation. She was well aware of the BASH plan and had been personally briefed by the BASH team during the July 1995 visit. The investigating officer attempted to establish her understanding of airfield management's specific responsi-

bilities in the OPLAN, but she invoked her right to remain silent.

The investigating officer interviewed the senior tower controller and another controller who were on duty in Elmendorf tower at the time of the accident. Both controllers, who had an excellent view of the runway area, invoked their rights to remain silent, the report said. Witnesses told investigators that after the accident, the senior tower controller said he observed geese lift off and turn right, directly into the path of the [accident] aircraft.

Moments before the aircraft's departure, the senior tower controller witnessed a C-130 take off and flush a flock of geese from the infield adjacent to Runway 5, the report said. Fortunately for that aircraft, this flock turned away from its flight path.

The report noted that while the senior tower controller could have assumed that every infield goose joined the flock that the C-130 flushed and that this flock had left the area, sound judgment dictates that he should have contacted the E-3 and warned the crew. The aircraft could have held takeoff until the squadron SOF or base operations could ensure that these geese had not returned and that no more geese were in the area. The investigating officer could not understand why the controller did nothing. He had more than 2 minutes to advise the [accident] aircraft that a flock of geese had taken wing and nearly struck the C-130.

The investigating officer commented in the report that he believed the tower controller had a duty to warn the accident aircraft and that his failure to do so was a contributing factor to this accident. While it would not have been standard operating procedure (SOP) for a tower controller to raise the bird watch condition [BWC] to severe, he certainly could have warned the aircraft of the potential hazard.

Post-Accident Actions

The following new procedures were ordered after the accident:

1. When workload permits, controllers will use binoculars to visually scan the runway and infield environments for concentrations of birds or bird activity prior to issuing a takeoff or landing clearance.

2. Airfield management will conduct an airfield inspection 30 minutes prior to civil twilight. This inspection should focus on the current bird activity and should help anticipate the increase in bird activity that is normally associated

Boeing E-3B Sentry

The E-3B Sentry Airborne Warning and Control System (AWACS) is a mobile, jamming-resistant high-capacity radar station and command, control, and communications center installed on a Boeing 707 airframe.

The first development aircraft, known as the EC-137, first flew in 1972. The E-3B has a basic operational crew of 20, including four flight crewmembers and 16 AWACS specialists, although this number can vary depending on the mission.

The aircraft has a maximum takeoff weight of 147,417 kg (325,000 lb.), a service ceiling of 29,000 ft, and a maximum level speed of 460 kts. It has an endurance on station of 870 NM (1,610 km), 6 hours from base, and a maximum unrefuelled endurance of 11 hours.

Source: Jane's All the World's Aircraft

with the early morning period.

3. Airfield management will conduct an airfield inspection within 30 minutes of the first departure of each day.

4. The SOF, airfield management, and Air Traffic Control (ATC) watch supervisor (WS) all have the authority to increase the declared Bird Watch Condition (BWC) in the interest of flight safety. In the absence of a Wing SOF, airfield management will have the authority to decrease the BWC.

5. In the absence of the SOF and when the tower watch supervisor and/or airfield management deems it necessary, he/she may increase the BWC. When the ATC WS upgrades the BWC, he/she will notify airfield management as to the location of the birds.

6. The SOF and the ATC WS may restrict and/or modify air traffic operations as deemed necessary for flight safety (e.g., cancellation of practice approaches, full stops only).

7. If bird dispersal is required on the airfield, the BWC will automatically be upgraded to severe during such activity.

The report noted that the new procedures required that the BWC be declared if there are birds flying over or on the ground anywhere close to the runways (infield, edges, taxiways, ramps, etc.) because they need to be dispersed. Most severe bird conditions, which prohibit takeoffs and all but emergency and fuel-related diversionary landings, can be resolved within 5 - 15 minutes.

The Aftermath

Four 3d Wing officers received disciplinary action for their lack of leadership before the fatal crash of the E-3B Sentry AWACS aircraft.

The officers were disciplined for failing to provide leadership to reduce bird hazards at the base airfield before the 22 September crash in which 24 people were killed.

One officer received a letter of reprimand and was relieved as vice commander of the 3d Wing. He was the former chairman of the wing Bird Hazard Reduction Working Group. The names and punishments of the three other officers were not released because of Privacy Act restrictions.

Copies of the accident report were given to commanders outside 11th Air Force — headquartered at Elmendorf — for their review and possible action against other people involved in the operation and evaluation of the Wing bird strike hazard program. As a result, administrative action ... [was] started against an additional officer whose name and the action initiated are also protected by the Privacy Act.

[As mentioned earlier in this article], the accident investigation board determined that the crash was caused by a flock of Canada geese striking the aircraft as it was taking off. Several geese were ingested into the No. 1 and No. 2 engines which failed, causing the plane to crash into a wooded area about a mile from the base. The jet, assigned to the 962d Airborne Air Control Squadron, was the first AWACS aircraft to crash.

The officer in charge of administrative actions was quoted as saying that, *"Military service is an inherently dangerous undertaking, [but the] Air Force strives to reduce that inherent risk in all activities, especially military flight operations."*

He added that, *"The risk from bird hazards encountered by Yukla 27 the day it crashed could have been reduced if appropriate actions had been taken and guidance had been given by the other officers responsible for implementing the wing bird avoidance program."*

The accident investigation provided sufficient facts for the investigator to arrive at his opinion as to the cause of the accident, said Wing officials. The administrative officer subsequently directed a criminal investigation by the Air Force Office of Special Investigation to fully develop issues identified by the accident investigator.

That criminal investigation expanded on areas that were not within the charter of the accident investigator. He elected not to take action against control tower workers at the time of the accident based upon that report. And examination of the regulatory guidance for the Elmendorf airfield management workers revealed that they were meeting the basic requirements established by local and higher headquarters directives.

He added, *"As the investigation showed, at the time of the incident, 3d Wing people were taking steps to react to geese they saw on the airfield; however, they were not taking adequate steps to detect and deter geese from appearing on or near the airfield ... Since the incident, they have completed a thorough review of their bird avoidance plan, revising it to more aggressively reduce the risk of bird strikes ... In addition, as we approach the bird migration season, all our Alaska military organizations are reviewing their bird avoidance programs and coordinating those efforts with civilian airport representatives and state officials."* ■

Did You Know...

that falcons are being used as a tool to reduce the risk associated with bird aircraft strike hazards?

Falconry and Bird Hazard Management

- In today's age of jet airplanes and computer technology, the ancient art of falconry is being recognized as an effective tool in the prevention of bird strikes on airports all around the world.
- Historically, falconry involved humans using trained birds of prey to hunt and capture wild game animals.
- Falcons are now being flown in a controlled manner as a part of a comprehensive program to harass nuisance birds on an airport and reduce the attractiveness of the airfield to the birds.
- Several Air Force bases are beginning to use falconry as a means to reduce the risk associated with bird aircraft strike hazards.
  --These installations include Scott AFB IL and RAFs Lakenheath/Mildenhall in the United Kingdom.

Left: *Mr. Thomas Cullen of T.C. Management, Inc., is an internationally-recognized leader in providing comprehensive falconry services for bird strike management to airports.* ***Right:*** *The falcon (lower left corner of photo) is dispersing the nuisance birds quickly and efficiently.*

The Combat Edge
Air Combat Command's
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