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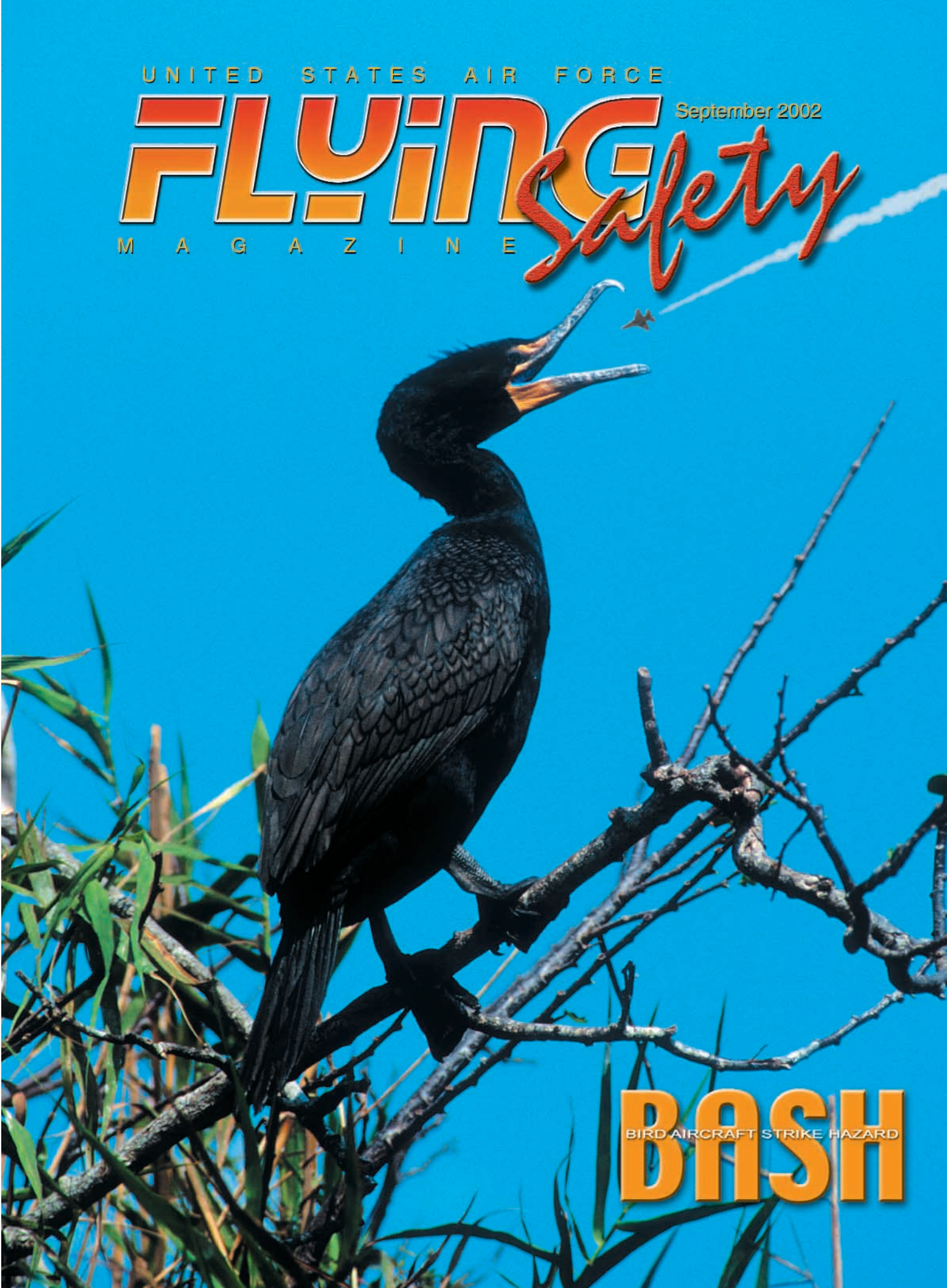
FLYING Safety

MAGAZINE

September 2002



BASH

BIRD AIRCRAFT STRIKE HAZARD

AIR FORCE RECURRING PUBLICATION 91-1 September 2002, VOL 58, NO 9

This Issue:

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Cover: Photo Courtesy of the Smithsonian Institution
Photo Illustration by Dan Harman

UNITED STATES AIR FORCE
FLYING Safety
MAGAZINE

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FSM notams

GOT FEEDBACK?

The Safety Sage wants to hear from you. Starting this month, this space will be devoted to answering your questions or concerns about safety or about this publication. In other words, this space is now your space.

Do you have:
Questions about flight, ground or weapons safety?
Feedback on FSM and how well we're doing?
Complaints on FSM and what we're doing wrong?

Is there an unsafe practice, procedure or situation out there on the flightline, back shop or weapons area that isn't being addressed, and you want to bring it to everyone's attention? Is there a problem with tech data or safety guidance that needs to be addressed and told to the rest of the world?If you are not sure of where to go for help with a safety issue, we can put you in touch with the experts who can help you solve the problem. Have you developed a program or procedure that prevents mishaps, and want/need to pass it along? Contact us.

Or maybe you want to comment about Flying Safety magazine. Is there a subject we're failing to address adequately in this publication, or one we have completely overlooked? For instance: Or "That ABC article was the best thing (worst thing) you've ever done." Or "Why didn't you do the DEF article this way?" (Keep it civil; our feelings get hurt as easily as anyone's. Well…probably not, but keep it civil anyway.) Or if you just want to give us an "attaboy," that's okay too.

Other possibilities: "I have an idea for an article you should write." Or (even better) "I have an article on XYZ that I want to send to you."

Our team of safety experts in flight, maintenance, life sciences, etc., is at your disposal. We'll research your questions and respond to you directly as promptly as we can. On this page, we'll present the questions, comments or complaints with the most interest or importance.

We'll still respond to "snail-mail" or e-mail addressed directly to the editor, maintenance editor, or any of the staff. But we wanted this space to be a *safety forum*, a place where we could have an active discussion, a sort of "safety message board" or "safety 'chat' room."

There are several ways to contact us. You can access the *Flying Safety* magazine **Web site** at (http://safety.kirtland.af.mil/magazine/htdocs/fsmfirst.htm) and access the Safety Sage there.

Or you can **e-mail** the Safety Sage at: safety.sage@kafb.saia.af.mil
Or you can **phone** DSN 246-0950 or (505) 846-0950
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We're looking forward to hearing from you.

The Identification of Birdstrike Remains

Opposite: Photo by Jon Steiner and James DiLoreto
Inset: USAF Photo by MSGt Scott Eck
Beaker: Photo by Carla Dove and Mary Heacker
Feathers: HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

CARLA DOVE, PH.D.
Smithsonian Institution, Division of Birds

On 21 March 2001 at 0915, an F-16D faced an in-flight emergency shortly after takeoff from Eglin AFB, Fla., when it suffered multiple birdstrikes at 1600 feet. These caused a punctured fuel pod and resulted in a fire that caused $19.6 million in damage to the aircraft after landing. What kind of bird caused this Class A (that is, more than $1 million in damage) mishap?

To find out, the 46th Test Wing at Eglin sent the remains of the bird feathers to the Smithsonian Institution in Washington, DC for species identification. The Smithsonian's Natural History Museum houses one of the largest bird collections in the world, with more than 620,000 specimens. At the Air Force's Bird Strike Remains Identification Laboratory at the Smithsonian Institution, Dr. Carla Dove and Marcy Heacker began the search for the culprit that caused the damage to the Eglin fighter. Each year, the two scientists work to identify more than 1500 USAF birdstrike cases. The following example describes the techniques used to identify the birds in specific to the Eglin case; however, the basic process is applicable to all birdstrike remains sent for identification.

Feather Identification

The first step in identifying the bird species required washing the feathers recovered from the aircraft. The feathers were washed in mild, soapy solution to remove grease, oil and dirt, and to help the feather regain its natural shape and texture. After washing, *all* feather remains were carefully placed on absorbent paper and then dried using compressed air.

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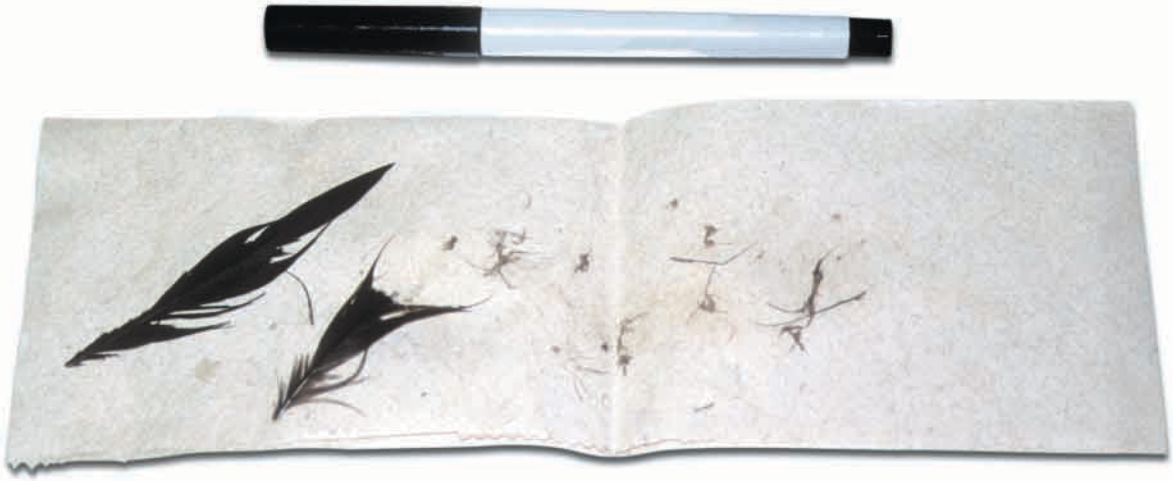
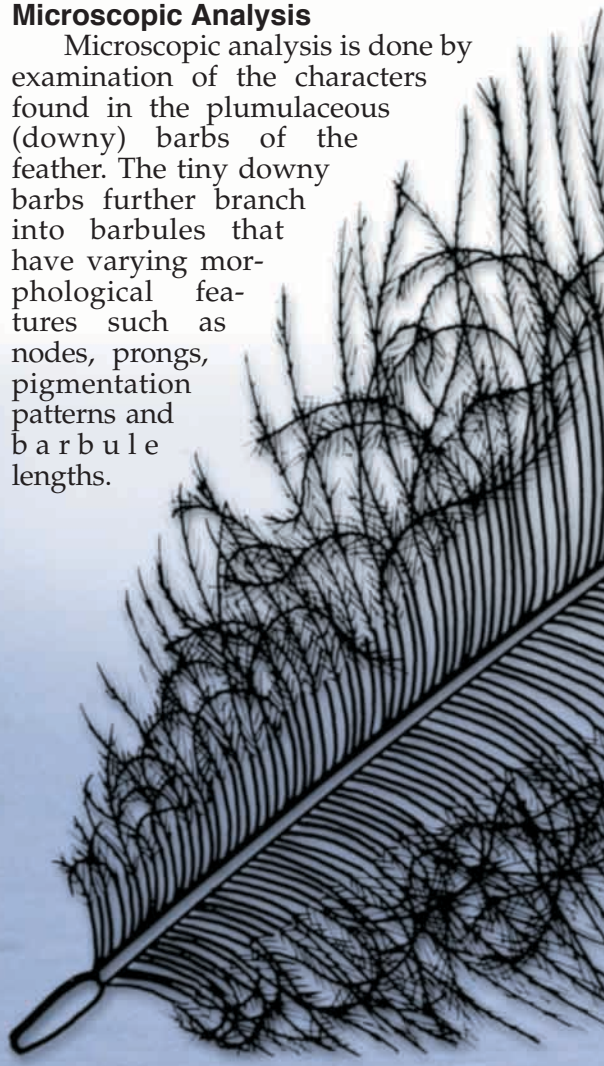


Two partial brownish-black feathers of medium size from the Eglin sample were restored to the natural color and shape and all of the tiny bits and pieces of feather and tissue were saved for further analysis. Occasionally, the washing process is all that's necessary to determine a unique color or reveal a pattern or texture diagnostic to a certain species of bird, but the Eglin case proved more difficult. Because there are numerous birds with brownish-black feathers similar in shape and size to the unknown sample, microscopic analysis was necessary to narrow the unknown bird to a specific "group."

Microscopic Analysis

Microscopic analysis is done by examination of the characters found in the plumulaceous (downy) barbs of the feather. The tiny downy barbs further branch into barbules that have varying morphological features such as nodes, prongs, pigmentation patterns and barbule lengths.



Contour Feather

Birds such as ducks, pigeons, gulls, owls and hawks have unique suites of micro-characters that aid in guiding us to the proper group of birds. It is important to send as much feather evidence as possible, as we rely on the fluffy downy barbs at the very base of the feather for microscopic clues if we cannot determine the species of bird based solely on the whole feather evidence. Most often, we use a combination of both the microscopic characters and the whole feather clues, such as color, pattern and texture, to match with the museum specimens for a positive identification.

The microscopic analysis of the unknown Eglin sample revealed the bird involved in this strike had short barbules and distinct long prongs at the distal nodes. These micro-characters are typical of several groups of diving birds such as loons, pelicans, cormorants and grebes. As a result of the microscopic analysis, the search in this case was narrowed to a group of diving birds with similar feather color and size to that of the unknown sample.

A. Diagnostic microscopic character of owls include pigmented rounded nodes.
B. Diagnostic microscopic characters of ducks are triangular-shaped nodes.
C. Microscopic view of Eglin birdstrike shows long prongs at distal nodes.

Photos by Carla Dove and Mary Heacker
Photo Illustration by Dan Harman

Museum Comparisons

The next phase in the identification process involved matching the washed partial feather fragments with museum specimens of the diving species with similar microscopic feather characters. After careful examination of all species with brownish-black, medium to large feathers occurring in Florida, a perfect match was found. The species involved in this birdstrike was a Double-crested Cormorant (*Phalacrocorax auritus*), a bird weighing approximately 7.5 pounds! The final part of the identification procedure involved corroborating the species identification with geographic distributions and migration patterns, and checking other circumstantial evidence such as altitude of strike, time of day, location and the date of the incident.

Knowing the exact species identification in this case not only aided in our understanding of the migration altitudes this bird can attain, but also confirmed the bird this aircraft struck was not a problem species on the airfield.

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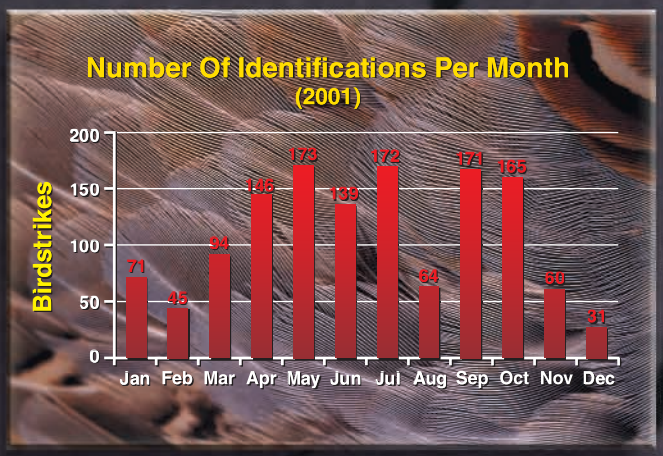
HQ AFSC Photo by TSgt Michael Featherston



Birdstrike Identification Statistics—2001

Fortunately, not all birdstrikes are as costly as the Eglin example. However, in 2001, the U.S. Air Force lost $31.7 million due to wildlife strikes. One way to help cut damaging costs is to report every birdstrike in addition to sending any and all remains for accurate identification. Proper species identifications helps provide baseline data used to make decisions about habitat management, to assist engineers in designing safer engines and windscreens, and to warn aircrews of birdstrike dangers. Additionally, information from species identifications is used in permit hearings on landfills, to analyze bird weight data, justify depredation permits, assess regional, local, national and global birdstrike patterns, and make bird control decisions. For more information on how to properly collect feather evidence and report bird strikes, please see *http://safety.kirtland.af.mil/AFSC/Bash/home.html*

For the past several years, the total number of birdstrikes received for identification has increased significantly from those of the mid-1990s. The reason for this increase is undoubtedly due to better awareness and reporting, and the introduction of the new online Air Force Safety Automated System (AFSAS) reporting program in 2000. In 2001, more than 1500 bird strikes were received from 209 domestic and 62 foreign bases, making this a record-breaking year. The USAF sent feather remains for identification in approximately 42% of the birdstrike cases reported, representing the highest percentage ever recorded. The average number of birdstrikes identified for the USAF per month in 2001 was 128, an increase from 95 per month in 2000. The average number of cases per day is 6.4, but during the busiest times of spring and fall migration identifications can number more than 60 per week.

Sometimes the "birdstrike" turns out not to be a bird at all, but rather, a mammal. Bat strikes are also commonly reported for identification. For the past several years, Suzanne Peurach, Museum Specialist with the US Geological Survey Patuxent Wildlife Research Center's Biological Survey Unit stationed at the Smithsonian Institution National Museum of Natural History has been identifying bats struck by USAF aircraft. Last year, twenty-eight bat strikes were received for identification. The bat most commonly involved in USAF aircraft strikes is the Brazilian Free-tailed Bat (*Tadarida brasiliensis)*, and the bat causing the most damage to USAF aircraft is the Hoary Bat *(Lasiurus cinereus)*. Although this little bat weighs less than an ounce, it has caused more than $36,000 in damage to aircraft in the past five years. Bat species identifications provide valuable information on altitudes of bat flight, times of activity, and may lead to a better understanding of bat migration patterns in the future.

Documenting and Reporting

Please report all bird strikes and send any and all remains for identification as required by AFI 91-204, *Safety Investigations and Reports*. Each unit safety office has access to the electronic online AFSAS reporting forms and can provide information on how to send feather remains. By working together, we can continue to upgrade our bird strike database with more precise information and ultimately make the skies a little safer for all.

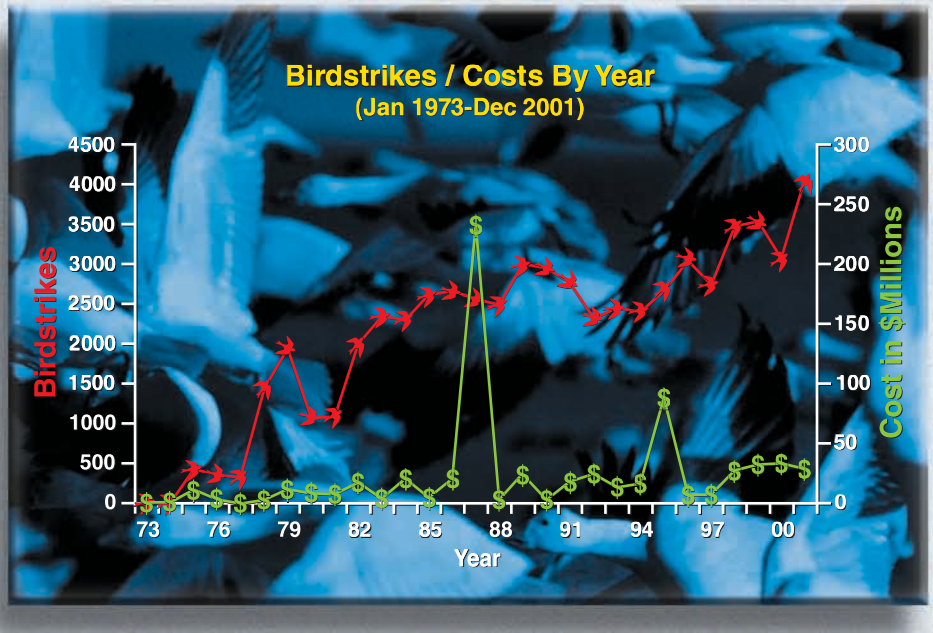
Photo by Carla Dove and Marcy Heacker, Background: HQ AFSC Photo by TSgt Michael Featherston

A Glimpse Into BASH Before 1985

1LT MATT GRANGER
HQ AFSC/SEFW

The strength of the Bird/Wildlife Aircraft Strike Hazard (BASH) bird strike database, developed as part of the Air Force Safety Automated System (AFSAS), is in the numbers. Over 49,500 birdstrikes have been reported by the Air Force since 1985. In those 17 years, 27 Class A, 114 Class B and 1,759 Class C birdstrikes occurred, at a total reported cost to the Air Force of over $609 million. Of the wildlife remains that could be positively identified, 559 different species of birds and other wildlife are included, with strikes reported at locations worldwide, in times of both conflict and peace. With added technology and manpower, the USAF BASH Team has now expanded this vast resource of knowledge even further.

Coming this fall, the AFSAS BASH database will include all reported bird strikes dating back to January of 1973, upgrading our current capability to allow users to look back on close to 30 years of birdstrike information. Below is a small glimpse into just some of the newly included data:



• Added are nearly 13,000 previously reported, but until now undocumented, birdstrikes over a 12-year period between January 1973 and December 1984.

• Included in these reports are 12 Class A mishaps, resulting in three fatalities.

• Also included are an additional 170 Class B and 2,191 Class C birdstrikes (keeping in mind the damage cost scale determining Class B and C mishaps has changed significantly since the early 1970s).

• In these 12 years alone, total reported cost to the Air Force in damages caused by birdstrikes exceeded $81.5 million—in today's economy, that's a price tag of nearly $178 million.

This new information will significantly benefit BASH operations. The largest gain will be the ability to conduct trend analysis on reported strikes per year and enhance our knowledge of whether the Air Force is really hitting more birds in recent years or if, as we suspect, aircrews in the field are simply reporting birdstrikes more accurately and consistently. It is easy to see birdstrikes are being reported with greater frequency when reports went from only three in all of 1973 to over 3800 in 2001. Air Force aircraft have always hit birds, but the extent of the problem—and the impact on the mission—is only now being realized, thanks in large part to the AFSAS reporting system and historical data such as this. New birdstrike additions from years past will also give wildlife managers and flight safety personnel at the base level more historical wildlife information to make better decisions on management issues and in identifying significant safety hazards. Seasonal and yearly changes in bird migration routes and local bird activity can be interpreted from historical bird data, thereby giving personnel the information needed to make responsible risk management decisions when it comes to flight operations and the threat posed by both migratory and resident bird populations.

The world of BASH is continually expanding and growing. Advances in the capability to analyze and interpret birdstrikes as they occur, as well as look back at previous strike trends, will continue to serve as the cornerstone of any sound BASH program at the base level. This new addition will also help add reliability and accuracy to the ongoing upgrades of the Avian Hazard Advisory System (AHAS) and Bird Avoidance Model (BAM), both of which can be accessed via www.ahas.com. In the end, sound risk management decisions can only be made with sound information, and this latest upgrade to the AFSAS BASH database is yet another step in that direction.

Who Reports What to Whom, and Huh?

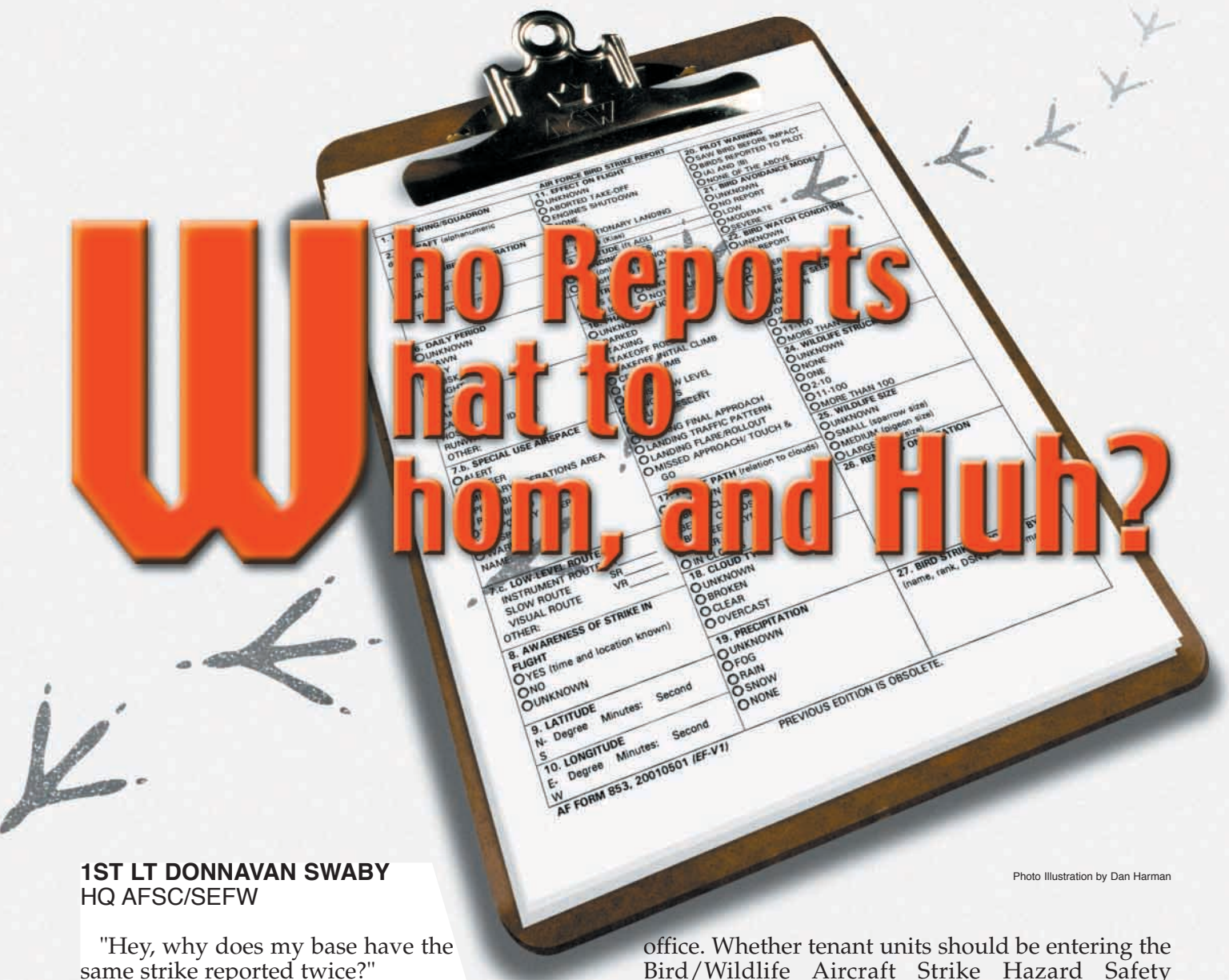


Photo Illustration by Dan Harman

1ST LT DONNAVAN SWABY
HQ AFSC/SEFW

"Hey, why does my base have the same strike reported twice?"

"I thought Base X was supposed to report that!"

"This AF Form 853 sucks; why can't it be more like AFSAS?"

We here at the Safety Center have received many calls asking who is responsible for reporting birdstrikes, why the AF Form 853, *Air Force Wildlife Strike Report*, is so antiquated, and how to report deployed aircraft strikes. Confusion on said subjects has led to many multiple reports of the same mishap and some mishaps going unreported. Hopefully, with this article (and a miracle), I can help to clear the muddy waters on the birdstrike reporting process.

If you feel comfortable with your reporting "skills," feel free to skip this and move on to one of the other action-packed articles in this magazine. For the rest of you who would like a little more instruction and guidance in BASH reporting procedures, grab a large cup of coffee and read on.

When reporting a wildlife strike, you should not be asking "Who's on first and what's on second." The base BASH plan should detail who is responsible for reporting what to the host unit safety office. Whether tenant units should be entering the Bird/Wildlife Aircraft Strike Hazard Safety Automated System (BASHSAS) reports themselves, or submitting the AF Form 853 to the wing for entry into BASHSAS, ought to be defined by the Bird Hazard Working Group.

Speaking of which, many of you asked for a revised AF Form 853. Your cries have been heard, and the Air Force-approved form is available on the Safety Center's website at: https://rmis.saia.af.mil/ld/bash/frm853_BASHSAS.pdf. (Please note the web server is *.mil restricted, meaning you can only download the form from a computer on a military server.) Having reviewed a few BASH plans, it is safe to say that some units are unaware that AF Form 853 was revised. This form should be used to report *all* wildlife strikes. Struck a cat on take-off? Use the 853. Deer strike at night? The 853 can handle that, too.

As you read this article, keep in mind that AFI 91-204, *Safety Investigations and Reports*, is the definitive instruction on all mishap reporting. The general rule of thumb to follow can be found in para. 1.2.2., which states, "Flight mishaps are normally assigned to the organization credited with the aircraft's fly-

ing hours at the time of the event... This may or may not be the same as the unit that assumes Operational Control (OPCON)." Additional information on BASH mishap reporting can be found in para. 7.4.7. of the aforementioned AFI. Here, in para. 7.4.7.1.1., it is written, "Flight safety offices of the organization credited with the aircraft's flying hours will report all bird/wildlife strikes. Strikes occurring to non-USAF aircraft at Air Force bases should be reported by the host installation flight safety office if the strike information is available." That said, let us look at various scenarios for reporting. If I miss something particular to your wing, please contact your MAJCOM for guidance.

1. *One of my jets struck a bird on a low-level route*. I figured I would start with the easiest situation. In this example, the organization that owns the aircraft's hours is responsible for reporting the mishap. Pretty clear-cut here.

2. *One of my jets struck a bird while performing transition work at a civilian airfield.* Here again, the organization that owns the aircraft's flying hours is responsible for entering the report into BASHSAS. Ideally, we ask that if the civil authorities find the remains of your strike, you request they package them and send them back to the home unit's safety office. From there, you can send the remains to the Smithsonian Institution along with a copy of the BASHSAS report.

3. *I had an aircraft strike a bird while performing touch-and-go operations at another base.* And so the plot thickens. As mentioned before in the 91-204 excerpt, the organization that owns the aircraft's flying hours is assigned the mishap. Therefore, that unit is responsible for reporting the strike. If the aircraft is going to be deployed at the operating location for some time, there are two options:

a. Have the crew complete an AF Form 853 and send it, along with the remains, back to the home station.

b. Have the operating location's safety shop submit a BASHSAS report, then send a copy of the report and remains back to the home unit's safety office.

In either case, the owning unit's safety office should be made aware of the strike. Option 1 is the preferred method, due to the fact that once the Smithsonian Institution's Feather Lab has input the wildlife identification into the BASHSAS report, the report's originator will be notified of the identification via e-mail. Conversely, if the aircraft immediately returned to home base following the strike, it would be courteous for the owning mishap unit to contact the safety office of the base where the strike occurred. This way, if they find remains on their runway, they have a point of contact for the remains to be sent.

4. *A Navy plane struck a bird on takeoff at my base.* I figured I would toss this one in the gumbo since this situation has arisen a few times. Looking at the aforementioned AFI 91-204, para. 7.4.7.1.1., we find that non-Air Force aircraft should be reported by the host installation if the strike information is known. Applying that to this situation, if the base has any strike information—such as date, time, location, phase of flight, etc.—then report it using BASHSAS. The STRIKE TYPE should be Navy. Although it will not be counted in our annual totals for Air Force strikes, it will be included in all queries for strikes by bases.

5. *A commercial plane struck a deer while taxiing at my base.* This situation should be reported exactly like the Navy strike in example 4. If you have any strike information, please report it. The STRIKE TYPE in BASHSAS should be FAA.

6. *I am a safety officer at a deployed location in support of OEF.* Treat this situation like example 3. You have two options:

a. Have the crew complete an AF Form-853 and send it, along with the remains, back to the home station.

b. As the deployed location's safety officer, submit a BASHSAS report, then send a copy of the report and remains back to the home unit's safety office.

7. *LT, should I report near misses?* This is really a judgment call. BASHSAS allows you to enter near misses. You enter in all of the information as a normal strike report except for NUMBER STRUCK, which should be NONE if it was a near miss. By reporting it, you get a better picture of the strike activity when you go to do a query later on. The BASH Team does not require the reporting of near misses; however, your MAJCOM may or may not provide supplemental instructions in this area.

8. *Great article. Is there anything else you want me to know about reporting?* I'm glad you asked—there is one more issue I would like to mention. If you have a damaging wildlife strike as defined in AFI 91-204 (i.e., it meets at least the Class C threshold), please remember that in addition to an AFI 91-204 damaging mishap report, you must still enter a BASHSAS report. Then, somewhere on the final message of your mishap report, indicate the BASHSAS report number.

Congratulations; you made it to the end of this article. As you peruse through the other riveting articles in this issue of *Flying Safety*, I hope you remember the golden rule from this article on reporting. If you missed it, here it is again: "Flight safety offices of the organization credited with the aircraft's flying hours will report all bird/wildlife strikes. Strikes occurring to non-USAF aircraft at Air Force bases should be reported by the host installation flight safety office if the strike information is available." Hopefully, with these few pages of additional guidance and examples, our reporting will become even more accurate. Enjoy that last sip of java, and get on those reports.

The New BASH Pamphlet

Photo Illustration by Dan Harman

After five years a new and improved AFPAM 91-212 is on the way.

CAPT DAVID HALL
HQ AFSC/SEFW

In April of 1997 the Air Force Pamphlet 91-212, *Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques*, was published to provide additional information to BASH program managers so compliance with BASH instructions in AFI 91-202 (*USAF Mishap Prevention Program*) would be easier. After five years a new and improved AFPAM 91-212 is on the way.

The new BASH pamphlet will incorporate many changes. A number of these changes arose from field use of the pamphlet. Other changes were made directly by the USAF BASH team and its affiliates. Here's a summary:

In section 1.3: Developing a Program, there is now a summary of topics that should be included in the discussions of the Bird Hazard Working Group (BHWG).

The following section, 1.4: Documenting Bird Hazards, has been updated to include the reporting procedures for the Air Force Safety Automated System (AFSAS). Also, the packaging procedures for bird remains to be sent to the Smithsonian Institution have been incorporated into the pamphlet, as well as the Smithsonian's address.

In section 2.2: Active Controls, a very important statement concerning depredation permits has been added: "A depredation permit is not required for non-lethal harassment of migratory birds on the airfield IAW 50 CFR 21.41."

The changes continue in section 2.2 subsection 2.2.1: Pyrotechnics. The descriptions of two 15 mm cartridges are now included, along with the coordination process for commercial off the shelf (COTS) purchasing of pyrotechnic munitions. Section 2.2.3: Depredation has been expanded to include a further explanation of the depredation process and permit acquisition. An additional

subsection has been added, 2.2.3.1: Airport Permits, which includes a very important statement: "This clause would allow airports to kill, capture, or relocate up to ten (10) other migratory birds species on an emergency basis." Please read the entire section before operating under this guideline.

Several changes and/or additions have been made in section 2.2.4: Other Wildlife Control Methods. The sub-sections pertaining to falconry and dogs have been expanded and two new sections concerning radio controlled crafts and all-terrain vehicles have been added. The final section in 2.2: Active Controls, sub-section 2.2.6: Personnel and Equipment, now addresses storage issues of the 15 mm launcher and Very Pistols with 12 mm sleeves.

In section 2.3: Passive Controls, the pamphlet addresses those management techniques that make airfields unattractive to wildlife. Sub-section 2.3.1.1: Grass Height, still recommends the seven-to-14-inch standard grass height, but there is an explanation of the difference between weed seed heads and grass seed heads. In sub-section 2.3.1.5: Native Vegetation, a sentence recommending de-vegetation in low-moisture areas has been added. Lastly, in section 2.3.9: Fencing, specific height and types of fencing recommendations are made.

An entire section (2.4) on hangars has been added into the pamphlet. Each sub-section (2.4.1.-2.4.6.) discusses different measures to reduce bird nesting and roosting in airfield hangars.

Section 2.5: Flight Operation Considerations, has many additions and changes. Sub-section 2.5.2. is devoted to the avoidance of flight operations one hour before and one hour after sunrise and sunset. The sub-sections 2.5.4.4.1 through 2.5.4.4.3 provide the definitions of low, moderate and severe risk classes associated with the low-level Bird Avoidance Model (BAM), further BAM explanations and the website address for the BAM model. Continuing to focus on the web-based tools, sub-section 2.5.4.5. concentrates on the Avian Hazard Advisory System (AHAS). The sub-sections under this category focus on the details of NEXRAD radar functions and the website address for AHAS. Changing pace a bit, section 2.5.4.6: Phase I and Phase II has been added. This section provides further guidance and a better explanation for determining Phase I and Phase II periods at airfields.

Section 2.6: Technical Assistance, has been updated with the addition of the HQ BASH Team's website and other valuable literature sources.

In Chapter 3, Airfield Wildlife Hazards, very few changes have been made. The most important change is the addition to section 3.14: Owls. This section now includes additional information concerning Burrowing Owls, including the position that they should not be allowed to establish residence on an airfield.

The attachments in the pamphlet also have been updated and some additional attachments have been added. Attachment 2, The Self-Inspection Checklist, now includes items number 15 and 16, which address the reporting of strikes in accordance with AFI-91-204 (*Safety Investigations and Reports*) and the sending of remains to the Smithsonian Institution, respectively. Item 52 has been added and emphasizes the use of BAM and AHAS for mission planning.

Attachment 4, USDA Animal Wildlife Services and USFWS Offices, has been corrected with new addresses and phone numbers. Attachment 5, Authorized Equipment List, has been expanded. Attachment 6, Video List, has been added and includes a list of BASH educational videos and how to acquire them. Finally, an Attachment 7, BASH Deployment Kit, has been added to provide guidance on items to consider during deployment operations.

It is evident the BASH Team has put quite a bit of effort into making the new AFPAM 91-212 a more effective tool to be used by BASH program managers. Many of the additions or changes are tested methods proven useful at different Air Force bases worldwide.

Items included in the BASH Pamphlet are suggestions and are not mandatory. The pamphlet is made to cover many diverse issues, as each base is going to have unique bird problems. Hopefully, the new and improved pamphlet will prove useful to you in the field. If an item is not addressed in the pamphlet or questions arise, please contact the USAF BASH Team.

4th Joint Annual Meeting of Bird Strike Committee USA/Canada

October 22-24, 2002
Sacramento International Airport, California

Theme: Practical Wildlife Control Techniques for Airports

Every year, over one billion dollars is wasted and lives are endangered worldwide when birds and other wildlife collide with aircraft. To meet this ongoing challenge, the Bird Strike Committees of USA and Canada present the 4th annual joint meeting, October 22-24, 2002, hosted by the Sacramento Country Airport System. A field trip to Sacramento International Airport (SMF) provides an ideal location to address wildlife issues. SMF is surrounded by bird-rich agricultural and aquatic habitats on the Pacific Migratory-bird Flyway. The conference hotel (Hyatt Regency), Sacramento's only 4-diamond-rated downtown hotel, is located across from the State Capital and within walking distance to numerous shops and restaurants.

Who Should Attend

This annual gathering is of particular interest to military and civilian personnel responsible for airfield operations, wildlife managers, land-use planners, FAA airport inspectors, university researchers, engineers, pilots, aviation industry representatives, waste management operators—anyone interested in reducing wildlife strike hazards. A special focus of the 2002 meeting will be bird strike issues at Latin American airports. For further information, contact any committee member listed below or www.birdstike.org.

Program

Presentations will include papers, posters and demonstrations on wildlife control techniques, new technologies, land-use issues (landfills, wetlands), training, engineering standards, wildlife strike statistics, and habitat management. The meeting will also have hands-on demonstrations and activities during a field trip to SMF. A strike reduction training session rounds out the program.

Exhibits

The program will include vendor exhibits featuring the latest in bird and mammal damage control technologies. Companies interested in participating should contact Gene LeBoeuf at the address listed below.

Agenda

Monday, October 21
- Early-bird military/civil field training (1300-1730) (limit of 150 participants)
- Welcome Social and Registration (1800-2000)

Tuesday, October 22
- Registration, Technical Sessions (0800-1700)
- Meet-the-Vendors Social (1800-1930)

Wednesday, October 23
- Military/civil breakout session (0800-0900)
- Special Latin American session (0900-1200)
- Field trip and demonstrations at SMF (1300-1700)

Thursday, October 24
- Military/civil breakout session (0800-0900)
- Technical sessions (0900-1500)
- Close-out session with Committee (1500-1600)

Registration (www.birdstrike.org)

Early pre-registration is encouraged. Cost is $190 if received by 1 September; then $230 if after 1 September. Cash, checks or credit cards are accepted.

Hotel Reservations

Reservations must be made by 22 Sep to guarantee this special rate.

Please call Hyatt Regency, 1209 L Street, Sacramento, CA 95814 USA at (800-233-1234) or (916-443-1234). Room rate: $84/night. Mention BSC-2002.

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The Good, The Bad and The BASH Team

HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

CAPT DAVID HALL
HQ AFSC/SEFW

High noon has hit on the flight line. Heat rises from the concrete, causing the airfield to appear blurry. An F-16 taxies to the runway, gets the nod and takes off. The sudden motion of the plane and the whine of the engine sends a flock of Mourning Doves airborne. The doves narrowly avoid the intake of the F-16 and the jet departs to complete its mission. The showdown is uneventful and both the doves and the jet will live to face off another day.

There is a sheriff in this town, though. The sheriff, when called upon, will arrive in an iron steed, wearing his white ten-gallon hat—feared by airfield pests, but trusted by airfield managers. The sheriff is the Bird/Wildlife Aircraft Strike Hazard (BASH) Team representative.

The question has been asked many times, "If we request a technical assistance visit (TAV) from the BASH Team, are they good guys or bad guys?" The BASH Team is more concerned with an airbase's ability to complete its mission than with laying blame and writing up individuals or offices.

If called upon to do a TAV at an airfield, the BASH Team representative will request any documentation concerning BASH issues that the requesting base has in its possession. The representative will also query the BASH database to get an idea of the strike history at the base to be visited.

When the BASH team arrives at the airfield, it will most likely first meet with the Flight Safety Office and discuss current problems on the base to get an idea of airfield activities. Then the representative will ask for a tour of the airfield to see the problems with his own eyes.

Many important parties on base should expect to be contacted during a BASH TAV. These organizations usually include flight safety, airfield management, the base golf course, base biologists, civil engineering and any contracted wildlife dispersal specialists. When contacted, these organizations usually are just asked questions concerning duties and perceived problems.

After the BASH Team representative has an accurate picture of the airfield and its management, he will review the current BASH plan with the Flight Safety Office and note any discrepancies. Furthermore, suggestions will be given on how to handle airfield problems more effectively, as necessary.

When the BASH Team Representative returns to the Safety Center, he will write an official report documenting his visit, complete with findings and recommendations. The report will be forwarded to the requesting base. This whole process is done while "wearing a white hat and trying to keep peace in the town."

It is important to note a few things about a BASH TAV. The intention of the visit is to help solve specific BASH-related problems on the airfield, not conduct a review of the installation BASH program. Requests for a BASH TAV from HQ AFSC/SEFW should be coordinated through your MAJCOM safety office. Recommendations will be made, and although there is no current methodology in place to see these recommendations through fruition, the base agencies should do their part to make necessary changes to enhance safety and the AF mission.

There is always the threat of an airfield showdown between aircraft and wildlife. As long as this threat exists, there will be the BASH Team to help airfield pests move along. Until next time, happy trails.

Managing Birdstrike Risk with The Avian Hazard Advisory System

HQ AFSC Photo by TSgt Michael Featherston
Photo Illustration by Dan Harman

T. ADAM KELLY
AHAS Project Manager, Avian Research Laboratory

We are constantly bombarded with statistics and probabilities of some event occurring in our lives. The media is full of statistics such as the probability of getting some form of cancer, being killed in a traffic accident, and the perennial benchmark for risk, being struck by lightning! The BASH team routinely reports the statistics for birdstrikes, but as an aviator do you know what chance you have of striking a bird or suffering a Class A or B birdstrike?

Humans have an odd appreciation of risk and statistics, and of the way they influence our behavior. We know that the odds of a marriage ending in divorce are high, but we continue to get married in the firm belief it is forever. We know the odds of winning a lottery are extremely low, but we continue to play. In both of these decisions, we consider the returns to outweigh the potential risks.

Military aviators know and understand risks. Combat is an inherently risky undertaking. The United States military goes to extraordinary lengths to load the odds in the favor of our per-

sonnel over those of a potential adversary. We are not as accepting of bad odds in combat as it may seem at first glance. Overwhelming power, beyond-visual-range-detection, AWACS and other reconnaissance resources, stealth, electronic warfare and a host of other hardware and tactics are all designed to stack the odds in favor of our military forces. When something goes wrong, we have ejection seats and rescue forces to ensure that our aircrews do not pay for the risks with their lives.

Risk management and risk assessment is now institutionalized in the way we train for combat through Operational Risk Management (ORM). The Avian Hazard Advisory System (AHAS) is the best means we currently have of assessing the risk of a birdstrike in near-real time. We can make long-range risk assessments with the United States Bird Avoidance Model (US BAM), (but this lacks the real-time input of a radar sensor actually detecting birds aloft that we have with AHAS). If you want to know if a range or low-level route is likely to be bird-plagued days, weeks or months in advance, then the US BAM is the best tool to use.

What is the US BAM?

The US BAM is a predictive model of birdstrike risk using Geographic Information System (GIS) technology to correlate bird survey data with environmental geospatial data. The model consists of GIS raster grids, which span the contiguous United States. The value for each cell (or pixel) is equivalent to the sum of the mean bird mass, for all species present during a particular daily time period for each of 26 biweekly periods in a year. This model, based on historical data, clearly indicates where birds are concentrated during any two-week period of the year.

What is AHAS?

AHAS has two main components. The first component is a forecast of bird activity for large soaring birds, such as vultures, and waterfowl, such as geese and swans. Forecasts are made twice a day for the next twenty-four hours using meteorological data. The second component is the current observation of bird activity. This is made using NEXRAD weather radar data. Special computer algorithms are used to detect bird activity in the NEXRAD data. Locations of birds are matched to the birdstrike risk for the area and time given by the US BAM. AHAS can therefore determine times and locations when the US BAM shows an area to be bird-saturated but no birds are actually present in the atmosphere. The benefits of AHAS are near-real-time detection and verification of birds in the atmosphere; these enable better utilization of airspace and more effective birdstrike risk management than just using the US BAM. The US BAM may show an area as "severe" for a two-week period. AHAS, by contrast, may show birds in the same area to be "active" on three or four days of that same two-week period. The flight performance of birds, like aircraft, is affected by weather conditions. For example, migrant birds are unlikely to move with a headwind or in rain. During these periods of bird inactivity, training can be conducted with lower birdstrike risk than on the days when weather conditions favor bird activity.

The benefits of AHAS are near-real-time detection and verification of birds in the atmosphere.

What's the probability of birdstrike?

In 2001, the BASH Team collected 3766 birdstrike reports. That means the USAF reported an average of 72 birdstrikes per week. In the worst month, USAFE accumulates about three times more birdstrikes around the airfield (328 per 100,000 flying hours) than PACAF (128 per 100,000 flying hours). Try to think of another flying safety statistic with a rate as high as that for birdstrikes. In the best months, strike rates fall as low as 23 for USAFE and 32 for PACAF per 100,000 flying hours. Birdstrikes are a common event even in the USA. AETC had a rate between 56 and 193 reported birdstrikes per 100,000 flying hours per month. Flying low-level missions where speeds and the resulting impact forces are higher increases the risk of birdstrike damage. In their worst month (August), AFSOC reported 408 birdstrikes per 100,000 flying hours. This high rate, more than 4 times higher than the worst month for ACC, is due in part to AFSOC flying low-level missions in large aircraft (AC/MC-130).

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AHAS does not provide recommendations for managing birdstrike risks

The nature of birdstrike risk changes for each aircraft type, model and mission profile. Therefore, AHAS does not direct pilots whether or not to train in an area, but simply quantifies the level of birdstrike risk. A composite airframe such as the B-2 or F-117 is much more frangible than an aircraft constructed with conventional materials. A single-engine fighter is more vulnerable than a twin-engine aircraft (F-16 vs. F-15), and smaller jet engines are more easily damaged than larger, high bypass engines (T-38 vs. KC-135R). A squadron that will shortly deploy overseas and faces the potential for combat missions is more likely to accept birdstrike risk in conducting realistic training mission profiles than one conducting routine training. Each base and squadron must conduct an ORM review and develop birdstrike risk management procedures based upon their aircraft type, mission profile and training requirements. AHAS and the US BAM provide a consistent measurement of birdstrike risk across the CONUS. Each mission can determine the level of risk they are willing to accept against a standard scale and what risk management procedures they implement when that level of risk is reached.

AHAS and the US BAM provide a consistent measurement of birdstrike risk across the CONUS.

What are the risk management options during increased bird activity?

Risk management to lower birdstrikes comprises two basic alternatives: Either change the location or change the time of the flight. A third option is to select altitudes with less bird activity, but neither AHAS nor the US BAM has an altitude component. It used to be said that increasing altitude reduced birdstrike risk. For example, if birdstrike risk was high on a low-level route, then flying at 1500 feet was safer than at 500 feet. At times, the distribution of birds supports this theory. Using high-resolution radars we have found that during some bird migration or soaring events you could be exposed to fewer birds at 500 feet than at 1500 feet. In the absence of reliable altitude data, we recommend changing routes, skipping a portion of a route or changing the time of day as the primary means of risk management. To meet training goals and requirements, this may require the use of aerial refueling to reach more distant routes and ranges. Advanced planning is required to assure the availability of refueling assets. The US BAM can be a key planning tool to ensure that potential hazards have been identified and mitigation considered.

Some forward planning and understanding of locations likely to be hot spots for bird activity can make mitigating birdstrike risks easy to accommodate. Knowing that Dare County range is a hot spot for bird migration, Seymour Johnson AFB has made arrangements to have high-resolution mobile radar on site this fall. This will enable them to monitor the distribution of birds and better manage their airspace and training time. Forward planning can minimize the impact of bird hazard restrictions on achieving mission-training goals.

Does your local BASH Plan use the available tools for reducing birdstrike risk?

If you answer "No" to any of the following questions, then you may need to revise your local BASH plan.

1. Does your local BASH Plan direct aircrews to use the US BAM to identify levels of birdstrike risk when planning an exercise or deployment in the lower 48 states?
2. Does your local BASH Plan direct aircrews to use AHAS to identify current birdstrike risks before conducting low-altitude flights or training on bombing/weapons ranges?
3. Does your local BASH Plan provide guidance to aircrews on how to manage risk during periods of increased bird activity?
4. Does your local BASH Plan provide for regular training to your aircrews in the use of AHAS, the US BAM and local procedures for birdstrike risk management?

Having a comprehensive BASH plan is a good first step, but it must be implemented and used by aircrews in all day-to-day training missions. To go back to risk and human behavior, we generally avoid areas we know will be congested during rush hour. Similarly, we should avoid the "rush hour" when many birds are active. In general terms, this is the migratory season, and when birds

move from roosting to feeding grounds on a daily basis. The best tools to understand when this occurs are the US BAM for long range planning and AHAS for near-real-time assessments of bird activity aloft.

What is the future for AHAS and Birdstrike Risk Management?

AHAS is currently being expanded to encompass all of the lower 48 states. The progress of this expansion has been delayed by constraints in the release of funds this financial year. In the past year AHAS has improved from 60-minute to 30-minute updates. To maintain the reliability of AHAS computers, which run 24 hours a day, 365 days a year, they must be replaced after three years of service. The increasing speeds of replacement computers will allow AHAS updates of 15 minutes in the coming years.

The AHAS system is based at the Avian Research Laboratory in Panama City, Fla., where work is being conducted with small high-resolution radars for measuring bird activity at airports and landfills. Avian radar technology can detect birds at airports in real-time and provide altitude information in the approach and departure corridors. Six months ago, our software could detect birds in relatively coarse radar data after 20 seconds of processing. Now, we can detect birds in high-resolution radar data in two seconds. This high-resolution, real-time, avian radar technology is scheduled to be deployed on the first military airfields this winter. The key to this technology has been our development of a faster and more efficient computer algorithm to detect bird targets in clear air, as well as in rain and in ground clutter. The improvements in the avian radar software will be replicated to improve the algorithms used in AHAS. This will again decrease the time between risk updates and improve the quality of the information that is available for birdstrike risk assessments.

At the Avian Research Laboratory, we are also working with other groups to obtain higher resolution NEXRAD radar data. In the past, network bandwidth constraints limited the resolution of NEXRAD data transmitted from each NEXRAD station. The higher resolution data is currently available on an experimental network of 40 NEXRAD stations. We are developing algorithms to process the higher resolution data, which will allow us to more accurately determine the locations of the most hazardous concentrations of birds, such as large waterfowl. This improved data is most likely to be used first in development of the US BAM. As the experimental network becomes an operational system for use by meteorologists, the AHAS system can quickly incorporate the improved dataset. The availability of high-speed, high-bandwidth networks of radar data also opens up the possibility of adding airport surveillance radars to the network. These additional radar systems may help to fill in gaps in the coverage, provide more detailed measurements where coverage overlaps, and provide redundancy when a radar goes out of service.

At the Avian Research Laboratory, we've made dramatic advancements in our radar bird detection capabilities. The AHAS system today provides the best available tool for ORM of birdstrike hazards. The limitations of the current system, in terms of frequency of updates and data resolution, are constantly being improved. AHAS benefits from the development of small-scale, high-resolution bird radars and the data they collect to ground-truth larger radars such as NEXRAD. More accurate monitoring and forecasting of bird hazards will allow more training during low-risk periods.

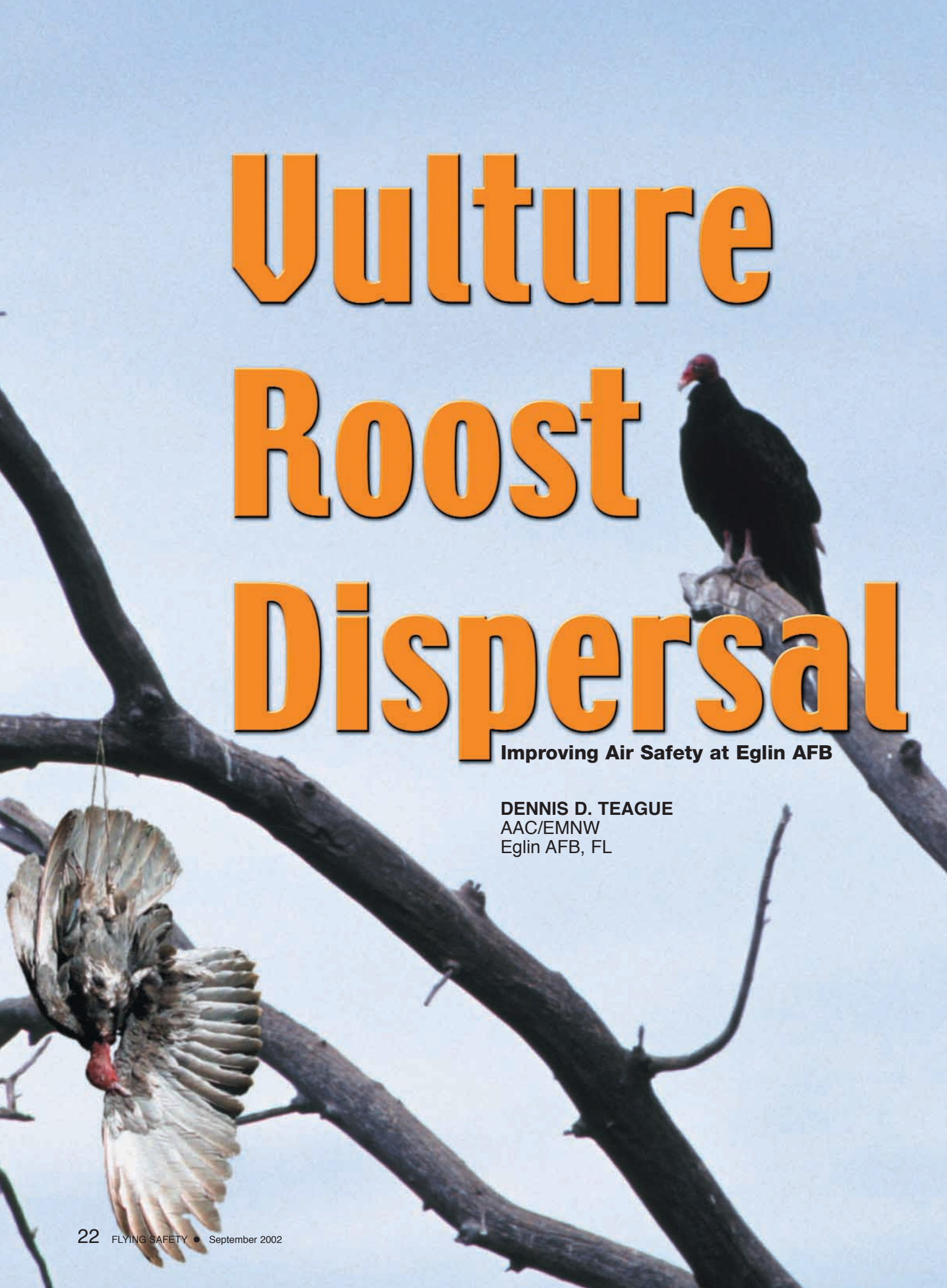
Incorporating the use of AHAS in your local BASH plan and mission planning routines will reduce the overall risk of a damaging birdstrike. Like divorce or lightning strikes, we cannot prevent birdstrikes from occurring. By knowing the risks of a birdstrike and developing procedures that reduce that risk, we can fly safer and protect our aircrews and our increasingly scarce aircraft assets. Over the past 10 years, the USAF reported an average of 1.6 Class A and 10.6 Class B birdstrikes annually. Birdstrikes are frequently reported events and do result in significant damage. AHAS can help to reduce the probability that a serious birdstrike will happen to you.

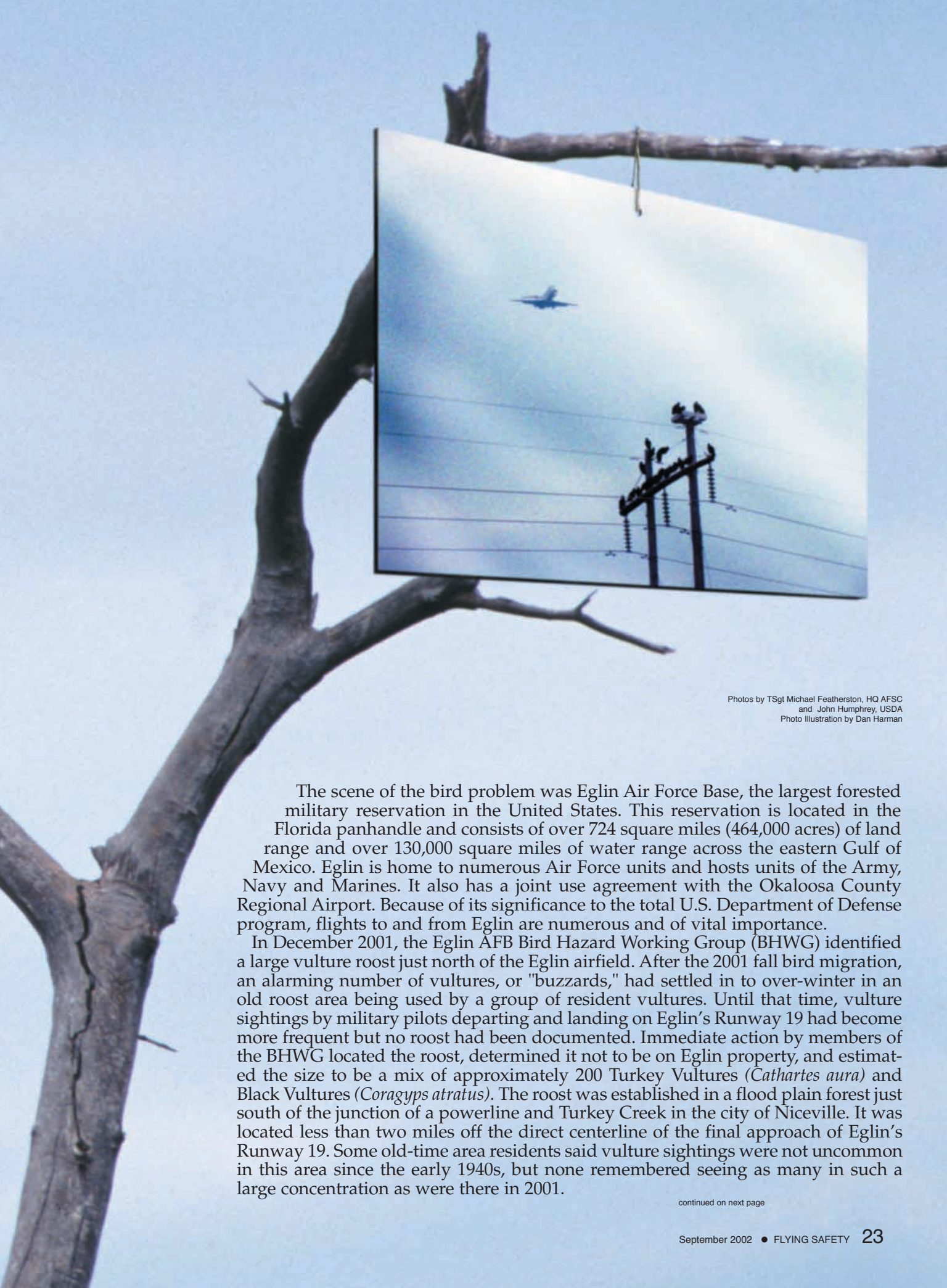
Avian radar technology can detect birds at airports in real-time and provide altitude information in the approach and departure corridors.

Vulture Roost Dispersal

Improving Air Safety at Eglin AFB

DENNIS D. TEAGUE
AAC/EMNW
Eglin AFB, FL





Photos by TSgt Michael Featherston, HQ AFSC
and John Humphrey, USDA
Photo Illustration by Dan Harman

The scene of the bird problem was Eglin Air Force Base, the largest forested military reservation in the United States. This reservation is located in the Florida panhandle and consists of over 724 square miles (464,000 acres) of land range and over 130,000 square miles of water range across the eastern Gulf of Mexico. Eglin is home to numerous Air Force units and hosts units of the Army, Navy and Marines. It also has a joint use agreement with the Okaloosa County Regional Airport. Because of its significance to the total U.S. Department of Defense program, flights to and from Eglin are numerous and of vital importance.

In December 2001, the Eglin AFB Bird Hazard Working Group (BHWG) identified a large vulture roost just north of the Eglin airfield. After the 2001 fall bird migration, an alarming number of vultures, or "buzzards," had settled in to over-winter in an old roost area being used by a group of resident vultures. Until that time, vulture sightings by military pilots departing and landing on Eglin's Runway 19 had become more frequent but no roost had been documented. Immediate action by members of the BHWG located the roost, determined it not to be on Eglin property, and estimated the size to be a mix of approximately 200 Turkey Vultures *(Cathartes aura)* and Black Vultures *(Coragyps atratus)*. The roost was established in a flood plain forest just south of the junction of a powerline and Turkey Creek in the city of Niceville. It was located less than two miles off the direct centerline of the final approach of Eglin's Runway 19. Some old-time area residents said vulture sightings were not uncommon in this area since the early 1940s, but none remembered seeing as many in such a large concentration as were there in 2001.

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A few words on these birds: Turkey and Black Vultures are large scavenger-type raptors that weigh in at an average of 4.5 pounds and are a common sight in the Florida sky, soaring on thermals in search of carrion. These migratory birds are communal in nature and different groups or individuals may gather in one location to roost together at night. According to Air Force Safety Center birdstrike statistics, since 1985 the Turkey Vulture has accounted for 438 birdstrikes putting it in third place for monetary losses to Air Force aircraft, with a $35,919,004.04 price tag. The Black Vulture is not far behind, in eighth place with 166 strikes and $9,291,671.66 in damages. Looking at these statistics (Air Force only), it is easy to understand why, with their size, track record and increasing numbers, these birds should be considered a serious threat for all aircraft pilots.

Immediately after the discovery of the roost, an emergency BHWG meeting was convened to assess the threat of the roost to Eglin aircraft and to determine a plan of action. In order to insure the safety of all aircraft utilizing Eglin airfield and avoid a catastrophic situation, a decision was made to attempt to disperse the roost to another location. Even though the roost had been in the area since the 1940s, knowledge of the roost location and the increased number of vulture reports by military pilots justified this decision. Now, the problem was how to get rid of over 200 vultures from an area that had been utilized as a roost for over half a century.

The BHWG realized this effort was going to be challenging and forged ahead to develop a plan. The implementation of this dispersal effort would require coordination between federal and state agencies, local governments and private landowners. The roost was not on Air Force property, and the BHWG was not sure who owned the property or what type of reception they might receive when they presented their request to disperse the roost. In addition, the reaction of the public to the removal effort was another major concern. A city-owned nature trail boardwalk had been opened along Turkey Creek and passed near the middle of the roost. On evening strolls along the boardwalk, local residents enjoyed seeing the vultures coming in to roost. The only harassment tools available for the BHWG to use were pyrotechnics, a federal depredation permit and propane cannons. Utilizing any of these tools in this particular situation would definitely attract unwanted attention.

Contact was first made with the Air Force Safety Center Bird/Wildlife Aircraft Strike Hazard (BASH) Team. The BASH Team is always the first and best resource to contact when an Air Force installation has questions or issues about bird or wildlife problems. The next contact was the Florida Fish and Wildlife Conservation Commission, who provided the BHWG with all the state requirements. Then contact was made with the United States Fish and Wildlife Service (USFWS) Regional Office. The USFWS permits coordinator informed Eglin that its federal depredation permit could not be used for this project, since the roost was not on Air Force property. Also, vultures are a federally protected migratory species and may not be taken (killed) without a special permit. All of the above agencies recommended that Eglin work with the Wildlife Services of the United States Department of Agriculture (USDA). This agency has the experience and expertise in vulture roost dispersal and all the required permits and equipment to complete the task.

After a telephone call to Dr. Michael Avery, Wildlife Biologist and Field Supervisor for the USDA National Wildlife Research Center (NWRC) Florida Field Station, plans were set to bring Mr. John Humphrey, NWRC wildlife biologist, to assess the vulture roost and provide the BHWG with recommendations for managing it. The NWRC staff has had much experience working with vultures and felt confident that, with the proper tools and techniques, dispersing the roost could be accomplished. The techniques available were hanging an effigy (taxidermic mount) of a road-killed vulture in the roost, the use of pyrotechnics, use of a hand-held laser to disturb the birds in the roost at night or early morning, the use of paint balls and, as a last resort, possibly some lethal control.

In less than two days after his arrival, Mr. Humphrey had assessed the situation and was ready to present the BHWG with his report. He recommend-

ed the BHWG should proceed by hanging the vulture effigy in a strategic location within the roost and, if needed, supplement this technique with the hand-held laser. This technique had been proven successful in previous vulture roost dispersals by the NWRC, but none of those other roosts had been in existence for so many years or had been associated with airport flight safety issues. Mr. Humphrey pointed out that when dispersing a roost there would be no control over where the vultures would move. He said they could possibly relocate to a location that was even more of a hazard or that might cause other problems. This was a chance that would have to be taken, because the first priority was to disperse the roost from the area off the end of Runway 19. During this same timeframe, Air Force public affairs staff had received permission from private and city landowners to use their property in order to implement the dispersal operation. Upon finding out about the hazard the vulture roost was posing to military and commercial aircraft, landowners were eager to work with the Air Force to remove the threat.

The decision was made to proceed with Mr. Humphrey's plan. The goal of the vulture effigy was to change the roost environment by placing a dead vulture in the immediate area of the roost. The presence of the dead vulture would make the roost so inhospitable that all the members of the roost would disperse and take up residence elsewhere. This technique, if it worked, almost seemed too good to be true; but the roost had to go, and if it worked the dispersal would be accomplished with little notice or fanfare.

Mr. Humphrey selected a large cypress tree in the flood plain near several of the perch trees the vultures used in the morning and evenings. He used a bow to shoot a fishing line across a dead limb in the tree and raised and secured the effigy. The effigy gently swayed as the wind blew through the trees. Now it was basically a waiting game to see what the outcome of the operation would be.

For the next few days, vultures from the roost would visit the tree where the vulture effigy was hanging. They would perch and watch, and some would slowly fly around the tree. In a couple of days it was obvious that the numbers of vultures in the roost had started to decline. Soon it appeared most of the over-wintering vultures had left and a few of the resident members were still hanging around. However, in less than two weeks all the vultures had left, and none returned to roost in the area again! Attempts were made to determine where the vultures had moved, but no other large roosts could be found. Several smaller groups of vultures were spotted, and it is assumed the large roost broke up into multiple smaller groups and dispersed around the area away from the airfield. As soon as it warmed up, the numerous over-wintering vultures naturally moved back north for the summer. A military helicopter flight was conducted to survey for vulture roosts in the Turkey Creek and surrounding creek drainages. None were found.

It has been over five months since the dispersal operation, and no vultures have started to use the roost again. After about four months, a goose decoy altered to look like a vulture replaced the original effigy. This replacement will protect the effigy from excessive weathering by the elements and make it available if needed in future dispersal efforts. As long as the decoy does its job, the real effigy will be kept in storage. Weekly monitoring of the roost area will continue for an extended period of time, and extra precautions will be taken after the 2002 fall migration when migratory vultures may attempt to use the roost again. The roost dispersal operation itself was a success and, without killing any birds, removed the hazard of over 200 vultures from a roost that had been in existence for over half a century. However, the fact remains that even with the roost dispersed and surveys that report no established roosts around the area, vulture sightings still occur.

Vultures are now and will continue to be a year-round threat to aircraft in the Florida skies. But at Eglin AFB, with continued vigilance and the help of a few effigies, known vulture roosts will not be tolerated near the airfields.

Dennis Teague is an endangered species biologist with the Eglin AFB Natural Resources Division. He is the Natural Resource Representative for the Eglin AFB Bird Hazard Working Group.

Photos by TSgt Michael Featherston, HQ AFSC and John Humphrey, USDA
Photo Illustration by Dan Harman

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

Those Precious Refuelers—We all know who they are when the fuel gauge reads low. However, we sometimes forget the refueling track procedures and abuse the ones who pass the gas. Refuelers, watch out for others and yourself.

Who's Out There?

A single KC-135 was refueling an F-16 two-ship with one aircraft in the contact position and the other waiting his turn. Another two-ship of F-16s was scheduled to refuel from the same tanker and was conducting a rejoin when things didn't go quite right. The rejoining two-ship acquired the tanker visually at 12 miles and began a descending turn to facilitate a visual intercept with the tanker. They accomplished the intercept visually because the lead aircraft's radar had decided to fail. The aircraft leveled off co-altitude with the tanker and did not obtain a 1000-foot vertical separation. The tanker started a left turn, as required by the refueling track, and the aircraft that didn't have any radar did not visually perceive the turn. As a result, the aircraft passed just to the right of the tanker with about a 3000-foot lateral separation. The wingman, doing like he is supposed to, followed in the exact same position in relation to the tanker.

What happened? The lead fighter had no radar and no Mode C. Therefore, he wasn't transmitting anything that the tanker and/or ground control could use to help deconflict the situation. The pilot of the lead aircraft spent too much time focusing on the radar and did not try to reset his Mode C, resulting in inadequate aircraft separation. The procedures were written and in place, and everyone knew them. Is this another case of over-tasking? Unfortunately, the pilot almost got tasked with an ejection. Make sure we maintain separation, and concentrate on the always-important task of not running into the flying gas station.

The Crowded Skies

At one of the many places we have our aircraft these days, a couple of aircraft missed the road signs and were going the wrong way down a one-way refueling track. The tanker had a fighter in the receiver position, and as they reached the point in the track where they turn around and go back the way they came, the tanker missed the turn point and continued 10 miles past their assigned track and into another refueling track. The aircraft was now at the same altitude and heading right for the tanker and receivers in the other track. TCAS provided the second tanker with a traffic alert, and the receiver aircraft acquired the other refueling pack visually. He then asked who would be avoiding whom? The aircraft were now playing a high priced game of chicken in the sky, as they figured out who would avoid whom. Finally, the second tanker cleared everyone off the boom as they approached five-mile separation and initiated a 1500 feet-per-minute descent to avoid the conflict. The two formations passed one-quarter to one-half mile laterally in opposite directions.

This is a simple case of one pilot missing the turn and the actions that follow (Where is that navigator?) Throw in the very crowded skies of an unfriendly area and very short refueling tracks, and you have an invitation to disaster. Just a friendly reminder, when you fly the crowded skies, keep your situational awareness and never forget where you are!

One, Two, Three Strikes

Sometimes we include our Navy brethren in the fun. During the refueling of two Navy F-18s by one of our KC-10s, two mishaps occurred that damaged all three aircraft. The F-18s would be using the Wing Air Refueling Pods (WARP) and were briefed on the procedures by the boom operator. Shortly after the aircraft made contact, the first receiver initiated a disconnect. Upon reconnection, a sine wave developed and proceeded to detach the probe tip from the shank. The boom operator noticed sparks spraying from the aircraft, and the F-18 reported the lost probe and engine FOD damage. The tanker reported that everything was still attached to their aircraft after the receivers had left, but no further contacts were made.

Upon landing, the tanker was surprised to find a 12-inch portion of the F-18's refueling probe still attached to the drogue. In addition, they found eight broken rib support cables, one bent rib and one damaged wiring conduit and harness. The Navy reported damage to the refueling probe of the second F-18 from his rapid disconnect after the first receiver breakaway.

"What happened?" you might ask. For those of you in the refueling world, what do you think happened? What closure speed do you use when you approach the drogue? What is your reaction when you come off the drogue? It's a dangerous business, especially at night. Keep your cool up there. Sometimes we need to slowly back away and take a breath before we try again.

Did It Get Quiet Or What?

A KC-135 was doing some approach work, and the co-pilot changed into the left seat for his first approach. Bet he was excited, and unfortunately his approach got *real* exciting. As they were cleared to 2000 feet from 4000 feet, all four engines shut down, and subsequently all electrical power was lost. Luckily for them, and the Air Force, the crew was able to restart all the engines by the time they reached 2000 feet. They had *lost* almost *1800 feet* during the non-powered portion of the approach. The copilot was replaced in the left seat, and the aircraft recovered safely.

How can an aircraft lose all four engines at once? Many things can happen, but maintenance found no defects in the system. So what do you look at next? How about system design? The KC-135 has the standard four side-by-side throttle levers with approximately 60 degrees of movement from full open to idle. From idle to cutoff is another 30 degrees, and the levers must be lifted a half inch to clear the idle stop. Newer heavy aircraft have additional safeguards to prevent inadvertent cutoff. In addition, the aircraft gear warning horn will sound whenever the throttles are moved to idle and the gear isn't down. Sounds like a good system. Lifting a pull-type switch located immediately aft and five inches below the aft throttle stop can manually silence the horn. You can even preempt the warning worn by lifting the switch while retarding the throttles. Do you see a potential problem here?

We can't forget about training and the techniques taught by our fellow aviators. In the KC-135, there are three different techniques taught on retarding throttles and silencing the horn. First, nearest hand with open palm pushes the throttles, same hand moves from the throttles to silence the horn. Second, nearest hand closes over the throttles knobs pinching them together and pulling them to idle; same hand moves from throttles to lift the cutoff switch. Lastly, the two-handed method: far hand reaches across the body to push the throttles; near arm and hand placed aft of the throttles to simultaneously, lift the cutoff switch. But never cross the arms over the body.

What technique do you think the very new and inexperienced copilot used? You figure it out. Whatever technique was used it wasn't the right one. An experienced crew was there to correct the error, and luckily they had enough altitude and time to restart the engines. Let's be safe out there, and make sure the new guy knows the right way to handle the aircraft. We don't need any more losses.

Almost A Bad Ending

Well, now a short story about a close call to wrap things up. The danger to refuelers isn't always up in the air. Here is a case when the end of the mission was almost a final ending. A base operations vehicle needed to enter the runway to perform the morning runway inspection, and was cleared by the tower. At the same time a KC-135 was flying a visual approach to the same runway and was cleared by the tower to land. Do you see a conflict developing? I do. The vehicle driver was unaware of the aircraft in the pattern and was doing his duty. After touchdown, the pilot saw the vehicle approximately 7000 feet down the runway. The crew did some very hasty braking and was able to stop the aircraft before they hit the vehicle. The driver then performed a hasty retreat from the runway he was cleared to be on. The aircraft luckily didn't have any damage and informed the tower of the upcoming paperwork.

The cause of the mishap? The tower controller was in the eleventh hour of a twelve-hour shift, was a 5-level and was working unsupervised due to a 7-level manning shortage. Do you see any weak links in this safety chain? There is a procedure in-place where the controller would put a runway-closed flap over the wind sensor to alert the controllers to the fact the runway is closed. Simple and effective. Unfortunately, the flap wasn't flipped, so the controller wasn't reminded about the vehicle. To add to the controller's problems, the vehicle was white, and on a white runway with an inoperative rotating beacon. A whole string of weak links in the safety chain led up to this near miss. Thankfully, the alert tanker crew was able to stop in time to avoid the vehicle and break the chain. Keep your eyes open, stay awake and don't forget the little things!

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What We Do To Ourselves—This issue is about birds, but let's talk about another form of FOD, the kind we do to ourselves with unaccounted-for hardware and improper procedures. It cost "US" more than you want to know to repair what we do to ourselves.

Rock and Roll

An E-8C was at one of our deployed locations and the sortie went just as planned until the postflight engine inspection, when the number four engine was found with FOD damage. Fortunately it was *only* to the fan section and *only* cost the government $186,000 to repair. What caused this incident?

How many of us have had the pleasure of being in a far away place and the roads aren't paved? I would say most of us. This airfield is relatively new and most access roads are loose gravel, and the area surrounding the field contains loose rock and gravel. No unit that has been at this location has survived without a FOD incident. The cause? You know it all too well. When you are not at home and the FOD danger is high, make sure you increase your FOD procedures to keep the ramp clear of the migrating rocks that will cause you unnecessary work. We are way too busy to do things "just because." Aren't we?

High-Priced OOPS!

That one word sums up this high- priced T-38 recovery. The aircraft had blocked in and the initial inspection of the left engine found the main landing gear pin and canvas pitot cover entangled in the front frame of the compressor. Further inspection found 96 compressor blades and 84 stator segments damaged beyond repair. Amazing what a little bit of canvas and one pin can do to an engine. The two crew chiefs that launched and recovered the aircraft were fully qualified for the task at hand. Do I need to say any more about what caused this mishap? Make sure we account for everything and keep a tight hold on the ground covers. Oh yes, cost to repair the engine, $56,245!

Where Did That Come From?

The old "CANN" bird that everyone has was being put back together after 45 days of donation, and many repairs had been done near the intakes of this F-15C. The NDI of the ramp area showed things to be free and clear, so they prepped the aircraft for a maintenance engine run. Pre-run checks were completed, and several personnel installed the final panels and helped with the intake inspections and engine run guards. Can't forget this fact. Before the aircraft was towed to the parking spot, the swing shift performed a FOD walk, and used the "FOD Boss" over the entire ramp, to include the mishap aircraft's parking spot.

The run was started, and after the idle runs were complete for the initial ops checks, the run man advanced the throttles to shut things down. Then things went wrong. A post-run inspection revealed damage to the first and second stage fan blades of the number two engine. Upon borescope, they found extensive internal damage and a foreign object (FO) in the anti-ice valve. The aircraft had no missing hardware, so where did that FO come from?

Metallurgical analysis determined that it was an A286 stainless steel flathead screw approximately one-half inch in length and .15 inches in diameter. Marks on the fan blades indicate that it did not originate in the engine, but came from an external source. How do they do that, anyway? The Safety Investigation Board consulted with the experts, and guess what is not used on the aircraft? The screw that caused $570,758 in damage to the engine. Then where did it come from? You tell us and we'll both know.

How Many Engine Changes Does It Take?

A heavy lifter needed an off-station engine change due to an overtemp. Are they ever at home station? The MRT changed the engine and all ops checks were good. So they sent the crew on their merry way, and after a short three-hour flight to the next stop, the flying crew chief found FOD damage to the new engine on the postflight engine inspection. Unfortunately, to the tune that three complete sets of compressor blades needed to be changed. So off with the engine, again. Once again, those miracle workers at the metallurgical lab found that a cadmium-plated 28-pitch threaded fastener between .45 and .50 inches in diameter caused the FOD.

There is a 28-pitch fastener used in the engine bullet nose, but it is only one-quarter inch in diameter and no other fastener in the engine intake area matches the characteristics of the FO. Also, an inspection of the engine revealed no missing fasteners. So where did the mysterious fastener that caused $176,738 in damage and a second engine change come from? Maybe Yoda is available to tell us.

They Were All There When I Started!

Another one of our F-15Cs was undergoing an hourly postflight when it became the next FOD victim. The aircraft required idle and max power runs, and various panels were removed and reinstalled as part of the normal inspection process. The panels were inspected, and NDI checks complied with prior to the engine run, with no defects noted. The first engine run at 80% power was completed with "No Problems." The aircraft was then towed to the trim pad for the afterburner runs. Once all preps were complete, the engines were started and everything was A-OK. The left engine checked good, but unfortunately the right engine did not meet the same fate. A post-run inspection of the engine revealed FO damage and a missing fastener from panel 27R, which is located between the fuselage and the intake. The nut plate was serviceable, and no other missing fasteners or sources could be found. The damage showed evidence of thread marks that match the type of fastener that was missing from panel 27R. Once again, the wrong hardware, or not taking the time to ensure you have the right hardware, caused double work and 47,946 wasted tax dollars.

Maybe They Need Preflight Binoculars

A B-1B had just completed an engine running crew change and was at the runway ready for takeoff when the supervisor of flying (SOF) noticed a puff of smoke from the number one or two engine. The SOF relayed the info to the crew, who terminated the mission and returned to parking. The postflight engine inspection revealed severe FO damage to the number three engine. The SOF was close. A small barrel-like piece of metal was found embedded in one inlet guide vane, and a screw was missing from one of the weapons bay door hinges.

The aircraft had over 99 flight hours since the last phase inspection and a current preflight. The inspections require the person to check access panels and doors for security. Now, the B-1 is a little different in the fact that the bomb bay doors retract partially up into the bomb bay, making the hinges almost impossible to inspect properly when the doors are open. When stores are loaded, the doors are left open, hinges hidden from view, so the aircrew can inspect the weapons. Maintainers inspect the doors the best they can when the doors are open, but can't see everything. Another factor that may have played a part in this mishap is the screw that is supposed to be installed in the missing location has been out of stock for quite a while and is not available. Bottom line—make sure the proper hardware is installed, and inspect everything. Maybe binoculars and bigger mirrors need to be issued.

Another Stray Fastener

After two Code 1 sorties, the proud crew chief was completing the basic postflight/preflight combo inspection, and to his dismay he found one missing Jo-Bolt fastener on the left wing leading edge behind the outboard side of the leading edge slat. The subsequent intake inspection revealed the true horror, as the fan had one nicked blade. The engine borescope that followed found severe FO damage to the compressor's first, tenth and eleventh stage blades. The aircraft had previously been written up for the missing fastener and it had been replaced.

Here is a case where the right part was in the right spot and came loose. Could maintenance have prevented the $199,033 in FOD? Your guess is as good as mine, if not better. Thing to watch out for is those pesky repeat offenders, and if there is a better fastener for a critical area, let your supervision know. Think FOD Prevention!

FY02 Flight Mishaps (Oct 01-Jul 02)

27 Class A Mishaps
11 Fatalities
14 Aircraft Destroyed

FY01 Flight Mishaps (Oct 00-Jul 01)

19 Class A Mishaps
8 Fatalities
17 Aircraft Destroyed

14 Oct	♣	An HH-60 crashed into a river while flying a low-level training mission.
17 Oct		An F-16CG was severely damaged following an aborted takeoff.
25 Oct		An F-16C departed the runway after landing.
02 Nov	♣	An MH-53 crashed while performing a mission.
05 Nov	✶	An F101 engine undergoing Test Cell maintenance sustained severe fire damage.
12 Dec	♣	A B-1B crashed into the ocean shortly after takeoff.
21 Dec	♣✶	A C-141B sustained a collapsed wing during ground refueling operations.
30 Dec	♣✶	An RQ-4A Global Hawk unmanned aerial vehicle crashed while returning to base.
08 Jan		A C-17 was damaged during landing.
10 Jan	♣	An F-16C crashed during a surface attack training mission.
10 Jan		An MH-53J crashed during a search and rescue mission.
17 Jan	♣♣	Two A-10As were involved in a mid-air collision. Only one pilot ejected safely.
24 Jan		An MH-53 crashed while performing a mission.
25 Jan	♣✶	An RQ-1 Predator crashed on landing.
31 Jan	♣	A T-37 crashed during a training mission. The two crewmembers suffered fatal injuries.
02 Feb	♣	A C-21 crashed while landing. The two crewmembers suffered fatal injuries.
12 Feb		An F-15 was severely damaged due to an engine fire.
13 Feb	♣	An MC-130P crashed during a mission.
18 Mar		An MH-53 crashed during landing.
20 Mar	♣	An F-16 crashed during a training mission and the pilot did not survive.
10 Apr		A KC-10 experienced FOD damage to an engine. (Upgraded to Class A 08 May 02.)
15 Apr	♣	An F-16 crashed into the sea during a training mission.
22 Apr	✶	An F-22 suffered a birdstrike that severely damaged the right engine.
30 Apr	♣	An F-15C crashed during a test mission. The pilot did not eject.

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13 May		An E-4B experienced damage when the HF wire broke loose and struck the fuselage.
15 May	✶	A B-2 suffered major damage when a main landing gear collapsed.
18 May	✶	An RQ-1 Predator crashed returning from a routine mission.
29 May	♣✶	An F-16CJ crashed during a training sortie.
30 May		An HH-60 crashed during a rescue mission.
12 Jun	♣	An MC-130H crashed shortly after takeoff. Three crewmembers suffered fatal injuries.
27 Jun	♣	An A-10A crashed during a training mission and the pilot did not survive.
03 Jul		An F-15 experienced an engine failure. (Upgraded from a Class B)
10 Jul	♣✶	An RQ-4A Global Hawk crashed during a mission.
21 Jul		A KC-135E had a Number 2 engine fire. (Upgraded from a Class B)
24 Jul		A C-17 suffered a hard landing. (Upgraded from a Class B)

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF military fatalities.
- "♣" Denotes a destroyed aircraft.
- "✶" Denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.
- Flight and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html
- **Current as of 30 Jul 02.**

HQ AFSC Photo by TSgt Michael Featherston