UNITED STATES AIR FORCE

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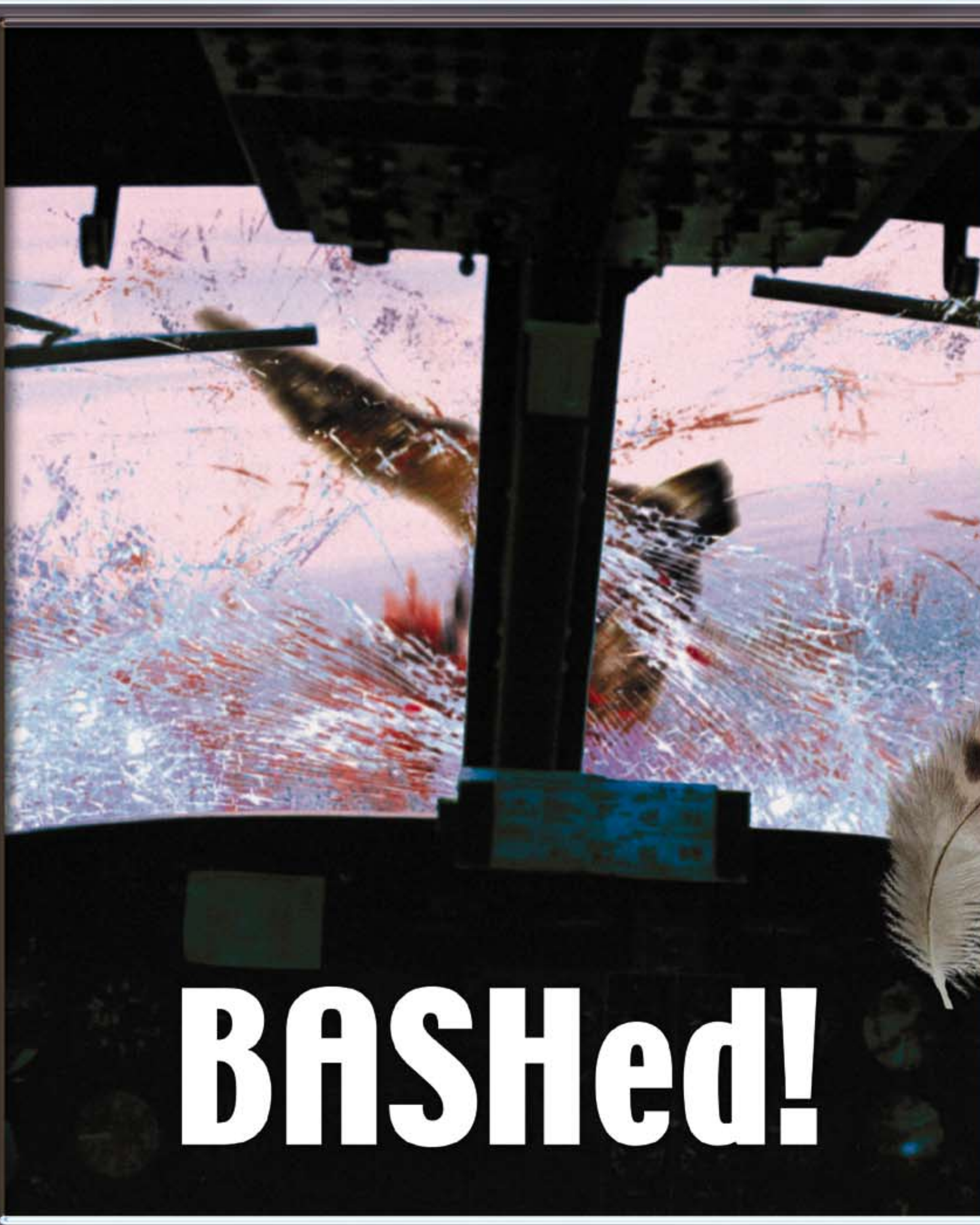
SEP 2004

FLYING SAFETY MAGAZINE



BASHed!

FSM
FLYING SAFETY MAGAZINE

AIR FORCE RECURRING PUBLICATION 91-1

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Cover: USAF Photos
Rear Cover: HQ AFSC Photo by TSgt Michael Featherston
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Flying Safety Magazine on line: http://afsafety.af.mil/magazine/htdocs/fsmfirst.htm

U.S. AIR FORCE

SAFETY SAGE

FEATHER LAB OPEN HOUSE

The Feather Identification Laboratory of the Smithsonian Institution is holding an Open House Reception at the National Museum of Natural History in Washington, D.C., on Sept. 17, 2004, from 9 a.m. to 12 noon. It is being hosted by the Smithsonian and US Geological Survey staff, USDA Wildlife Services, the FAA, U.S. military safety offices, the National Transportation Safety Board, and other aviation safety agencies.

Activities will include tours of the Bird and Mammal Division and the Feather Lab, specimen preparation demonstrations, displays, posters, and a chance to mingle with other BASH people.

For information or to R.S.V.P. (by September 1), contact:
Marcy Heacker-Skeans
heacker-skeans@nmnh.si.edu
202-357-2334

GENERAL JOHN P. JUMPER
Chief of Staff, USAF

MAJ GEN LEE MCFANN
Chief of Safety, USAF

LT COL RICHARD BURGESS
Chief, Plans and Policy Division
DSN 246-0738

JERRY ROOD
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CMSGT JEFF MOENING
Maintenance/Technical Editor
DSN 246-0972

PATRICIA RIDEOUT
Editorial Assistant
DSN 246-1983

DAN HARMAN
Electronic Design Director
DSN 246-0932.

TSGT MICHAEL FEATHERSTON
Photo Editor
DSN 246-0986

DEPARTMENT OF THE AIR FORCE — THE CHIEF OF SAFETY, USAF

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DISTRIBUTION — One copy for each three aircrew members and one copy for each six maintainers and aircrew support personnel.

POSTAL INFORMATION — ***Flying Safety*** (ISSN 00279-9308) is published monthly except combined Jan/Feb issue by HQ AFSC/SEPM, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670. Periodicals postage paid at Albuquerque NM and additional mailing offices. **POSTMASTER:** Send address changes to ***Flying Safety***, 9700 G Avenue, SE, Kirtland AFB NM 87117-5670.

CONTRIBUTIONS — Contributions are welcome as are comments and criticism. The editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning.

Commercial Prefix (505) 846-XXXX

E-Mail — jerry.rood@kirtland.af.mil
Address Changes — patricia.rideout@kirtland.af.mil

24-hour fax: DSN 246-0931

HQ Air Force Safety Center web page: http://afsafety.af.mil/
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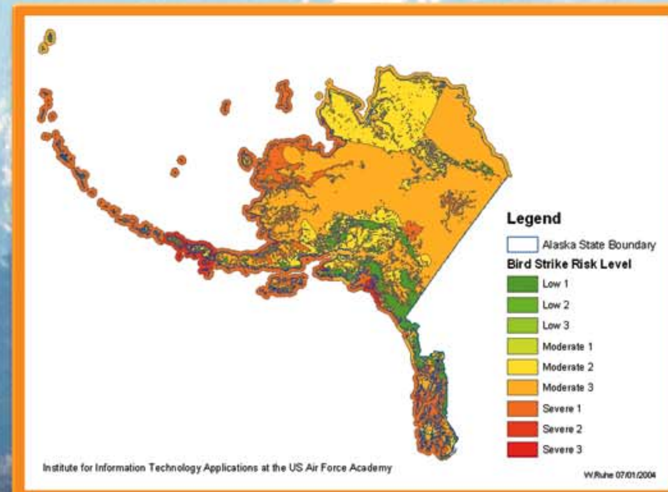
BAM Comes to Alaska



Imagery Courtesy of Authors

Fig. 1

RUSSELL P. DEFUSCO, PH.D
BASH Inc.
Colorado Springs
WILHELM RUHE
Bundeswehr Geo Information Office
Germany

The state of Alaska could have its first Bird Avoidance Model (BAM) before the end of the year. The new BAM, a computer-based risk predictor for bird strikes, builds upon the familiar US BAM for the contiguous 48 states, which has been online for the past several years (http://www.usahas.com/bam/).

A coordinated effort from several agencies has produced an operational Alaska Bird Avoidance Model (AK BAM). The Natural Resources division of the Air National Guard provided major funding for the effort, with the USAF BASH Team contributing monies as well. Germany provided Mr. Wilhelm Ruhe for one year as an invaluable visiting scientist from their Geophysical Institute and is a member of the International Bird Strike Committee. Data were provided by a myriad of sources from federal, state, local, and private agencies. A coordinated team effort from government personnel and contractors was necessary to tackle the complex nature of producing the initial version of the AK BAM.

The AK BAM research team is hosted by the Institute for Information Technology Applications (IITA). Located at the USAF Academy in Colorado Springs, Colorado, the IITA is an independent research center supported by the Air Force Office of Scientific Research. The institute conducts research for the Department of Defense, the Air Force, and the USAF Academy. IITA supports acquisition, educational and operational IT needs, develops an information-rich environment to prepare graduates for the high-tech Air Force, and applies multidisciplinary expertise to IT research. They help develop research topics, select researchers, administer sponsored research, publicize results, and host conferences and workshops that facilitate the dissemination of information to a wide range of private and government organizations. With their multidisciplinary approach, the IITA was the ideal sponsor of the research leading to development of the new AK BAM.

The AK BAM operates just as the US BAM, by allowing users to analyze potentially hazardous concentrations of birds in their operational airspace. The crux of the model is the color-coded "relative risk surface" depicting distribution and abundance of birds in time and space over the entire state of Alaska (see Figure 1). Risk is defined as the likelihood of encountering a hazard and the severity of that hazard. Individual layers in the BAM define the hazard level of birds in units of airspace; thus, relative risk can be assessed by comparing one physical location with another, by comparing one time of day with another, or by comparing a period of the year with another.

Relative risk layers of the model are defined by the cumulative biomass, in ounces, of all hazardous bird species within a square kilometer of airspace from

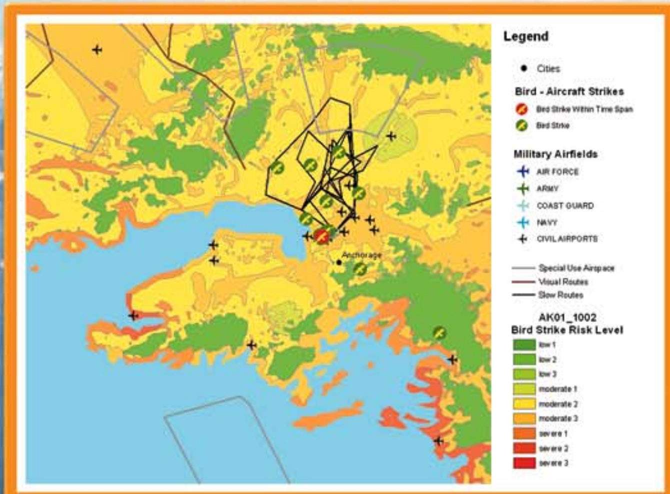


Fig. 2

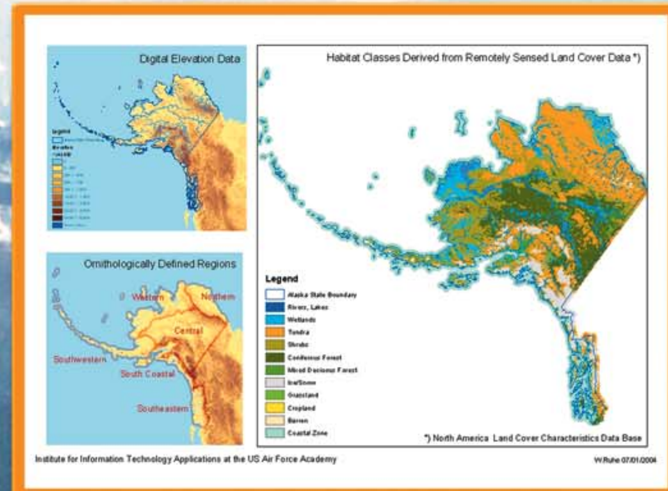


Fig. 3

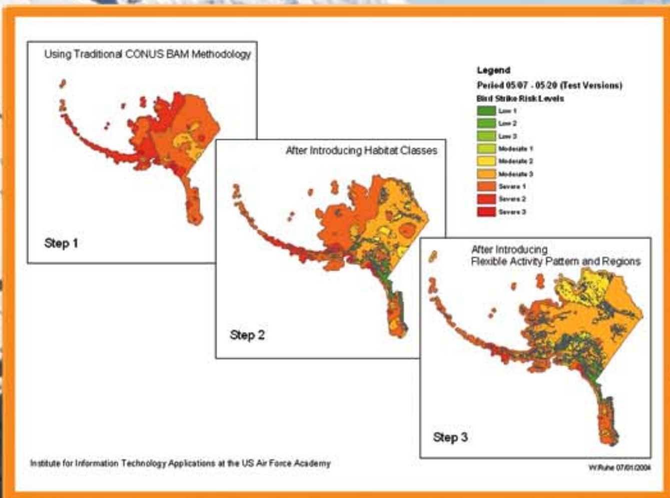
the surface to 3000 feet above ground level. Bird risk surfaces are depicted for every two-week period of the year and four daily time periods. These surfaces may be overlaid with a variety of environmental, infrastructure, and airspace depictions in a dynamic, web-based mapping application (see Figure 2). The surfaces were derived from over thirty years of ornithological data on seventy species of birds deemed most likely to cause catastrophic loss of aircraft, damage to components, or injury and/or loss of life. Species were determined by examining data from historic bird strike records provided to the USAF BASH Team by safety officers around the globe and from bird population levels as determined from numerous sources. Behavioral characteristics and activity patterns were also key in determining potential hazards posed by these species.

These same data were important in developing the US BAM, but there are several improvements made to the AK BAM. Methodological changes in the modeling techniques were made based on two decades of experience in developing the US BAM, improvement in computer processing technology and programs, and the nature of the data available in Alaska. These new techniques are now being reexamined to make future improvements and updates in the US BAM as well.

From the start of the AK BAM project, it was obvious the scarcity of ornithological data, especially in space, would require a more sophisticated approach. When observation sites are in reasonable proximity to each other, a standard interpolation technique is valid, as was used in the US BAM. However, ornithological data collection sites are unevenly and widely spaced over the state of Alaska as a consequence of inaccessible areas and low human population densities; attractive properties to many, but difficult to deal with in this instance. As a result, there are several major changes in the methodology that led to creation of the new bird risk surfaces. These changes involved additional data processing and judgment from experts in the field. The resultant calculations for the risk surface creation increased by about an order of magnitude over comparable US BAM elements. The major improvements involve three main areas, as briefly explained below.

Habitat Correlation

The approach used for Alaska is based on additional information from land cover and land use characteristics. Such data were derived from satellite imagery provided by the US Geological Survey. These data are of one squre kilometer resolution and are almost globally available. Using a more accurate spatial dataset on aquatic areas enhanced their accuracy. The land cover data were transformed and processed for bird habitat classifications, resulting in 10 different habitat classes. Typical habitat preferences were defined for each of the relevant species in Alaska. Spatial interpolation of sampled bird population densities and cumulative biomass of species groups were related to their specific habitat preferences (see Figure 3).



Imagery Courtesy of Authors

Fig. 4

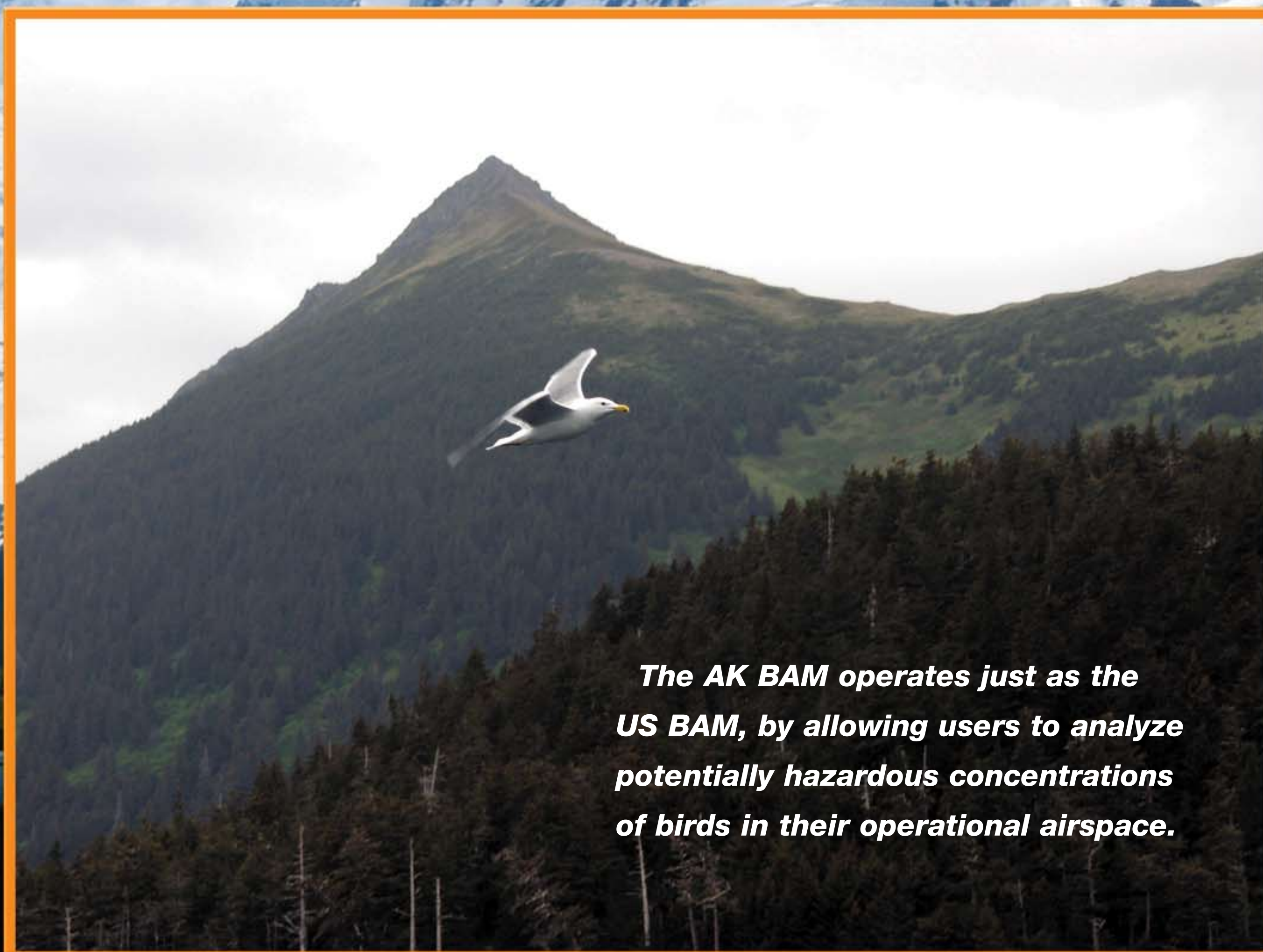
Flexible Bird Activity and Population Size

In both the US BAM and AK BAM, there are four daily activity periods within each bi-weekly period (dawn, daytime, dusk, night). In the US BAM, a conservative approach was taken whereby if birds were known to be in the area and active at a specific time of day, all these birds were assumed to be in the air. This has changed to a completely flexible approach in the AK BAM. For each species group and time period, a value was calculated based on an estimate of the percentage of birds in the air. During breeding periods, for example, only 50 percent of some bird species may be in the air, while the other 50 percent may be tending a nest. Baseline populations are now incrementally adjusted to reflect increases in the number of birds after fledging and decreases due to winter mortality and other causes.

Regional Migratory Periods

Both versions of the BAM treat migration as periods in which the winter population size and distribution is transitioned into the summer population size and distribution, and vice versa. This is calculated by a mathematically linear increase or decrease within the migration period. In the case of the US BAM, the whole of the contiguous United States is treated as one area experiencing this transition, leading to long migration periods that are conservative but may not be most accurate. For Alaska, a huge and quite diverse area, geographical regions with specific environmental characteristics have been defined. Each region is treated separately during migration periods, including adjustments to daily bird activity patterns. The approach leads to a more realistic and incremental depiction of bird migration in the model (see Figure 3).

These improvements have made the initial version of the AK BAM the most sophisticated and resolute bird avoidance model in use today (see Figure 4). Aircrews and planners can be confident they are working with the best available current information. The work is not nearly complete, however. While the major fire may have been extinguished, there remain many smoldering embers left to stamp out. Additional ornithological data are always being evaluated, particularly as population levels or distribution patterns change and new information is collected in the field. Refinements are being made to background environmental data and new



The AK BAM operates just as the US BAM, by allowing users to analyze potentially hazardous concentrations of birds in their operational airspace.

airspace designations. Hopefully, with continued funding support, continuous improvements can be made to the AK BAM and other such systems.

Work may now also begin to bring the dynamic version of BAM, in place in the contiguous United States as the Avian Hazard Advisory System (AHAS), to Alaska. The US BAM forms the underpinning of AHAS, and it is envisioned that a similar integrated system can be developed for Alaska in the future. The Federal Aviation Administration and Canadian civil and military aviation communities are now beginning to cooperate on an integrated North American bird avoidance system for military and civil aviation across the continent. Ultimately, the goal is to project all these data systems into the cockpit for real-time bird avoidance capability.

For now, operational planning to minimize risks posed by concentrations of hazardous birds may be accomplished using Alaska's new BAM.

(Editor's Note: The USAF BASH site at http://afsafety.af.mil/AFSC/Bash/home.html contains links to the US BAM, AHAS, bird strike statistics and other important information.)

Nevermore at Davis-Monthan

MAJ DAVID C. VON BROCK
355 WG/SEF
Davis-Monthan AFB AZ

Once upon a morning dreary, while I pondered,
weak and weary,
Over many AFSAS volumes of forgotten lore,
While I nodded, nearly napping,
suddenly there came a tapping,
As of a cell phone gently rapping,
rapping at my office door,
" 'Tis some visitor," I muttered,
"tapping at my office door"
Only Base Ops, and nothing more"

Ah, distinctly I remember,
it was in the bleak December,
And each depredated foul,
wrought its ghost upon the floor.
Ghastly, grim, and ancient raven,
wandering from the local landfill
"Sir, we've got 50 birds on the infield again,
your shotgun we implore"
"Ravens again?!!" said I,
"surely, there must be something done before.
But how," thought I,
"rid Ravens from thy airfield evermore?"

(with apologies to E. A. Poe)

This spring, operations at Davis-Monthan AFB were confronted by the hazard of large flocks of ravens congregating in and around the airfield. It started in December, when the birds started showing up once or twice a week in small groups. The situation continued to decline through early spring, culminating every morning with a flock of 30 to 50 ravens hanging out near the approach lighting or immediately adjacent to ACC's busiest single runway operation.

Here's what we knew. The source of the ravens was a city landfill three miles south of the airfield.

A trip to the landfill revealed hundreds to thousands of ravens feeding from the discarded scraps from the citizens of Tucson. Although the landfill managers covered the trash at night, during the day the ravens enjoyed an all-you-can-eat buffet.

So, what was the attraction at D-M? We couldn't identify a food source near the runway (dirt and six-inch-high dormant grass) that came close to the free smorgasbord offered daily at the landfill. Nor were there any water sources nearby. The ravens didn't call D-M home either—they roosted next to the landfill. According to our

resident biologist, Ms. Gwen Lisa, ravens have a highly intelligent nature and social life. Like the Auger Inn on a Friday night, our infield was a popular fly-in singles bar for local ravens. The ravens came here to pick mates—which includes hopping around on the ground and picking up rocks to impress females, if you are a raven. The biologists agreed that the ravens would pair off in March and then go their separate ways. Unfortunately, it was the beginning of February, and I had to brief the vice wing commander at the upcoming Bird Hazard Working Group on how we intended to deal with the hazard.

Attack Plan Alpha: Make them uncomfortable. Our BASH program had three shotguns and a large allotment of bird-scare devices and bird-shot. Every morning, our Flight Safety shop diligently converged on the ravens. After a few rounds, the flocks would move to another location, and eventually were persuaded to leave the airfield—albeit without a few of their friends. However, next morning they were back with new friends. One morning, our tired but determined flight safety NCO, SSgt Aaron Spanier, said, "You know, sir, back on the farm, my grandmother would string up dead blackbirds to keep them out of the garden." We kept up the morning depredation for a month and killed three to five ravens a day. My NCOs became proficient killing machines, but we weren't making any headway with the raven influx. It was the end of March and time for a different plan of attack.

Attack Plan Bravo: Dead bird on a stick. I had been in contact with the HQ AFSC BASH Team chief. After discussing a few options, the subject of hanging a dead carcass came up again. I decided to give it a try since we had plenty. A trip to the base recycling center provided some nine-foot galvanized steel fence posts, and using skills acquired during Squadron Officer's School project X, we lashed together three tripods. We persuaded our skeptical but open-minded airfield manager to allow us to place our tripods around the local raven congregation area under the approach end of Runway 30. We suspended one-each dead raven upside down a foot below the apex of each tripod, where it was free to blow around with the wind as a warning to other ravens.

The next morning we arrived at dawn with binoculars (and shotguns) to observe the daily raven arrival from the landfill. (Incidentally, the previous morning we went through a whole box of shotgun shells from the same location.) The ravens flew in over the tripods, circled a few times, and flew on. Amazingly, this was repeated every day over the next month and we never saw another raven in the area again. The ravens found another open field to congregate in away from the local flight path, where we allowed them to socialize unmolested. At the end of April, the ravens eventually stopped showing up altogether, as predicted by the biologists.

The tripods were an easy fix. They were easy to construct, easy to set up, and could be moved without acquiring a CE work order. The galvanized steel fence posts provided more than enough weight and strength, preventing them from blowing over in strong gusts (we had gusts up to 50 knots one day). A resident coyote did manage to dine on one of the suspended fresh carcasses. However, we hung the next one up a bit higher and didn't have any more problems. I don't know how high a coyote can jump, but ten-foot poles instead if nine-foot poles may be a better option.

If you have a similar bird problem, you may want to consider this method. I don't know if it works on less intelligent species, but I can tell you we have been able to sleep in ever since and don't receive any more calls from base ops early in the morning.

If you have any questions, please contact us at the 355 Wing Flight Safety Office, Davis-Monthan AFB, DSN 228-4617.

Photos Courtesy of Author

Vance is on Fire!

MAJ RYAN E. GUIBERSON
71 FTW/SEF
Vance AFB OK

It's Friday, 19 March 2004, and another successful week of training America's next generation of aerial warriors is beginning to wind down at Vance AFB. As the last T-37 engine is shut down, the sweeping Oklahoma wind becomes the only distraction from an eerie silence that has enveloped the airfield. Seemingly unaffected by the wind, and with a chilling, calculated calmness, one man quietly surveys the field and sees only the enemies that he has been plotting against for months. With the simple phrase "Cleared to Press" whispered in his handheld radio, his operation to deal his enemy a stinging blow has begun. Glancing to the North, he sees a gray cloud begin to rise into the Oklahoma sky, and flames begin to move across the field, pushed along by the ever-present wind. With a smile slowly forming across his mouth, he knows the battle has begun and his enemies will have no choice but to flee.

OK, maybe the above scenario is a pretty weak attempt at drama, but a significant battle was waged at Vance on 19 March against one particular enemy—birds! As part of an aggressive and multifaceted Bird / Wildlife Aircraft Strike Hazard (BASH) program, Vance initiated a prescribed airfield burn to help in the never-ending effort to reduce the wildlife hazards to aircraft. Although the storyline may not rival Tom Clancy, Vance is hoping the results of the burn will, in themselves, be dramatic.

The Oklahoma Natural Resources Conservation Service (NRCS), an agency of the US Department of Agriculture, provided technical assistance on the actual burn and worked in conjunction with numerous base agencies, including 71 FTW Safety, DynCorp CE, Airfield Management, 71st Communications, Security Forces and the Vance Fire Department. The NRCS provided the assistance at no monetary cost to Vance, and they used the opportunity to satisfy one of their own recurring training requirements. The effort involved some local volunteer fire departments, which also capitalized on the training opportunity. Additionally, Vance DynCorp civil engineering personnel received excellent experience, which will be invaluable three years down the road when the next prescribed burn is planned. The entire operation was completed in approximately three hours, and the only unintended damage was an aging plywood runway distance marker on a seldom-used cross-runway.

Prescribed airfield burns have proven themselves to be great tools in an effective habitat management program. By burning, attractive habitat features are removed from the airfield environment, and would-be bird and other wildlife populations are dissuaded from calling the airfield home. Vance AFB annually suffers over $50,000 in damage costs due to bird strikes. These bird strikes also contribute to the loss of precious training time, which always seems to be in short supply at a JSUPT base. These costs are significant, and the potential costs of a bird strike, i.e., loss of aircrew or aircraft, provide enormous motivation to deal with the issue.

At Vance, in particular, Bermuda grass is the dominant and desired turf on the airfield. However, annual weeds begin to grow before the Bermuda grass and tend to "suffocate" the development of a uniform turf across the airfield. Additionally, the native grass and weed seeds are an attractive source of food for larks, which constitute over 50 percent of bird strikes at Vance. The varied and uncontrolled vegetation also makes the area attractive to a wide variety of rodents, who themselves pique the interest of raptors such as hawks and falcons. A prescribed airfield burn in the spring effectively destroys the embedded and germinated annual weeds. This promotes the growth and dominance of the desired Bermuda grass, which forms a uniform turf, and thus an unattractive location for birds, rodents and other wildlife.

Photos Courtesy of Author
Photo Illustration by Dan Harman

Although habitat management was the No. 1 goal of the airfield burn, the effort provided numerous other benefits to Vance. Currently, Vance spends approximately $60,000 in chemical herbicides for weed control each year. The airfield burn not only negated the requirement for a large spring herbicide application, but it also destroyed the accumulated thatch on the field that normally hinders efficient chemical application. Early estimates of the annual savings are at least $20,000 in chemicals alone, not to mention the environmental benefits of reduced chemical use. Additionally, the development of a homogenous Bermuda grass turf will only require mowing once or twice a season. This results in an additional annual net savings of over $10,000 in mowing costs!

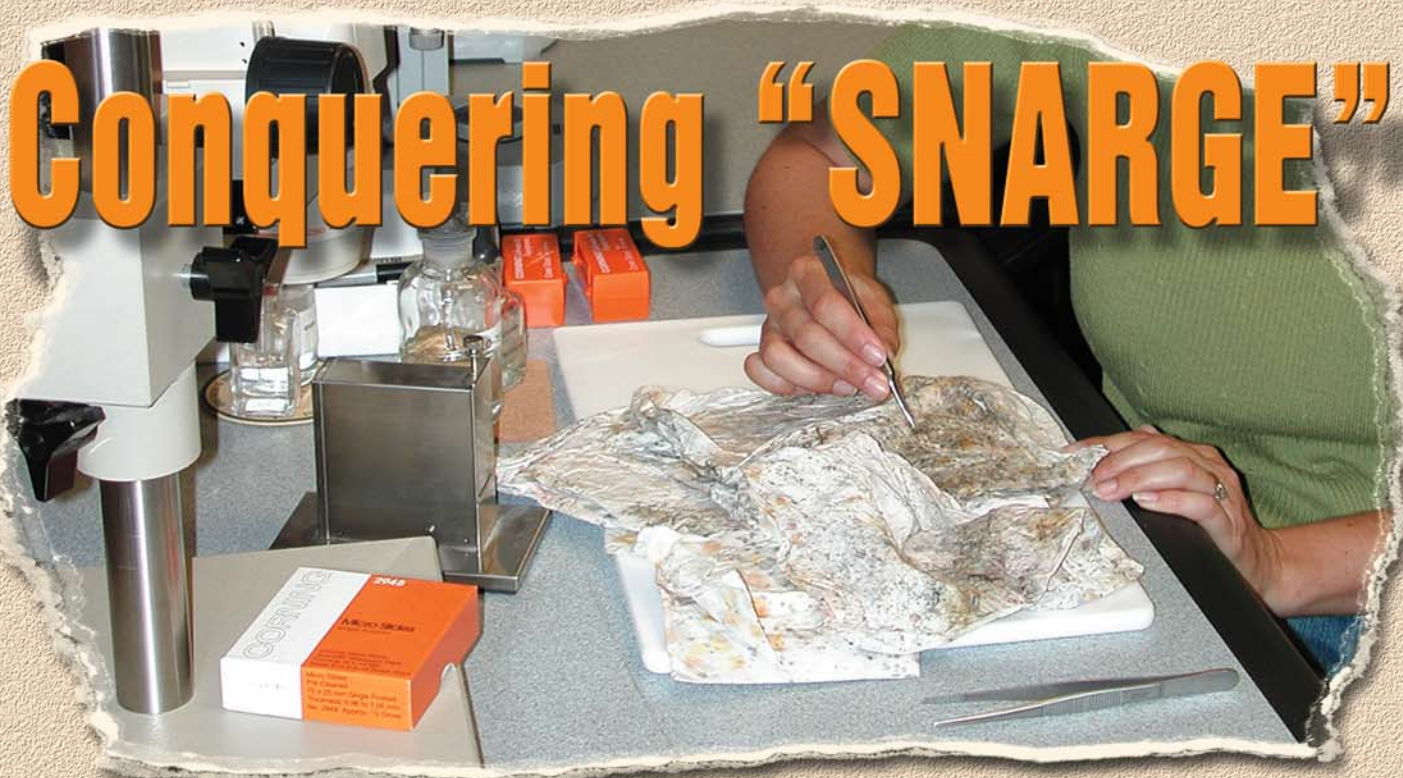
Removal of the vegetation also allows civil engineering to assess the uniformity of the underlying terrain on the airfield. This helps base surveyors to better determine drainage patterns, rodent habitats, and depressions in the terrain, which tend to pool water and serve as bird attractants. A better understanding of the underlying terrain will serve as an invaluable source of knowledge when addressing future BASH techniques.

The long-term benefits of the airfield burn will be uncovered over the course of time, but the initial outlook appears promising. Persistence is the accepted key to any BASH program and the prescribed burn is only one part of any successful plan. However, from the perspective of Vance AFB, the airfield burn provided a promising leap forward in the area of wildlife management.

So, as the last billow of smoke melted away in the orange Oklahoma sunset, the events of 19 March left the airfield as only a charred, black plot of ground. The individual who calmly gave the command to begin the operation once again surveys the results of his latest offensive against a familiar enemy. Even as the smoke dissipates, he is already planning his next operation. But, for now, he knows the initiative is his.

(Author's Note: 10 days after the burn left Vance a blackened ruin, rainfall and sunlight changed the landscape back to a promising green!)

Conquering "SNARGE"



Photos Courtesy of Smithsonian Institution
Photo Illustration by Dan Harman

AN UPDATE FROM THE FEATHER LAB

CARLA J. DOVE
MARCY HEACKER
Division of Birds, Feather Identification Lab
Smithsonian Institution
Washington, DC

In 2003, the Feather Identification Laboratory at the Smithsonian Institution's National Museum of Natural History received a record number of bird strike cases for accurate species identification (2042 Air Force cases and 286 cases for civil aviation). Although most of these identifications were completed using whole feathers or feather parts, more than 260 of the Air Force identification cases consisted exclusively of a single paper towel swipe taken from the impact point on the aircraft.

Collecting bird strike remains by spraying the impact point on the aircraft with a water bottle and swiping it down with a paper towel is a collecting technique that has been in use throughout the military BASH programs since 2001 (see http://afsafety.af.mil/AFSC/Bash/wild.html for collecting methods). Paper towel swipes containing only small amounts of blood, bird tissue and small microscopic bits of downy fluff from feathers is what we in the Feather Lab have termed "snarge." Smelly by nature, and often packed with mold spores, gooey bird fat or amorphous bits of flesh, "snarge" can provide valuable information about the species of birds your aircraft just smacked.

For many years now, the number of "snarge" samples sent for identification has increased. This is due to better awareness of bird strike issues, more outreach efforts to inform field personnel of collecting methods, and the need to have accurate data on problem species. Also, aircrew and maintenance personnel are much better at spotting the diagnostic signs of bird strikes and are becoming experts at finding the evidence. Eugene LeBoeuf (Chief, USAF BASH Team) once described "snarge" as looking like something you find in your handkerchief after a bad cold, but we see it as a goldmine of information and the ultimate identification challenge!

Feather Identification

The majority of bird strike cases we receive have enough whole feather material to identify species by using the morphological characters such as size, shape, pattern, color and texture of the feather. These whole feather samples are then compared to bird specimens housed at the Smithsonian Institution until a perfect match is found.

For cases with small or fragmented feathers, we use the unique microscopic characteristics in the fluffy plumulaceous (downy) barbs of the feather to give us clues as to the "group" or family of birds from which the unknown sample has come. This helps focus our efforts in the right direction for comparing any whole bits of feather and getting a final identification. These identification cases involving whole feather material are identified to the species level in nearly 93 percent of the cases.

The Problems With "Snarge"

As the amount of feather material decreases, the difficulty in identifying a bird increases. While our goals here at the Feather Lab strive for specific identification in each case, many times the microscopic evidence can only be identified to a general level.

Identifications based solely on microscopic characters (many of which were paper towel swipes) reached the highest number in 2003 at 559 cases. A third of these cases were identified only to the major group (Order) of birds because the microscopic structures are very similar in closely related birds. For example, many of the microscopic samples are identified as Passeriformes (the group of birds including the songbirds, or perching birds). Although we think of songbirds as being small birds, in 2003 Passeriformes caused a combined estimated $450,000 in damage to US military aircraft. Many times we cannot determine which songbird or even the family the particular songbird belongs to, because feather micro-characters are similar within this order of birds. This is also true in other groups (ducks, hawks, etc.) making microscopic identifications difficult if no other feather material is present.

While only approximately 12 percent of the bird strike cases received for identification are "snargy" paper towel swipes, they can be some of the most important in terms of identifications. Many times there are downy feather barbs embedded in the goo. With a lot of practice, patience and squinting, we have gotten pretty good at finding these minute pieces of feather. Even so, processing and identifying these minute samples is much more labor intensive and at least 50% more time-consuming than a strike with ample material. For example, an average bird strike case with many feathers and adequate data (location, date, etc.) usually takes about one hour to prepare (sometimes we have to actually wash the feathers to remove dirt, grease and blood), identify and report the results. A swiped sample currently requires a minimum of two hours.

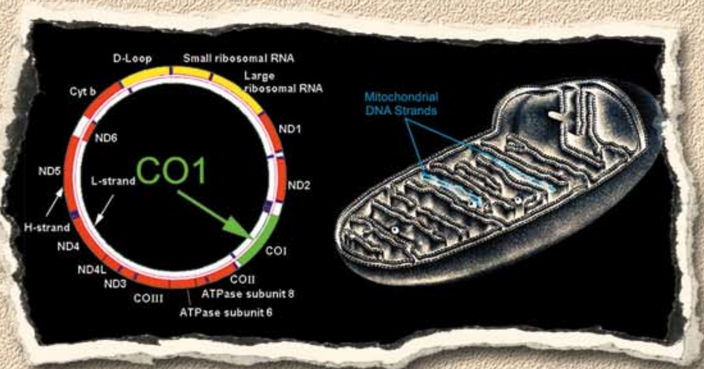
Ultimately, we would like to identify every bit of remains we receive to the exact species level to increase our overall knowledge of bird strike damage and prevention. With the increased numbers of microscopic cases, decreased level of identification for these cases, and increased amount of time to work them, you can imagine that "snarge" has presented us with some challenges.

200 species on our "hit" list were sequenced for the mitochondrial cytochrome oxidase I (COI) gene. This gene is currently being used for a comprehensive project to "DNA Barcode" all insect and animal life. Consequently, this COI gene is also working well with the forensic type of material such as found in bird strike cases. Three additional genes are also being explored in our project to develop a final molecular protocol best suited for our bird strike "snarge" samples.

The goal for this FAA/USAF/SI agreement is to have a reference database of sequences, established lab protocols, field collection kits, and readily available molecular identification techniques by the year 2006.

FAA Joins The Fight

As reported in the BASH issue of *Flying Safety* last year, the Smithsonian's Feather Lab entered into an agreement with the USAF and the FAA to join forces to conquer the "snarge" problem once and for all. DNA technology is being initiated to help improve the level of identifications in the paper towel swipes or in cases where insufficient feather material is received for species identification. This year marks the second year of a five-year agreement with FAA to support a database-building effort at the Smithsonian in which portions of four different genes will be sequenced for more than 300 of the species most commonly involved in bird strikes. This database will serve as the master comparison file to match "unknown" sequences extracted from bird strike "snarge."



In 2003, we made good headway on this new project. The preliminary tests on extracting DNA from the material we receive (including paper towel swipes) looks promising. We now have four beta test DNA collection test kits in the field to help develop a user-friendly, efficient way to collect DNA material. Approximately

The Value Of The Bird Collection

Once again, the bird collections at the Smithsonian are proving to be a valuable resource for bird strike identification. For many years, tissue samples from birds collected all over the world have been saved from specimens and stored cryogenically at a Smithsonian facility located in Suitland, Maryland. These samples are now available for a variety of genetic studies, including the DNA bar coding project to aid in bird strike identifications. Many bird specimens were collected by the Smithsonian through grant support from the DoD Legacy Resource Management Grant Program in 2000 and are now being used for sequencing in the bird strike DNA database.

Reporting

Proper species identifications help provide baseline data needed to properly implement habitat management plans on airfields, warn aircrews of bird strike dangers and assist engineers in designing safer engines and windscreens. Knowing the identity of the culprit crossing your path is the first step in preventing a wildlife problem on the airfield. Once the problem species is identified, measures can commence to modify habitat, design prevention models, and keep problem species off the airfield.

Some of the benefits of wildlife species identifications include:

- Development of bird-tolerant aircraft windshields based on weights of birds
- Redesign of F-16 cockpit to lower pilot's seating position to avoid injury from break-away
- Development of USAF BAM (Bird Avoidance Model)
- Monitoring species trends and modify USAF BASH (Bird/Wildlife Aircraft Strike Hazard) plans
- Providing statistical data for legal issues and F&W Service concerns
- Building cases against construction of landfills near airfields
- Information for depredation permits

The more evidence we have, the faster we can identify the culprit and the more confidence we have in the identifications. Please send as much evidence as possible (see "Feather Collection Tips"). DNA technology is expensive and takes some time to get a final answer. So, even when the DNA sequence database is up and running, we will still rely on whole feather samples to keep the program economically functional and efficient.

In 2003, remains were received from 118 different airfields (28 foreign and 90 domestic). Feathers were received for identification in every Class A (three), Class B (five) and in 33 of the 34 Class C strikes. So, keep up the good work on the airfield, and we will continue our quest to conquer the "snarge" problem here in the Feather Identification Lab!

Websites for more information on bird strike issues:

http://safety.kirtland.af.mil/AFSC/BASH/home.html
http://wildlife-mitigation.tc.faa.gov
www.birdstrike.org

Feather Collection Tips

1. Send as much and as varied feather material as possible.
   a. If you have a whole bird, pluck a variety of feathers from the breast, back, wing, and tail.
   b. Feet and beaks are also good.
   c. Small amounts of material can be wiped with a paper towel—send the whole towel.

2. Place remains in a Ziploc bag.

3. Enter all information in the AFSAS report.

4. Send a copy of the report with the remains to the Feather Lab.

Routine, non-priority cases can be shipped regular mail to:
Dr. Carla Dove
Smithsonian Institution, NMNH
E601, MRC 116
P.O. Box 37012
Washington, D.C. 20013-7012

Damaging, priority cases can be overnight shipped to:
Dr. Carla Dove
Smithsonian Institution, NMNH
E601, MRC 116
10th & Constitution Ave, NW
Washington, D.C. 20560-0116

5. Once the ID is finished, it is entered into the AFSAS report and an e-mail notification will be sent to the cognizant official on the report.


WARN
BASH IN PRO

Photos by Gail F. Miller
Photo Illustration by Dan Harman

Photos Courtesy of Author
Photo Illustration by Dan Harman

BAT STRIKE!

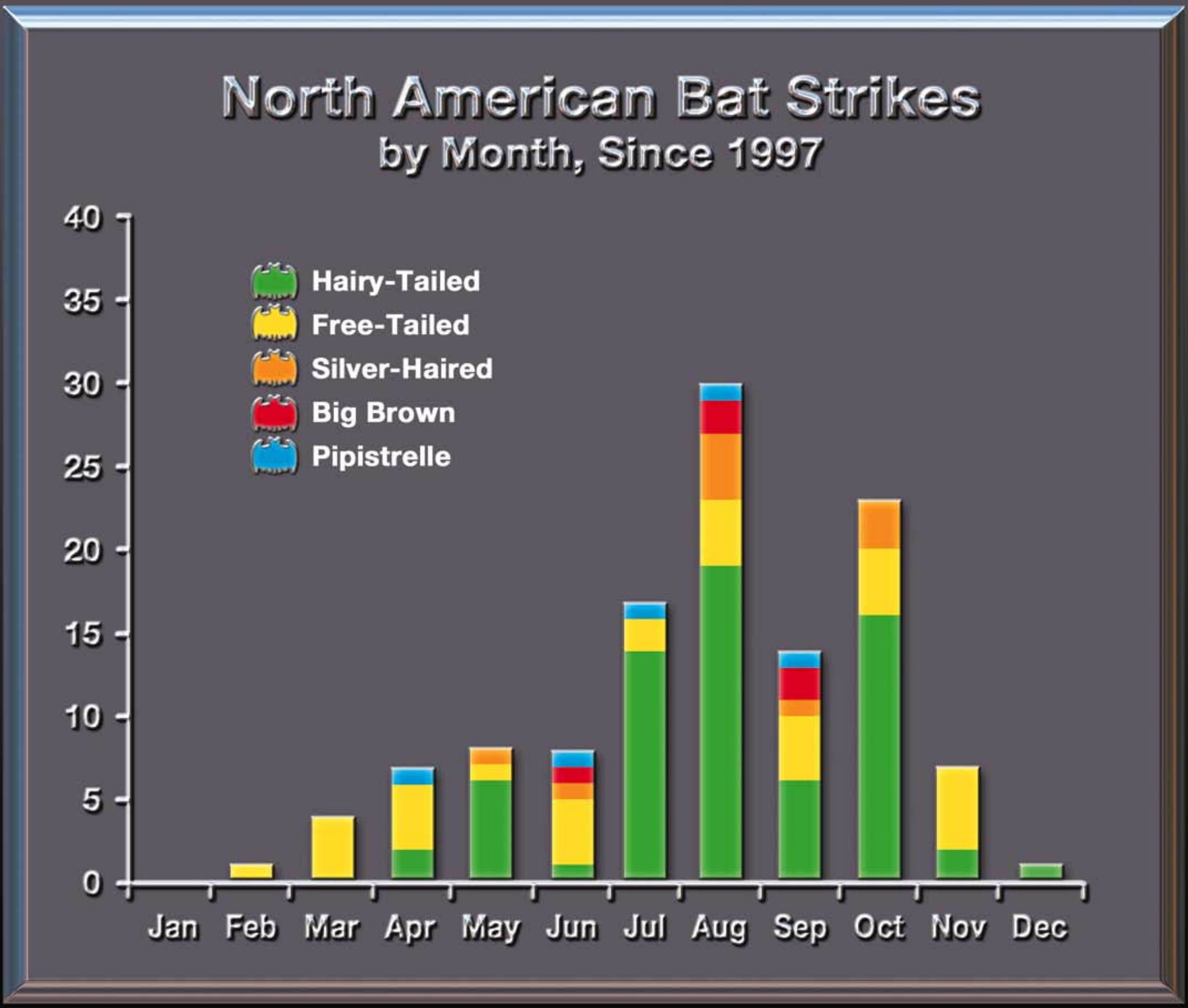
USAF Photo by MSgt Val Gempis

SUZANNE PEURACH
Biological Survey Unit
United States Geological Survey (USGS)
Patuxent Wildlife Research Center
National Museum of Natural History
Washington DC

After an aircraft/wildlife strike, field personnel can easily identify large mammals such as deer and coyotes, but tiny bits of "snarge" (wildlife remains) sometimes contain bat hair and fragments that need more careful examination. That's where the Biological Survey Unit of the USGS Patuxent Wildlife Research Center comes in. It has assisted the Smithsonian Institution's Feather Identification Lab for many years by providing identification of fragmentary hair, bones and claws from mammals involved in wildlife strikes. By comparing the remains with material in museum reference collections or by examining microscopic hair characters, much in the same way that birds are identified by feather fragments, the identity of the wildlife becomes clear.

Although often overlooked, bats also have been known to cause problems to aviation safety. In the late 1960s, large flocks of Brazilian free-tailed bats were reported as posing a greater threat than birds to T-38 pilot safety at Randolph AFB, Texas. The bats were problematic for the same reasons that birds are at low altitudes…engine ingestions, damage to aircraft parts, and time out of service for maintenance. This example underscores the importance of identifying the wildlife hazards before major flying operations begin in new areas. Every time a pilot flies into a new area, there is a need to adapt to the area and its wildlife dangers.

In the U.S., bats normally do not cause as great a threat to aircraft safety as birds, but with increased overseas flying this could easily change. For example, some fruit bats in Asia can have wingspans of up to six feet and weigh two pounds! Again, knowing what species are involved in wildlife



strikes, including bats, adds to the overall integrity of the U.S. Air Force database and helps improve aviation safety.

What Happens to the Strike Remains?

All fragmentary remains are filed through the Feather Identification Lab and the Air Force Safety Automated System (AFSAS). The bits of bat "snarge" are then transferred to the USGS Biological Survey Unit from the Feather Lab for more specific identification. The results are entered into the database and are now also being used to help understand more about bat natural history.

Interesting Findings

Some strikes have already provided interesting information to the aviation and scientific community regarding damages to aircraft, high-altitude flight in bats, and observations of bats and birds migrating in mixed species flocks. Recent damaging bat strikes occurred when a Brazilian free-tailed bat (a small 0.5-ounce bat) caused nearly $10,000 in damages to a T-37B aircraft and also when a red bat (0.5 ounces) teamed up with a Mourning Dove and caused $195,707 in damages to a C-130E Hercules. Since 1997, remains from more than 126 bat strikes have been processed by our Biological Survey Unit. From these, we know that Red bats and Brazilian free-tailed bats are the most common bat species recovered from USAF strikes, and that most North American strikes occur in August (see chart).

What Can You Do To Help?

- Continue to send fragments and "snarge" swipes to the Feather Lab.
- Complete an on-line AFSAS form.
- Enhance our collections and make our identification process easier by sending whole bat specimens, if possible, to the museum for preparation. If you find a whole bat specimen, please call Suzanne Peurach (202-633-1277) for details.

Seasonal Changes?

Photo Illustration by Dan Harman

1ST LT MELANIE PRESUTO
HQ AFSC/SEFW

Ground safety folks speak of the "101 Critical Days of Summer," but for those of us concerned with bird strikes, every day of the year is critical, especially the fall migratory season. That's when the consequences of those "flames of animal romance" of the previous spring become evident: New chicks have hatched, which soon will begin their migration southward. With any long road trip that includes infants, toddlers and teenage drivers, mishaps are always a possibility and precautions are necessary to make the trip uneventful; the world of bird strikes is no different. While the mother goose and her "unlearned" youth join many other species as they fly south for the winter, the potential for damaging strikes to aircraft increases. This year, the BASH team has gone to significant lengths to improve the strike statistics for the years ahead.

Two such BASH program initiatives, which have the potential to take a big bite out of bird strikes, are an Alaska Bird Avoidance Model (BAM) and Small Mobile Radars (SMR). The Alaska BAM is discussed further in a separate article in this issue (see page 4). As for SMR, development is underway to create a real-time warning tool for airfield use. SMR can be a valuable tool for determining bird watch condition codes on an airfield using real-time data. The plan is to build and deploy an SMR this fall and to begin using it at high-asset bases to field-test how to best use the information that it can provide.

If you've read the latest (April 2004) edition of AFI 91-204, *Safety Investigations and Reports*, you might notice much of the BASH information previously listed is missing. We like to keep things interesting, and feel that change is growth, so we've mixed it up for 'ya. General information for bird and wildlife strike events, as well as instructions for investigative evidence, can now be found in AFMAN 91-223, *Aviation Safety Investigations and Reports*, a manual providing unique guidance in support of AFI 91-204 for investigating and reporting aviation mishaps. Paragraphs 1.3.1.2 and 5.4.2.1 contain the information outlined above.

In addition to that change, BASH has made some other changes this past year. Most notable is our reporting process. We've migrated BASHSAS into AFSAS, which actually reduces the number of reports the field has to generate after a bird/wildlife strike occurs. Previously, an AF Form 853, *Air Force Wildlife Strike Report*, was required for all strikes; thus, after reporting a Class A, B or C event, an AF Form 853 is still needed. Now, with AFSAS, no matter what class the mishap, only one report will be required.

Of course, when merging two very different databases, a number of bugs will always arise. Here is where the field's support really becomes important to assure that the final product works. Thanks to our early users, we've had some great feedback on how to make this reporting process more user-friendly. Thank you for your patience as we attempt to perfect this new system! One of the bugs we found from the field lay in the wording accompanying Class E BASH events within 91-204. While it is true that no FINAL MESSAGE will be generated for these events, reporting ALL events is required. The report will be used for trends that are applied to our models such as the BAM.

The biggest difference in this new reporting is the change in certain required fields. Currently, the AF Form 853 does not exactly match the fields required in AFSAS. Strobe lights, landing lights, flight path, cloud type and precipitation are no longer required fields when filling out the AFSAS strike report. "Phase of flight" is now called "phase of operation," with more details to match those fields already residing within AFSAS. Do not get hung up on "precision approach" vs. "non-precision approach" for Class E BASH events; knowing the bird strike happened on approach is more critical than the details.

We expect, as with any new system, we will have some changes to make. Your feedback is always helpful in making this a more efficient and user-friendly system, so, thank you for your inputs; they will make your life easier!

(Editor's Note: In addition to 1st Lt Presuto at DSN 246-1440, our BASH team includes Gene LeBoeuf, DSN 246-5679, Pete Windler, DSN 246-5674, and Maj Ted Wilkins, DSN 246-5673.)

“Groundhog Day?”

USAF Photos
Photo Illustration by Dan Harman

ANONYMOUS

There was a certain familiarity about the morning, as if I had been there before. A “Groundhog Day” of sorts, to reference the 1993 Bill Murray movie. Unlike in the movie, the previous two days were uneventful. So, why was I having to repeat them? That one is easy to answer. We were in our third and final day of surge operations.

The daily events were the same as the previous two. I didn’t know the pilot I was to fly with that day. The squadron was short a pilot, so we borrowed an instructor pilot from the FTU. He and I were No. 3 of the first four-ship of F-15Es. It was my third day of surge operations, flying three sorties each day, hot pitting between the first and second sorties. I arrived at 0530, as I had the previous two days. The mass briefing began at 0600. It was strikingly familiar. Our strike and weapons shops had spent the previous week constructing superb plans for each of the sorties to be flown. The routes and missions remained unchanged; however, the targets and types of attacks to be executed changed daily, each becoming more challenging.

The first sortie focused on the WSO. There was a medium altitude Laser Guided Bomb (LGB) on the way to a low-level Military Training Route (MTR), with a low altitude LGB delivery once established in route structure.

The second sortie focused on LGB operations and crew coordination performance in a time-sensitive role. The mission was a Strike Coordination and Reconnaissance and Time Sensitive Targeting (SCAR/TST) scenario with JSTARS support. The objective was to positively identify the target and collateral damage issues and put bombs on target in minimum time, provided the rules of engagement permitted based on collateral damage assessment.

The third and final sortie focused primarily on pilot bombs. The objective was to identify targets by using the Mark I eyeball. The plan called for a medium altitude ingress to a different low-level MTR than the first sortie. The low-level ended with formation pop attack on targets requiring specific identification prior to release.

After the briefing, the pilot and I had our crew coordination briefing, and I answered a couple of questions regarding our squadron standard ground operations. At 0820 our four-ship arrived at the Operations Desk for tail numbers and words. We stepped to life support, then to the jets without incident. It wasn't long before the pilot and I realized things weren't going to be as briefed. The previous two days, the jets had flown exceptionally well. That was not going to be the case today. At our first jet we found a pool of hydraulic fluid in the left engine inlet. We notified maintenance and stepped to our spare. The preflight of the spare went as advertised. We started the jet and got an ECS caution light and a bleed air light, so we aborted our second jet and awaited word on spare status. In the interim, maintenance finished the engine run and leak check of our original aircraft. We approached the aircraft, hoping for the best, but they were unable to complete the maintenance in time for us to meet our flight. Our top-three advised us we'd be on the bench for the first sortie.

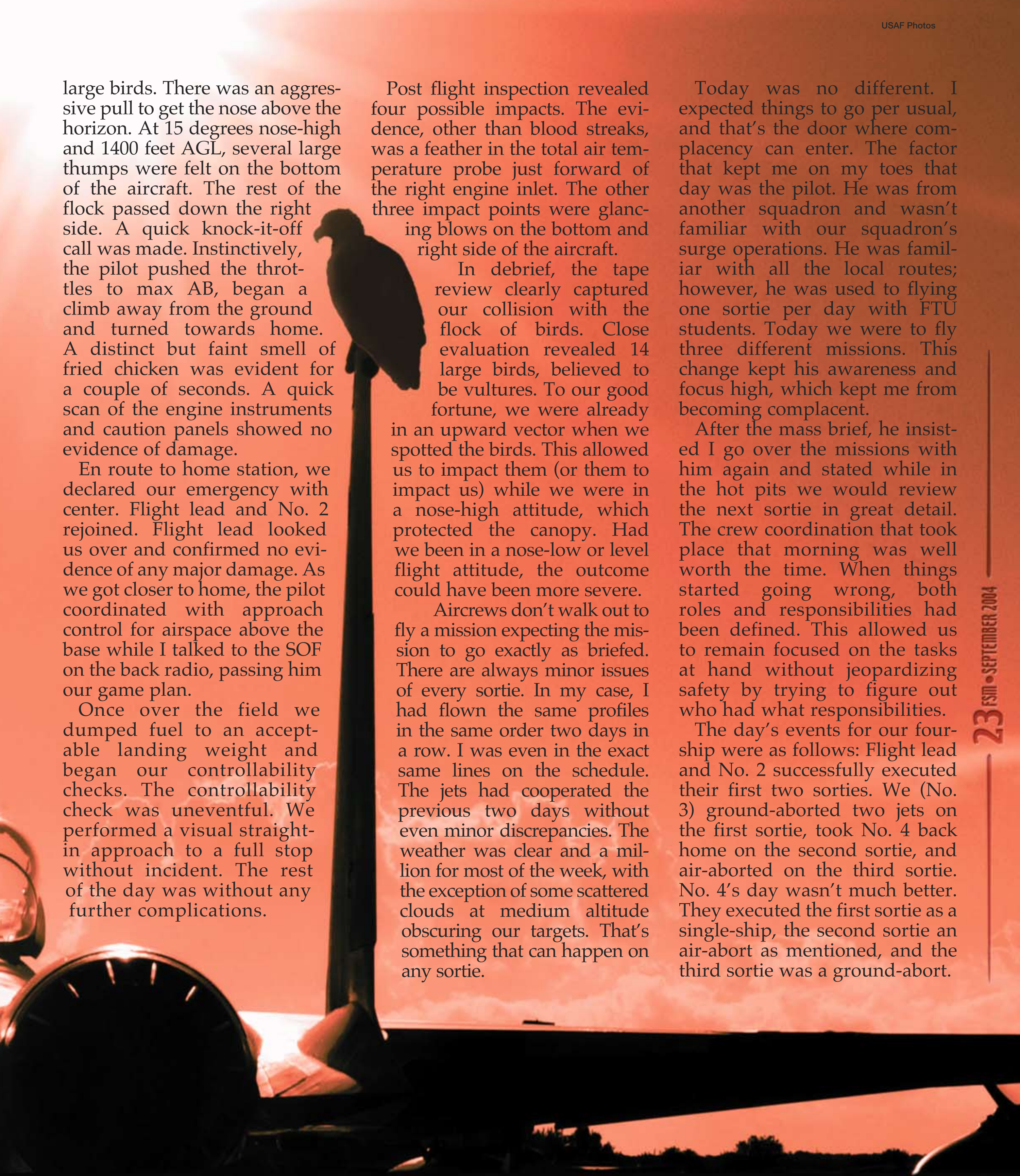
The new plan was to meet 20 minutes prior to our adjusted step time to re-brief the second sortie. We briefed and stopped by the operations desk for additional words and new tail number. Déjà vu: We were back to our original jet. Ground operations and taxi were normal. Finally, the flight met up in the arming area as a four-ship. The departures were 20-second, single-ship takeoffs. Flight lead took the runway and we were off to the races. We got airborne, leveled off and rejoined. Things were looking good—not! The dreaded call came from No. 4: They had a boost pump failure. The flight split, and we turned towards home with No. 4. They ran the checklist, while we backed them up and coordinated return to base. After safely dropping them off, we coordinated to meet the rest of the flight out in the working area. Upon our entry, we passed flight lead and No. 2 on their way back home. We utilized the remaining 10 minutes of airspace time and returned home without further incident. The tone of the conversation on the way back was jovial, discussing what else could possibly go wrong.

On the ground, the flight rejoined in the hot pits as a three-ship. No. 4 ground-aborted their spare. Ground operations were normal for the three-ship. Takeoff, departure and en route to the low-level MTR were uneventful. The first three legs were planned at 1500 feet AGL and 420 KCAS due to BASH condition moderate. The remaining legs were to be flown at 500 feet AGL and 500 GS due to local guidance deleting BASH restrictions in mountainous terrain. Entering the low-level, we (No. 3) were in four-mile trail of flight lead and No. 2.

The first leg was uneventful. On the second and third leg of the route, we dodged birds on two occasions. The birds were spotted in enough time so aggressive maneuvers weren't required. Comments were made about wanting to drop to 500 feet AGL to vacate the birds' altitude. Remember, we were restricted to no lower than 1500 feet AGL due to bird condition moderate. Finally, we dropped to 500 feet without incident.

With restrictions lifted, the airspeed was pushed up so we could begin our tactical maneuvering. I called for the AAA threat reaction. The pilot maneuvered the jet, and I watched our altitude and attitude and made the pertinent radio calls. We progressed through the threat reaction, and the aircraft was about 10 degrees nose-low and rising up through the horizon. As I took a quick look inside at the HUD repeater, I heard the pilot say "#%*@." I could see in the HUD a flock of 10-12

Photo by SSgt. Jeremy T. Lock
Photo Illustration by Dan Harman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large birds. There was an aggressive pull to get the nose above the horizon. At 15 degrees nose-high and 1400 feet AGL, several large thumps were felt on the bottom of the aircraft. The rest of the flock passed down the right side. A quick knock-it-off call was made. Instinctively, the pilot pushed the throttles to max AB, began a climb away from the ground and turned towards home. A distinct but faint smell of fried chicken was evident for a couple of seconds. A quick scan of the engine instruments and caution panels showed no evidence of damage.

En route to home station, we declared our emergency with center. Flight lead and No. 2 rejoined. Flight lead looked us over and confirmed no evidence of any major damage. As we got closer to home, the pilot coordinated with approach control for airspace above the base while I talked to the SOF on the back radio, passing him our game plan.

Once over the field we dumped fuel to an acceptable landing weight and began our controllability checks. The controllability check was uneventful. We performed a visual straight-in approach to a full stop without incident. The rest of the day was without any further complications.

Post flight inspection revealed four possible impacts. The evidence, other than blood streaks, was a feather in the total air temperature probe just forward of the right engine inlet. The other three impact points were glancing blows on the bottom and right side of the aircraft.

In debrief, the tape review clearly captured our collision with the flock of birds. Close evaluation revealed 14 large birds, believed to be vultures. To our good fortune, we were already in an upward vector when we spotted the birds. This allowed us to impact them (or them to impact us) while we were in a nose-high attitude, which protected the canopy. Had we been in a nose-low or level flight attitude, the outcome could have been more severe.

Aircrews don't walk out to fly a mission expecting the mission to go exactly as briefed. There are always minor issues of every sortie. In my case, I had flown the same profiles in the same order two days in a row. I was even in the exact same lines on the schedule. The jets had cooperated the previous two days without even minor discrepancies. The weather was clear and a million for most of the week, with the exception of some scattered clouds at medium altitude obscuring our targets. That's something that can happen on any sortie.

Today was no different. I expected things to go per usual, and that's the door where complacency can enter. The factor that kept me on my toes that day was the pilot. He was from another squadron and wasn't familiar with our squadron's surge operations. He was familiar with all the local routes; however, he was used to flying one sortie per day with FTU students. Today we were to fly three different missions. This change kept his awareness and focus high, which kept me from becoming complacent.

After the mass brief, he insisted I go over the missions with him again and stated while in the hot pits we would review the next sortie in great detail. The crew coordination that took place that morning was well worth the time. When things started going wrong, both roles and responsibilities had been defined. This allowed us to remain focused on the tasks at hand without jeopardizing safety by trying to figure out who had what responsibilities.

The day's events for our four-ship were as follows: Flight lead and No. 2 successfully executed their first two sorties. We (No. 3) ground-aborted two jets on the first sortie, took No. 4 back home on the second sortie, and air-aborted on the third sortie. No. 4's day wasn't much better. They executed the first sortie as a single-ship, the second sortie an air-abort as mentioned, and the third sortie was a ground-abort.

Bottom line: It's never really "Groundhog Day." Each sortie is independent and separate from previous events and should be treated as such. There are always opportunities for complacency. Our job as professional aviators is to identify those opportunities in ourselves and others and ensure each sortie or event is accomplished with the same detailed planning and emphasis, regardless of exposure, proficiency or experience.

Waiting (is) For the Birds

1LT LUKE JAYNE
Whiteman AFB, MO

Is it possible to ever be fully prepared for any situation that is thrown your way? Through mission preparation, briefing and the bombardment at the step desk, you would think the system is foolproof. Every pilot knows that is not the case, and oftentimes we are thrown into a situation that we never even considered a problem. Here is an example of just such a predicament that, through better planning and preparation, probably could have been avoided.

I had been instructing in the T-38 at Whiteman AFB for about three months on the day in question. My student and I were just about to launch on a "routine," local instrument mission. The mission would consist of one high-altitude TACAN penetration followed by multiple radar patterns. We had spent most of the morning debating if we would even be able to launch because of icing. If you are at all familiar with the T-38, you know that it does not mix well with ice. It was determined the icing was northwest of the airfield and that it would not be a factor until later that morning. The weather was overcast at approximately 1000 feet AGL with the tops at 3000 feet MSL. Our divert option would be Scott AFB, which had only one applicable NOTAM. The NOTAM said there would be no takeoffs after sunset due to migratory birds. We paid little attention to the warning because, let's face it, we did not plan on diverting. We proceeded with our pre-flight planning, briefed the mission, received the go-ahead from the Top 3 and we were on our way.

The takeoff and climbout were uneventful. Our clearance was to 6000 feet direct to the initial approach fix where we would then commence the approach. Shortly after we took off, another T-38 launched and stayed in the radar pattern for some pattern-only fun. Since we were doing the entire penetration, this aircraft was vectored in front of us and began their approach. We commenced our penetration at about the same time they were inbound from the Final Approach Fix. The SOF cut off our approach shortly thereafter (before entering the weather). He directed us to remain clear of the weather because the aircraft in front of us had picked up icing. My initial thought was to max endure in a holding pattern until the icing went away. I was quickly informed that would not be an option because the icing would remain in the area until later that afternoon and that we were to divert immediately.

Several thoughts ran through my head at this time, including very bad thoughts about the weather shop. I then began to realize this was not the simulator and it was time to put all that excellent training to use. We coordinated for our clearance to Scott AFB and proceeded with our divert instructions. We worked together as a crew and got the aircraft on the ground safely at Scott.

The story does not end there. Once we were on the ground, we phoned the Top 3 to see if he had any advice on how we should proceed. He recommended that we should just hang tight until the icing dropped from the forecast later in the afternoon. I had no problem with that recommendation;

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Photo Illustration by Dan Harman

we could find plenty to keep us busy at Scott. We got a lift to the BX, ate some lunch, had an awesome Galaga tournament, and even did a little PFPS training to help pass the time. It was great to finally have an excuse to get out of the scheduling shop. What we did not do was consult with Base Ops about that little NOTAM that we thought was a no-factor.

If you recall from before, the NOTAM said no takeoffs after sunset. I had no problem with that, because we would be off the ground almost two hours before that would be a factor. What I did not know was that while we were waiting for the icing to drop out, the birds were already starting to migrate through the area.

We received the Dash-1 from the home scheduling shop, and it was clear of any icing issues. The Top 3 let us know that Whiteman was still holding Scott as the divert option and gave us the nod to launch. We pre-flighted the aircraft and started our taxi for takeoff. As we continued our taxi, we began noticing huge flocks of birds flying out of the nearby fields. They began inching their way closer and closer to the airfield, and at that point I knew that it would just be a matter of time before we would be stuck because we cannot take off if the airfield is bird severe. We quickened the taxi pace slightly to try and gain an advantage, but it was no use. Before reaching the EOR, tower informed us that the field was bird severe. We decided to hold in the EOR until the birds left and then take off. The only problem was the birds would not leave. Flock after flock crowded the airfield, rendering us helpless on the ground.

After waiting in the EOR for approximately 30 minutes for the condition to revert back to moderate or better, we decided that we could only wait for a few more minutes before we would be too low on gas to be able to make it back home with enough divert fuel remaining. And, oh, by the way, if we could not take off right now, we would be unable to refuel and take off before sunset. Needless to say, we were desperate. It was at that time that tower informed us that the parallel runway was bird low and we were cleared for takeoff. We quickly refigured our TOLD data, and it looked good. We launched and pressed home uneventfully.

The question remains, "How could we have avoided this situation?" I do not believe there is a right answer, but I have a few suggestions. First, before we ever launched in the morning, we should have possibly reconsidered using Scott AFB as our divert option due to their immense bird traffic at that time of year. Second, while on the ground at Scott, we should have knocked off the Galaga tournament and spent more time in Base Ops watching the bird status. If we had launched just 15 minutes earlier, we would have beaten the birds and still avoided the icing issue. Finally, we should have reconsidered doing the entire penetration on our first approach. If we would have stayed in the radar pattern, we would have been on the ground at Whiteman, and the guys that screwed us would have to go to Scott. However, through this fiasco we did gain valuable experience and were able to learn from our mistakes.

OPS TOPICS

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

Here are a few cases of bird strikes to our valuable aircraft that caused Class B damage. What are you doing to prevent a mid-air with wildlife?

KC-10 BBQs Poultry

This was a local pattern training sortie and while established on final approach and in landing configuration, the crew witnessed multiple white/brown flashes (birds) pass off the left side of the aircraft. The crew then reported a thump, a slight shudder, and a momentary No. 1 engine vibration. All engine indications remained normal. The crew then reported the smell of scorched poultry coming through the air conditioning. They immediately shut down the No. 1 air conditioning pack and the smell dissipated. The instructor pilot (IP) took control of the aircraft, disconnected auto-throttles, and left the No. 1 engine at the same throttle position as when the incident occurred until landing. The IP landed and the aircraft was shut down with no further incident. Postflight inspection revealed feathers and blood spatters on the spinner cone and acoustical panels inside the No. 1 engine. Also, the trailing edge of the left inboard flap had minor structural damage. Another blood streak was noted with no damage on the outboard flap.

The engine was removed and shipped to the manufacturer where it was broken down for damage assessment. Extensive bird debris and damage was found throughout the engine. So much bird debris was found in the fan section that a true damage assessment could not be determined until the fan section underwent a comprehensive cleaning. Over 292 blades were found damaged in the compressor stages. Both the fan and compressor sections had evidence of blade shingling. There was damage to the outlet and inlet guide vanes, high pressure compressor section (both casing and blades) and combustion can. All damage was consistent with bird ingestion.

F-15D Meets Black Vulture

The mishap flight was flown as a safety chase for an environmental evaluation test mission. Takeoff and departure were uneventful. During the course of the sortie, the test aircraft experienced a flight control anomaly and declared an emergency. The mishap aircraft (MA) chased the test aircraft to a full stop landing. After the low approach, the MA was directed to report a local pattern entry point. The mishap instructor pilot (MIP) in the rear cockpit took control of the aircraft to update backseat-landing currency. On one-mile initial at 1600 feet MSL and 300 KIAS, the mishap pilot (MP) in the front cockpit saw two large vultures co-altitude on the left side of the aircraft. The MP did not have time to take control of the aircraft and maneuver away from the vultures. A black vulture impacted the aircraft on the left No. 1 engine inlet ramp and was ingested by the No. 1 engine. Both pilots felt the impact and retarded the left throttle to idle, noting normal engine idle indications. The aircrew heard a "humming" sound from the left engine and smelled an acrid smell in the cockpit. They noted no fire indications or unusual engine readings and left the engine running in idle to maintain a backup source of hydraulic and electrical power. The MP took control of the aircraft declared an IFE and landed uneventfully. Maintenance investigation revealed sheet metal damage to the No. 2 and 3 inlet ramps. Inspection of the No. 1 engine revealed extensive damage to the fan and core module. The damage was the direct result of ingesting a black vulture into the No. 1 engine.

F-16C and Bird Fly Same Low-Level Route

The mission was the second sortie of a scheduled two-ship double turn day. The sortie was briefed as a low-level strategic attack mission with emphasis on lightning pod work in the training area. Bird condition for the route of flight on both sorties according to the bird avoidance model (BAM) and avian hazard advisory system (AHAS) was moderate 2. Brief, ground operations, takeoff, departure and entry into the low-level were uneventful. The mishap pilot (MP) flew the exact same route and low-level on the first sortie and saw no bird activity. Approaching a turn point on the low-level route, while executing low-altitude tactical navigation, the MP saw a large bird out the front of the aircraft and immediately pulled back on the stick to avoid impact. The MP felt a definite impact, heard a loud bang and smelled burning feathers. The pilot zoomed the aircraft and began a climbing turn toward base, declaring an IFE. Climbing through 21,400 MSL approximately a minute after impacting the bird, MP felt a loud bang and experienced a compressor stall. After alleviating the compressor stall, MP emergency jettisoned the external fuel tanks and climbed through 27,500 MSL with the engine operating normally. MP then elected to fly a straight-in SFO and landed uneventfully.

Postflight inspection found remains on the underside of the radome, in the ECS ducts, and all throughout the engine intake. The continuous wave/directional antennae on the front underside of the aircraft had been sheared off. Burnt bird remains were evident throughout the aft section of the engine.

Big Bird Mission Stopped By Little Bird

During takeoff roll, at approximately 85 knots, a slight vibration was felt in the aircraft. The mishap copilot (MCP) and mishap evaluator pilot (MEP) noted birds on the right side of the runway. Immediately following the vibration, a faint smell of smoke became evident. The MEP called "reject" and the takeoff was aborted. The aircraft taxied clear of the runway onto a perpendicular taxiway. The scanner was deployed and observed holes in the engine cowling and loss of hydraulic fluid from the No. 1 engine. An emergency was declared, fire trucks responded, and emergency checklists were initiated. The No. 1 engine was shut down uneventfully. The engine was replaced and sent to depot for repair.

Formation Add Ons

The MC-130 aircraft and crew were part of a seven-ship formation package participating in a multilateral exercise. After takeoff from the exercise objective airfield, the mishap aircraft (MA) was en route to rejoin on the other formation elements when a bird strike occurred at approximately 750 feet AGL and 180 KIAS, in rural flat terrain. The mishap crew (MC) did not see the bird prior to or during the actual strike, but they did hear the strike. Shortly after the strike, the MC landed the aircraft at the objective airfield, and inspected the aircraft for damage. No damage was noted and no remains were found; the crew elected to continue the mission. Upon mission completion, postflight inspections revealed a structural failure or "soft spot" on the nose radome.

Air Meet Has Extra Players

The mishap aircraft (MA) was deployed for a training exercise and was the lead of a two-ship formation. On the morning of the mishap, the exercise flying was cancelled due to weather. The profile was changed to the backup intercept mission. On takeoff roll, the MA hit a bird on the right wing and ingested another bird in the right engine. The mishap pilot (MP) heard two loud bangs and initiated an abort at approximately 130 knots. The MP's wingman reported seeing a fireball and debris from the aircraft's No. 2 engine. The MP took the departure end barrier at 50 knots. Barrier engagement was normal. Approximately three minutes later, the No. 2 engine quit running on its own. Initial investigation revealed severe damage to the No. 2 engine caused by the bird strike and subsequent fan blade failure.

Busy Final Approach

An MC-130 departed on a joint and combined exercise training mission. The crew planned and flew the VOR approach. While on a three NM final at 125 KIAS, the aircraft flew through a flock of suspected brown speckled ducks. Three birds impacted the aircraft; one on the nose radome, one on the nose gear, and one on the right wing between the No. 3 engine and the fuselage. The crew continued the approach and landed uneventfully.

A few things aircrew can do to avoid bird strikes:

1. Avoid flying at high activity times.
2. Be vigilant, especially at high activity times.
3. Avoid excessive time at low altitude when operating in high activity times.
4. Reduce airspeed at low altitudes when encountering birds at high activity times.
5. Use BAM and AHAS as a mission planning tool.

BAM was constructed with the best available geospatial bird data to reduce the risk of bird collisions with aircraft. Its use for mission planning can reduce the likelihood of a bird collision, but will not eliminate the risk. Unfortunately, it is inevitable that occasionally birds that are transiting an area will get into the flight path of an aircraft. ✈

Maintenance Matters

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

To continue the airframe specific theme, here is the first fighter version. I took a look at the F-16, since it is the most numerous and one of the busiest fighters we have.

Raise the Gear, No That's the Canopy

The F-16 gear checkout team was composed of maintenance technician-A (MTA), seated in the forward cockpit, MTB, standing on the left side of the aircraft reading the job guide, MTC, operating the hydraulic servicing cart, and MTD, seated in the aft cockpit. MTA and MTD were both working with the F-16 for the first time since being assigned to the team earlier in the week. Supervision for the landing gear team had not documented whether proper qualifications were met or training requirements satisfied for any team members. All technicians were on headset and able to communicate with each other. The team was to complete the basic landing gear operational checkout, which had been stopped the day before due to the discovery of a hydraulic reservoir leak, and the alternate extension system operational checkout. The team performed a Foreign Object Damage (FOD) check around the aircraft before beginning the checks, but failed to perform the aircraft safety procedures required by tech data. The team performed a brake bleed and leak check prior to continuing the basic operational check from the day before. The brake bleed and leak check and the basic operational check were uneventful.

The team then began the alternate extension system operational checkout. The procedures call for the forward cockpit alternate extension system to be checked before the aft cockpit system. The checkout for the forward cockpit was uneventful until step 29, which states: "29. (A) Position gear handle to up." (The (A) means technician A, seated in the front cockpit, should perform the step.) MTB directed MTD to raise the gear. At some undetermined time, prior to this moment, the canopy jettison handle safety pin was pulled and placed next to the handle. MTD pulled the canopy jettison handle, initiating the canopy jettison sequence. The canopy, doing just what it was designed to do, jettisoned, contacting and bending electrical conduits on the ceiling of the hangar. The canopy then fell onto the aircraft, damaging the spine, tail, left wing, and missile rail launcher before falling to the hangar floor and coming to rest nearest the forward edge of the left wingtip. The MTB and MTC shut down the hydraulic servicing cart and disconnected the power while MTA and MTD egressed the aircraft. The team then egressed the hangar.

The main causes of this mishap were failed supervision, failure of the team to follow tech data and lack of training. How qualified are your people, and are they using tech data? Is your supervision setting people up to fail by not ensuring tech data is followed?

Stuck Throttle

The mishap pilot (MP) was on a continuation training sortie, and on recovery the MP noticed an equipment hot caution light. The MP attempted to reduce power, but the throttle would not physically move more than an inch or two aft of the military position. The MP notified the flight lead of a stuck throttle and equipment hot light. The flight lead passed the lead to the MP, went to a chase position, and directed the MP to point to high key at the home base. At this point, the mishap aircraft (MA) had approximately 5000 pounds of fuel. The MP analyzed the situation en route to high key and he had minimum engine rpm (88 percent), fuel flow was 6900-8800 pounds, and the FTIT was normal. The MP could maintain approximately 300 KIAS with the throttle in its stuck position and the speedbrakes in override. The MP then declared an IFE. After much work and coordination for the jettison of stores and the decision to run the engine out of fuel, the aircraft landed safely and took the approach end arresting cable.

Maintenance took over and found the aircraft engine had been installed six months prior to the mishap. The aircraft had over 150 uneventful sorties since the engine was installed, and all inspections were completed IAW tech order guidance since the engine was installed. After MX removed the engine from the aircraft, they discovered a 1/4-inch engine bolt stuck in the main fuel control (MFC), restricting the throttle from full movement. After a thorough investigation of the engine, there was a bolt and nut missing from bolt position number 45 on the "e" flange (aft of the fan and the beginning of the core) of the engine. The bolt stuck in the MFC was the same part number as the missing bolt on the "e" flange. The missing nut was never located. The key here is: Why did the nut come loose? No one knows, but maintenance must do all we can to prevent this potential loss of an aircraft.

Aircraft Attacks Tech Order or Vice-Versa

A maintenance team had completed the installation of the rudder integrated servoactuator and was beginning to perform the hydraulic system operational checks. Mishap Personnel 1 (MP1) and Mishap Personnel 2 (MP2) were on top of the aircraft, visually inspecting for evidence of leaks. MP1 placed the job guide on top of the aircraft prior to hydraulic power being applied. As Mishap Personnel 3 (MP3) applied hydraulic power, the aircraft abruptly shuddered (normal operation). When this movement occurred, the job guide fell from the backbone of the aircraft and slid down between the airframe and the left horizontal stabilizer as the surface was in motion. The stabilizer pinned the tech order against the airframe, and the stabilizer sustained delamination and tearing damage to its upper surface.

In the section of the job guide which describes the task being performed at the time of the mishap, there is a warning which states: "Ensure personnel and equipment are clear of movable surfaces anytime that hydraulic power is turned on to prevent injury to personnel or damage to equipment."

Although there were no obstructions at the beginning of the task, MP1 failed to recognize the possibility of the job guide falling toward the stabilizer as power was applied. The result was that team members failed to properly secure their equipment prior to hydraulic power being applied. What is your team communication like? Are your maintainers talking to each other to ensure they don't make the same kind of mistake?

Oil Thirsty Engine

While performing a routine postflight/preflight inspection, the crew chief noticed metal chips on the engine master chip detector (MCD). He also noticed the engine consumed eight half-pints of oil. A joint oil analysis program (JOAP) sample and MCD were sent to the non-destructive inspection (NDI) lab for analysis. The JOAP sample revealed no discrepancies. However, the jet scan analysis on the MCD revealed level three chips of M-50 (No. 1 bearing material). Additionally, during the intake inspection, the crew chief noticed a puddle of oil underneath the forward sump cover. The tech order troubleshooting procedures for high levels of M-50 requires an engine isolation run. Due to the discovery of oil in the intake, senior flight line maintenance personnel elected not to perform the isolation run. Instead, maintenance removed the engine and sent it to the engine back shop. After removing the forward sump cover, engine shop personnel discovered the No. 1 bearing retaining nut missing. In addition, the No. 1 bearing inner race had migrated forward. This caused the bearing to ride on the fan rotor shaft, which produced the level three M-50 chips found on the MCD.

A review of the engine maintenance records revealed that the last time the forward sump cover was removed from the engine was when the engine was removed for high engine total accumulated cycles. The engine overhaul was performed by a depot field team, and during the engine build-up, the engine technician failed to install the No. 1 bearing retainer nut. Additionally, the engine inspector failed to properly inspect the procedure. Both the technician and inspector signed the in-progress inspection (IPI) worksheet acknowledging that the work was completed. This incident occurred simply because tech data was not followed during engine build-up. Additionally, the engine inspector signed off the IPI worksheet without having physically inspected the procedure. Senior maintenance personnel stated that this engine would have seized if it had flown just one more flight. How close are you following tech data? Good work by the crew chief and senior leaders for making the right calls!

USAF CLASS A FLIGHT MISHAPS

FY04 Flight Mishaps
(Oct 03-Aug 04)

23 Class A Mishaps
9 Fatalities
10 Aircraft Destroyed

FY03 Flight Mishaps
(Oct 02-Aug 03)

26 Class A Mishaps
10 Fatalities
19 Aircraft Destroyed

05 Oct		A C-17 had an engine failure (upgraded to Class A).
09 Oct		A KC-135E experienced a No. 3 engine fire.
14 Oct	✈	A T-38 crashed during takeoff.
20 Oct	✶	An F-22 engine suffered FOD damage during a test cell run.
17 Nov		A KC-10 experienced a destroyed engine.
18 Nov	✈	An A-10 crashed during a training mission.
23 Nov	✈	An MH-53 crashed during a mission. Four AF crewmembers were killed.
11 Dec	✶	An RQ-1 crashed after it experienced a software anomaly.
30 Dec	✶	A C-5 engine had damage from a compressor stall during a test cell run.
31 Jan		A KC-10 experienced an engine failure.
03 Feb		An E-4B had an engine failure inflight.
04 Feb		A C-5B had a right main landing gear failure.
25 Feb	✈	An A-10 crashed after takeoff. The pilot did not survive.
27 Feb		A B-1B departed the runway during landing .
02 Mar	✶	An F-15 engine was damaged by FOD during a maintenance run.
03 Apr	✈	A T-6 crashed on takeoff. Both pilots were killed.
29 Apr		A C-130 landing gear collapsed during landing.
05 May		An MH-53 experienced a lightning strike (upgraded from Class B).
06 May	✈	An F-15 was destroyed after it suffered a bird strike.
08 May		A C-5B had an engine failure inflight.
17 May	✈✈	Two F-16s had a midair collision, one pilot was killed.
21 May	✈	An F-15 crashed during a sortie; pilot ejected safely.
06 Jun		A C-17 suffered engine damage inflight.
12 Jun		An A-10 suffered an engine fire.
14 Jun	✈✶	An MQ-1 crashed on landing.
18 Jun	✈	An F-15 suffered a double engine failure; pilot ejected safely.
10 Jul		An F-16C departed prepared surface during landing.
11 Jul		An MC-130P experienced multiple bird strikes.
18 Jul	✶	A C-17 maintainer was fatally injured during flight control maintenance.

Editor's note: 13 Jul engine mishap has been downgraded to a Class B.

U.S. GOVERMENT PRINTING OFFICE 2004-673-456-53073

- 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://afsafety.af.mil/AFSC/RDBMS/Flight/stats/statspage.html.
- **Current as of 12 Aug 04**.

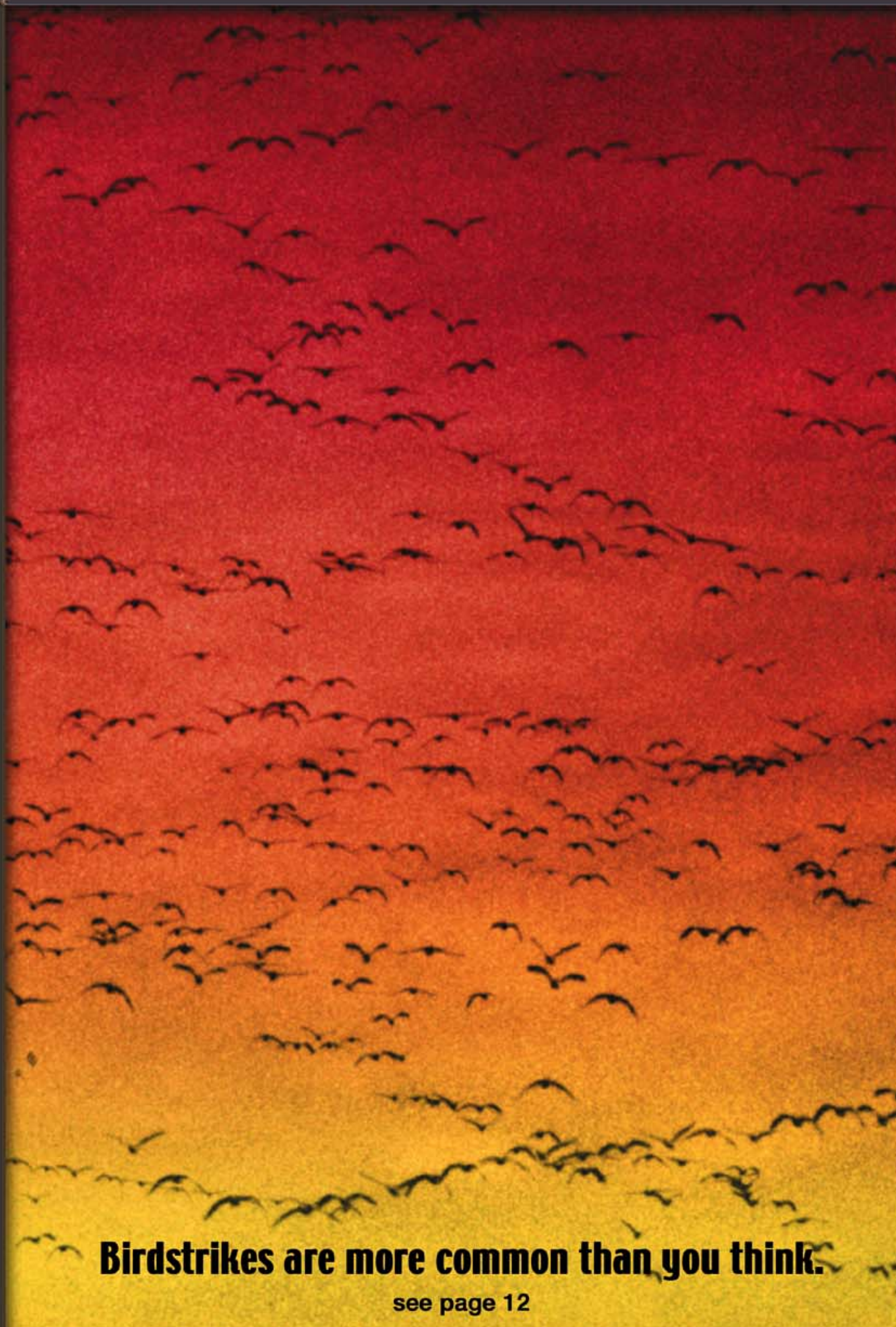
STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

The United States Postal Service requires all publications publish a statement of ownership, management and circulation.

Title of Publication—*Flying Safety* Magazine
USPS Publication No.—02799308
Frequency of Issue—Monthly

Location of Office of Publication—
HQ AFSC/SEPM
9700 G Avenue SE
Suite 282A
Kirtland AFB NM 87117-5670

Publisher—U.S. Air Force
Editor—Lt Col Richard Burgess
Owner—U.S. Air Force
Total number of copies printed—19,913
Number of copies distributed—19,663
Number of copies not distributed—250
Total copies distributed and not distributed—19,913



Birdstrikes are more common than you think.

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