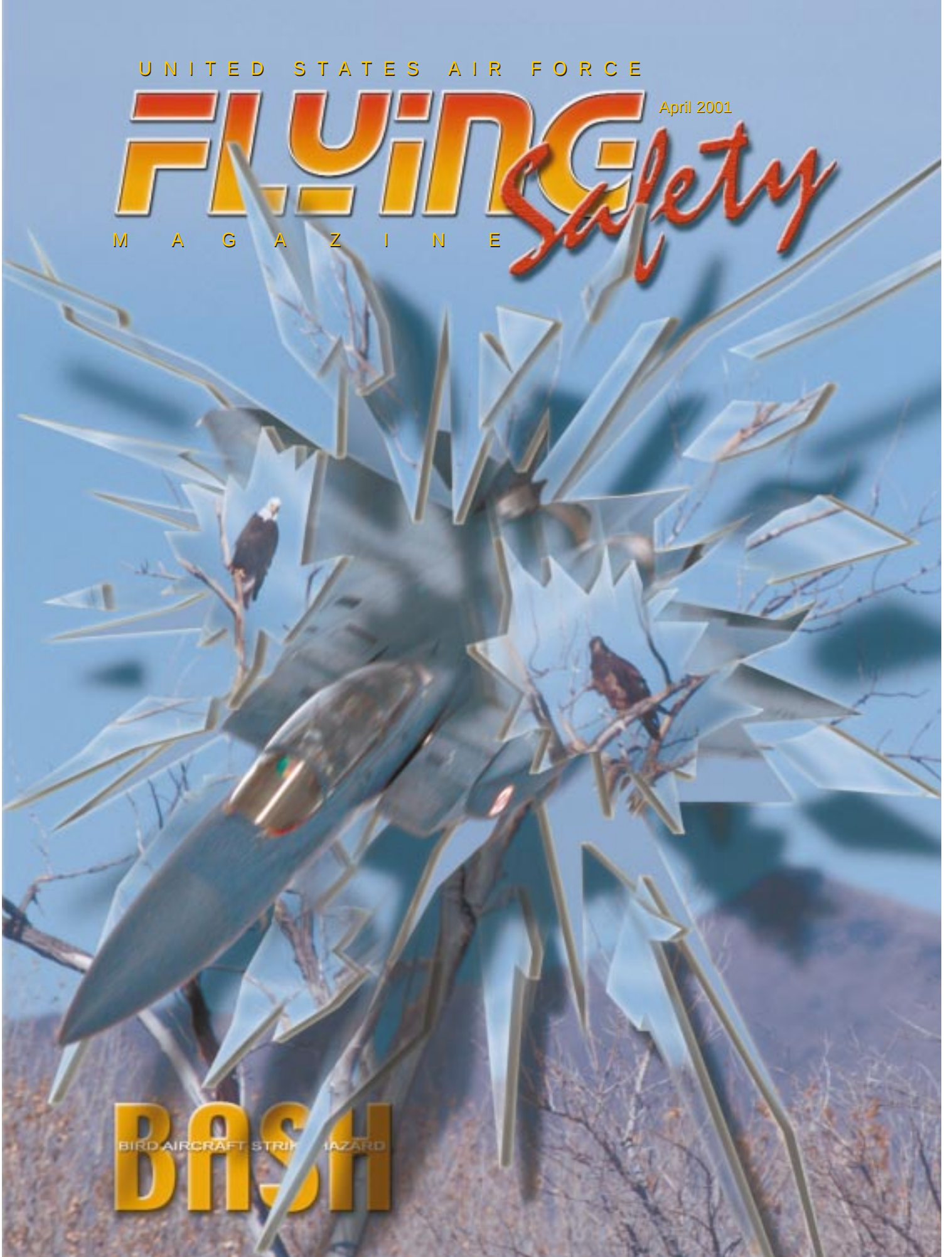
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BIRD AIRCRAFT STRIKE HAZARD

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FSM notams

WHEN CFIs FLY TOGETHER

Courtesy ASRS *Callback* #245, Nov 99
NASA's Aviation Safety Reporting System

This excellent report from a CFI involved in a loss-of-separation incident at an uncontrolled field describes some of the crew coordination issues at stake—and potential hazards—when two CFIs fly together.

This was a training flight where I, the pilot flying, was getting checked out in a new aircraft ...by another CFI. While I was doing the flying, the pilot not flying was handling all the electronics. We were both looking out for other traffic and making radio calls.

Unable to get a response from UNICOM we decided to land on Runway 22 ...On taxi back there was a fair amount of chatter on the UNICOM and the pilot not flying turned the volume down on the radio. We performed our before takeoff check and looked for traffic on final, base, and downwind for Runway 22. We did not turn the volume up on the radio (some takeoff check!) nor did we announce our departure.

While on the takeoff roll, the pilot not flying suddenly grabbed the controls, only to release them again allowing me to continue the takeoff, but pointed out [another aircraft] on short final for Runway 10! We were well past the intersection prior to his touchdown, but this was just a little too close.

There were a number of factors leading up to this incident. First and foremost, the concept of "See and Avoid" was not practiced. Unlike what I teach my students, we only checked the pattern we were using and did not accomplish a 360 to check the whole area ...Nor did we have the radio volume turned up. This was another factor. There is no excuse for not monitoring UNICOM or announcing our attentions.

Probably the most important factor, I feel, was the delineation of who actually was PIC and who was to do what. Though I was "sole manipulator of the controls," I assumed the role of student and expected/relied on the other CFI to assume all responsibility.

I feel that when two CFIs are flying together, the responsibilities HAVE to be spelled out so that there are no assumptions, second guessing, missed items/procedures and missed traffic.

It is truly scary when two CFIs fly together.

Photo courtesy of Author

What's BASH?

By tracking strikes and identifying the species struck, the BASH Team knows which species are causing the most damage.

MR. GENE LEBOEUF
HQ AFSC/SEFW

It takes personnel from many Air Force specialities to keep aircraft flying. Whether your career field falls within the flying, maintenance, engineering, airfield operations area or some other discipline, it's easy to become so focused on your own duties that you have little understanding of what your neighbor does. While this situation might not be uncommon, there are some things everybody should know. Take the Bird/Wildlife Aircraft Strike Hazards—BASH—Program, for instance.

BASH Program information is contained in Chapter 7 of AFI 91-202, *The US Air Force Mishap Prevention Program*. This guidance covers responsibilities for establishing and administering the BASH Program, all the way from headquarters level to base level. It covers lots of BASH Program details, from "Bird Watch Condition Codes" to airfield grass heights and lots more.

If one of your aircraft suffered a bird strike and you needed information on required actions, how would you begin?

One of your first actions should be to check for written guidance. It's available online at the Air Force Publications Web site at http://afpubs.hq.af.mil. From there, you can navigate to the necessary publications and forms and print out what you need.

If you're actually involved in a strike with a bird or other animal, AFI 91-204,

Safety Investigations and Reports, tells how to properly report the strike. Chapter 7 contains BASH reporting information and directs what needs to be reported for inclusion into the database here at the Air Force Safety Center. You'll also find an address to the Smithsonian Institute, where feather remains are sent for identification. It is crucial that all strikes are reported and that remains from all strikes are sent to the Smithsonian. Information gleaned from these strike reports provides a huge benefit to the flying community and is vital for keeping the BASH Team's Bird Avoidance Model (BAM) up-to-date. By tracking strikes and identifying the species struck, the BASH Team knows which species are causing the most damage, and where and when this damage is happening. Information like this is one reason the US Air Force has the only BAM of its kind in the world.

Now that you know where to find descriptive and directive BASH Program guidance, you can learn more about bird and other wildlife hazards to aircraft by taking a look at AFPAM 91-212, *Bird Aircraft Strike Hazard (BASH) Management Techniques*. It provides general information on BASH Program management basics, wildlife control methods around an airfield, a list of hazardous species, a self-inspection checklist, flight considerations, an authorized equipment list and a list of other government agencies that may provide assistance. It's a wealth of information that should be on hand in all flight safety offices.

As it takes more than one organization to keep an airfield operating, there's more than one source of information for BASH matters. Three other documents that mention BASH are AFI 13-213, *Airfield Management*, AFI 13-201, *Air Force Airspace Management*, and AFI 32-7064, *Integrated Natural Resources Management*. These instructions don't directly address BASH, but they do identify a number of areas of overlap between the disciplines.

Other sources, like online Web sites, have also become great sources of information. We here with the USAF BASH Team have an excellent Web page with a much wider range of information than that available through the AF Publications web site. Access it by going to: http://safety.kirtland.af.mil/AFSC/Bash/home.html. You'll find enough information to keep you busy for an entire day. It includes previous articles from *Flying Safety* magazine, MAJCOM safety magazines and excerpts from the AFIs listed above that deal with BASH. There are links to other organizations that deal with wildlife as well as *Prevention and Control of Wildlife Damage*, a US Department of Agriculture manual that provides information on all nuisance (or hazardous) species of wildlife.

If you happen to find yourself at a "joint use" location—an airfield where military and civilian operations are collocated—then you may want to log onto the FAA's "Airports Home Page" at www.faa.gov/arp/arphome.htm for their Advisory Circulars. The FAA has issued an Advisory Circular (AC), AC No: 150/5200-33, "Hazardous Wildlife Attractants on or Near Airports," dealing with wildlife hazards.

The most recent product from the BASH Team is another Web-based program, the Avian Hazard Advisory System (AHAS). It may be accessed at www.ahas.com. AHAS provides bird hazard information to pilots operating in the low-level environment. AHAS uses NEXRAD weather radar data and weather forecasts to post hourly updates on whereabouts of large flocks of birds moving along the eastern third of the United States. Plans are for the system to expand coverage to the central and western portions of the US as funding becomes available. The AHAS site also has a link to the BAM. This latest internet version of the BAM is a big improvement over what was posted on the Safety Center Web site in the past. BAM users can now access multiple data sets, along with the risk levels from birds, to gain a better understanding of bird hazards over their entire low-level route.

These sources of information aren't the only ones out there for BASH info, but they should provide answers to most of your questions. As always, if you can't find answers to your questions, you may get in touch with us via e-mail at: BASH@kafb.saia.af.mil. We here at the USAF BASH Team stand ready to assist you. Fly Safe!

The Avian Hazard Advisory System provides bird hazard information to pilots operating in the low-level environment.

At http://safety.kirtland.af.mil/AFSC/Bash/home.html, you'll find answers to many of your BASH questions.

2D LT DONNAVAN SWABY
HQ AFSC/SEFW

To borrow a line from my predecessor, Capt Curt Burney, we here on the BASH Team are often very hard to get in touch with. We receive lots of phone calls and, to make matters worse, we are TDY a lot. If you've ever tried to call the USAF BASH Team, you may have been greeted by a busy signal or spoken to our answering machines.

In order to disseminate as much information as possible and answer many of your questions, Capt Burney created the USAF BASH Team Web site. Now, I have the responsibility of maintaining the Web site, and this would explain why, if you've visited it recently, you may have noticed a few changes. From a change in color to new pages, the BASH information distribution animal continues to grow.

Located at http://safety.kirtland.af.mil/AFSC/Bash/home.html, you'll find answers to many of your BASH questions, which can save you the trouble of trying to get in touch with us. "What kind of information will I find there?" you ask? What follows is a page-by-page tour of the BASH Team Web site, to help you find what you're looking for.

BASH Homepage

The BASH Team home page is where you can find our mission statement, the make-up of the Team, and the Team's history. If you hold your pointer over the bullet in front of a team member's name, that person's background history is displayed to the right. You can also find each member's DSN number here.

Avoidance Page

The Avoidance Page contains the latest information on avoidance tools. The new Avian Hazard Advisory System (AHAS), the Central European BirdTam, the online Bird Avoidance Model, how to order Portable Flight Planning Software (PFPS) and the use of infrared devices on the airfield are examples of information accessible from this page.

Harassment Page

Ever wonder how effective falconry is? What's the real story behind warning whistles to mule deer? Can ultrasonics be used as a method of bird control? Does methyl anthranilate, as a food source, repel birds? Various scientific papers and studies regarding the aforementioned subjects, in addition to a host of others, can be found by clicking on this page. Other topics include depredation, bird capture/relocation, and pyrotechnics/propane cannons.

Exclude/Mitigate Page

Similar to the Harassment Page, the Exclude/Mitigate Page is home to papers and studies that were done with respect to wildlife exclusion/mitigation techniques. Current topics which have studies associated with them are: landfills, hangars/built-up areas and fencing. As we get papers and studies on other subjects, we will post them to this page, too.

Guidance Page

Here's where to find Air Force BASH regulations or FAA guidance for civilian airports. Have you ever said to yourself, "I wish I had a sample BASH plan to use as a foundation for my own program"? Have thoughts of depredation and how to go about getting permits ever crossed your mind? "Where do I go to set up a SAS account so I can report my bird strikes?" These questions can be answered by clicking on the Guidance Page. Here you will find answers to the aforementioned topics, in addition to a downloadable version of the Interim Form 853, *Air Force Bird Strike Report Form*, classifications for pyrotechnics and links to resources to help you identify your BASH problems.

Strike Stats Page

As you can probably gather from the title of the page, this is where you will find basic stats for the entire Air Force. Strikes by year, month, hour, phase of flight and altitude are a few of the statistical analyses you will find here. If you were looking for numbers Air Force-wide, this would be your first stop. For more specific data, contact the Air Force BASH Team at: BASH@kafb.saia.af.mil.

Wildlife Info Page

This page will direct you on wildlife remains to collect and how to collect them. It will also give you information on how feather identifications are done. Lastly, there's the bird classification list. Should you need information on a specific bird, simply click on the respective order and family until you get to the correct species.

Online Help Page

Did you know that the University of Nebraska and the US Department of Agriculture have developed a manual that addresses wildlife damage prevention and control? If you want to read a copy of it, you can find it here. Also included on this Web page are links to BASH-related articles in *Flying Safety* magazine (published by HQ AF Safety Center) and *The Combat Edge* (published by ACC). There are also links to MAJCOM BASH Web pages, the FAA's Web site, the USDA's Web site, and the US Fish & Wildlife Services Web site, to name a few.

Upcoming Events Page

I recently received a call from a person new to the BASH world, who asked if I had any information on future BASH-related meetings. I told him about the Bird Strike Committee conference in Canada this coming August. (See page 26 in this issue. Ed.) When they asked where they could find more information on the subject, I directed them to this section of the BASH Web site. We list all major BASH-related meetings here as they come to our attention.

New in Bash Page

If there is a change in BASH or something new that's advantageous for the field to know, this is where we will post it. This page is dedicated to providing the most recent and up-to-date information concerning changes or advances in wildlife damage control and prevention. Also, you will find a link to the Aviation Safety Division's new "Crossfeed" page (http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/Aviation-Crossfeed.htm). The "Crossfeed" page will allow you to post and view aviation-related items, such as presentation slides and posters, which units feel are worthy of being shared.

Frequently Asked Questions (FAQ)

The BASH Web site would not be complete without an FAQ page. We have compiled a list of our most frequently asked questions (FAQ) with answers. The article that follows is an excerpt of this page and gives a good idea of the topics covered on the FAQ page.

The BASH Team Web site is one of the most comprehensive resources for learning about BASH-related issues. Whether new to the BASH world or an expert, everyone can find something useful when they visit. If you have any questions or comments regarding the BASH Team Web site, please let us know by contacting us at: Bash@kafb.saia. af.mil. We endeavor to provide you with as much information and guidance as possible. In case you missed the address the first time, the web address is: http://safety.kirtland.af.mil/AFSC/Bash/home.html.

If you have any questions or comments regarding the BASH Team Web site, contact us at: Bash@kafb.saia. af.mil.

USAF BASH TEAM FREQUENTLY ASKED QUESTIONS

2D LT DONNAVAN SWABY
HQ AFSC/SEFW

Report all damaging and non-damaging bird/ wildlife strikes.

The following is an excerpt from the "Frequently Asked Questions" page of the USAF BASH Team Web site. We're offering it here for two purposes. First, it shows the wealth of information you may easily access by going to http://safety.kirtland.af.mil/AFSC/Bash/home.html. Our second reason is to try to answer some of the questions that may have been burning in your brains for some time. As the title states, these are our most frequently asked questions. Keep in mind there are other FAQs on the Web site. For the full list of questions and their answers, go to the above Web address.

1. What do I report?

• Report all damaging and non-damaging bird/wildlife strikes.

• Remains found on the runway as the result of a suspected aircraft strike must also be reported.

• 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.

• Bird/wildlife strikes should be reported as they occur, but must be reported no later than the 15th of the following month. Reference AFI 91-204, paragraph 7.4.7.

2. How do I set up a SAS (Safety Automated System) account to enter my bird strikes?

• You must contact your MAJCOM BASH SAS Administrator.

• A list of MAJCOM BASH SAS Administrators is available on the BASH Team Web site by selecting the "Guidance" page, then going to the "Reporting" section and downloading "Bash/SAS Instructions."

3. SAS will not allow me to do a full query for my base. How do I get that information in the meantime?

• All requests for bird/wildlife strike data must be done through the USAF BASH team at: BASH@kafb.saia.af.mil.

• Full BASH query capability will go online when Aviation SAS is complete. Estimated date of completion is Fall 2001.

4. What is the difference between reporting a damaging versus a non-damaging strike?

• For non-damaging bird/wildlife strike reports, you must fill out a BASH SAS report. If remains are found, send a copy of the SAS report and the remains to the Smithsonian Institution.

• For damaging bird strike reports, you must adhere to the regular reporting procedures as outlined in AFI 91-204 for all Class A, Class B and Class C mishaps. Additionally, you must complete a BASH SAS report, and if remains are found, send them to the Smithsonian Institution along with a copy of the BASH SAS report.

• In the final mishap report for a damaging strike, state if a BASH SAS report was done.

5. How do I get the USAF BASH Team to do a technical site visit at my base?

• You must coordinate all requests for a technical site visit with your MAJCOM safety office. The BASH Team's funds are limited; therefore, bases may be required to fund the trip.

6. When doing a technical site visit, what else does the BASH Team require from the base other than funding?

• The BASH Team prefers to stay on

base in the VOQ as opposed to an off-base location. This provides an opportunity to observe base operations and wildlife activity both during the day and at night.

• During the visit, it would be most advantageous for both the BASH Team and the base to have all units involved in the Bird Hazard Working Group present to discuss any issues that arise.

7. Why should I use AHAS (Avian Hazard Advisory System)?

• It's free and easy for the field to use. AHAS eliminates the work associated with having to interpret NEXRAD radar returns to determine weather versus bird returns.

• It is the most accurate bird avoidance tool available today.

• If you are in the eastern region of the US or flying through the eastern region, it is the most current and advanced form of bird detection (other than a mobile radar unit).

• To gain familiarity with the system. The more you use it, the easier it will be to incorporate AHAS readings into one's flight planning. It will be expanded to the Central region in Spring 2001, with plans for expansion to the Western third of the US scheduled for FY02.

• No special software or computer hardware is needed. All you need is an internet browser and access to the internet.

• AHAS is an excellent ORM tool.

8. What avoidance tool is available for crews flying over Central Europe?

• BIRDTAMs, an elaborate bird monitoring system, has been developed and is being used by Germany, Belgium and the Netherlands to generate bird strike risk intensity levels. These levels range from 0 (nil bird strike risk) to 8 (extremely great bird strike risk). Aircrews flying over Central Europe, to include the aforementioned countries, in addition to Denmark and France, should consult the DoD NOTAM Web site, in the "European Theater" section, during flight planning. Additionally, you will find a link to BIRDTAMs on both the "Avoidance" and "FAQ" pages of the USAF BASH Team Web site.

• BIRDTAMs condition 0 to 2 corresponds to Bird Watch Condition LOW, 3-5 to MODERATE, and 6-8 to SEVERE.

• For more information on BIRDTAMs, contact USAFE/SEFP–Flight Policy via e-mail at: sefp.policy@ramstein.af.mil.

9. What types of pyrotechnic devices are available?

• USAF has stock-listed and centrally managed the 12 GA "shellcracker" for many years. It is centrally managed by Hill AFB and may be ordered via normal supply channels.

• Two 15MM pyrotechnic devices have been interim-classed for use for the past several years. One of these 15MM devices, the racket bomb or "screamer," was issued a final hazard classification from USAF last year. The other 15MM device has passed the testing process and a final classification is forthcoming.

• The 15MM devices may be purchased with an IMPAC Card IAW AFI 64-117, *Air Force Government-Wide Purchase Card Program*.

10. Which pyrotechnic works best?

• There is no one "best" harassment device or technique.

• Varying the use of different methods, techniques and devices is defined as "integrated pest management," and is generally accepted as a best course of action to resolve wildlife hazards.

• The "screamer" seems to generate the best results, but wildlife may become accustomed to its use if relied upon as a sole course of action.

Because we are a "low density/high demand asset," getting in touch with us can be a hassle at times. Therefore, we try to put as many answers and contacts as possible on our Web site for your viewing pleasure. If your questions are not answered on any of the pages on our BASH Web site, please contact us (contact information is on the Web site), and we will work to get you an answer.

There is no one "best" harassment device or technique.

Do You Have Questions About BAM and AHAS?

MAJ PETE WINDLER
HQ AFSC/SEFW

USAF Photo by TSgt Michael Featherston

AHAS is the latest bird hazard avoidance tool available for predicting bird risk during low-level and range flight operations.

One year ago, near-real-time bird risk advisories became a reality when the Air Force's Avian Hazard Advisory System (AHAS) began operations. AHAS is the latest bird hazard avoidance tool available for predicting bird risk during low-level and range flight operations. AHAS is operational and available (www.ahas.com) to access information on bird strike risk in the eastern third of the CONUS (west to 90W longitude). Data for the central third of the CONUS (west to 105W longitude) will be available in the spring of 2001 and full coverage of the CONUS is expected in 2002. The Web site provides simple-to-use pages to access bird strike risk for published instrument routes (IR) and visual routes (VR), ranges, military operating areas (MOA) and military airfields. Published slow routes (SR) will be available at the same time as the central region.

Now that we have both a Bird Avoidance Model (BAM) and AHAS, there is some confusion as to which one to use and what the differences are. I've tried to capture the most common concerns and questions about the BAM and AHAS which have been brought to our attention.

When using AHAS, I would like to access a graphic that depicts the routes. You can access the route displays through the bird avoidance model (BAM), which is available on the Web at the AHAS site (US BAM). You can look at any route (IR, VR, SR) or military airfield in the CONUS. Work is in progress to provide the graphic depictions through AHAS. The advantage of the tabular data is bandwidth, or speed of response. The tabular data can be retrieved as much as six or seven times faster than graphical information. This can be significant if bases experience slow Internet connections due to traffic loads.

AHAS's predictive value is based partly on hazard (bird strike) records for specific areas, but most areas have very sketchy records, thereby diminishing the strength of the predictions. AHAS is built on the BAM. We used the top 60 bird species in our bird strike database to build the model. We incorporated 30+ years of Breeding Bird Surveys, Christmas Bird Counts, and refuge bird counts. Hazard levels in the BAM are based on bird mass. Larger birds drive the hazard level higher. We have good information from the BBS, CBC and refuge data, but our data on how the birds get from summer to wintering areas is sketchy. That is where NEXRAD (next generation weather radar) comes in. We are archiving the radar data on bird migration. When we develop an algorithm to incorporate the data into the model, we will be able to fill in those areas where our data is currently lacking.

Bird strikes often occur during landing and takeoff, involving "local" birds. Aircrews should be aware that AHAS isn't designed to address localized bird problems. That is absolutely a true statement; AHAS won't address

local bird problems on your airfield. However, it will give you a heads-up when seasonal migration begins, which increases the bird hazards in your local flying area. Even if the birds don't stop at your base, they will be transiting your airspace, increasing your risk level, if only temporarily. An aircraft in the local traffic pattern could be 20 nautical miles from the base and 2000 to 3000 feet AGL. That aircraft is at greater risk from migrating birds than "local" birds. Night flying presents an even greater risk since most bird migration occurs at night. There is a note on the AHAS web page which reads, "Note that the bird strike risk indicated by AHAS is NOT the condition ON the airfield determined by airfield management, but the bird strike risk OFF the airfield within 5NM."

AHAS risk forecasts rely on weather predictions, which are very unreliable. This weakens the strength of the risk predictions in AHAS. The weakness of weather forecasts are fully understood and compensated for in AHAS. Consequently, more than 24 hours before flight time, when weather forecasts are most unreliable, AHAS reflects the historic information from the BAM. Less than 24 hours into the future, AHAS risk predictions are based on the BAM and National Weather Service (NWS) weather forecast data. These forecast models predict the bird risks expected and are updated every 12 hours. Risk prediction requests for the current hour generate a "near-real-time" risk prediction based on observations from the national NEXRAD radar network. AHAS processes the radar data hourly to detect bird activity in near-real time.

If a key weather variable for a particular low-level route or airspace is missing, the risk value shown by AHAS is the value depicted by the BAM. Taking a conservative approach to forecasting bird activity, as we have with AHAS, makes for a fairly robust system. Keep in mind, however, in the current configuration the accuracy of AHAS can never exceed the accuracy of the NWS weather forecast models. As computer-processing power increases and new automated weather sensors (wind and temperature profiler radars) become available, 24-hour bird activity forecasts will be very accurate, and modeling for 48 hours and beyond will approach current 24-hour prediction accuracy.

The emphasis of AHAS is almost strictly on large birds, but aircraft often hit flocks of small birds. Flocks of small birds should be considered more in the BAM and AHAS. We focused the BAM, and subsequently AHAS, on the top 60 bird species in our bird strike database, gathering information on these species from over 30 years of Breeding Bird Surveys, Christmas Bird Counts, and wildlife refuge bird counts. The risk values are based on the sum of the mean bird mass (in ounces) for all species present during a particular time period. The larger birds influence the risk layers since they do significant damage when struck. The small flocking birds are very much a part of the risk layers. Radar is being utilized more and more to map neo-tropical migrant stopover points along the coastal regions. Radar is also proving very useful in pinpointing large roosts of small birds such as Purple Martins and Swallows. As we gain more information on large concentrations of small flocking birds, we can update the risk layers in the BAM to reflect the hazards.

continued on next page

Aircrews should be aware that AHAS isn't designed to address localized bird problems.

Small birds flock at low altitude while foraging, as an anti-predator strategy, or while entering and leaving roosts. Robust control measures and habitat modifications can minimize airfield hazards associated with small flocking birds. Current radar technology is capable of tracking local bird activity and is especially useful during hours of darkness or inclement weather. Any base can obtain and use a mobile radar to track bird movements within their own airspace as a way of enhancing their BASH program.

AHAS discusses migratory routes of large bird species as though these routes are very precise, which they are not. There isn't enough information known about migratory routes for most birds. That's why data holes exist in our model. Our aim with AHAS is to describe 95 percent of the migratory track of birds 95 percent of the time. Migratory routes change over time as land uses along traditional corridors change. As radar and satellite tracking technology improve, we will be able to correctly map migratory routes and gain altitude data as well. The BAM and AHAS cannot account for local movements of flocks looking for new foraging and roosting areas as pressure increases at traditional locations. The BAM and AHAS are light years ahead of where we were five years ago. I anticipate we will make the same quantum leap in the next five to 10 years as we incorporate more accurate data into the risk layers of the BAM. We are working hard to capture the new technologies for improving AHAS.

As radar and satellite tracking technology improve, we will be able to correctly map migratory routes and gain altitude data as well.

Radars use filters to mask out ground clutter and weather and sometimes mask slow-moving airborne objects. Can the weather masking discussed on the AHAS web site mask out birds? The algorithms used to filter out the weather are very good and have been tested thoroughly. We are working with the Environmental Protection Agency (EPA), Audubon Society, Clemson University and US Geological Survey (USGS) to "ground truth" the radar returns. The WRS-88 (NEXRAD) radar and its follow-on generations are a vast improvement over some of the earlier radars. Even some of the airport surveillance radars are very good at detecting birds. There is no guarantee we aren't losing a few bird returns in the weather we filter out. However, from an aircrew standpoint, I'm less concerned with any birds within the weather return because I shouldn't be flying that close to the weather in the first place. AHAS is not suffering significantly from any potential loss of bird returns within the weather.

How do I know the risk assessments are accurate? Has a scientific peer review been done on the BAM or AHAS? Both the BAM and AHAS have received extensive peer review from MIT, Boston University, Cornell University, Lockheed Martin, Raytheon, the Federal Aviation Administration, the Dutch Air Force and the Israeli Air Force. The USAF's BAM and AHAS are the only bird hazard avoidance tools of their kind in the world, making comparisons difficult. After at least five years of operations, enough archived data will be available to compare BAM and AHAS predictions with actual bird activity and build a scientific peer review for publication. Neither the BAM nor AHAS are perfect; rather they are "works in progress," carefully scrutinized and reviewed by many different experts. Both are vast improvements over any previous avoidance tools available to Air Force personnel.

I'm not sure what the different risk values (low, moderate, severe) mean. There is no information given on the number of birds passing through a given portion of airspace (e.g., 1000 birds per square mile), nor any indication of the altitude of the birds. Is the term "moderate" defined the same way it is in a typical base BASH plan? The risk levels are basically the same between the BAM and AHAS. The risk levels describe three predicted risk classes—Low, Moderate and Severe—which are based upon the bird mass in ounces per kilometer squared. In other words, the risk levels represent the amount of birds (bird mass) in a kilometer squared spatial area.

"Moderate" indicates a risk ratio that is 57 to 708 times the risk of "Low," while "Severe" indicates a risk ratio that is 2,503 to 38,647 times the risk of "Low." Bird strike risk is the likelihood of a catastrophic event, a function of the mass of a bird. The larger the birds present, the higher the risk of a catastrophic

event. Up to this time there hasn't been any reliable altitude data on bird migration. Improvements in radars and satellite telemetry may provide accurate altitude data for future incorporation in the BAM and AHAS.

Risk levels in the BAM and AHAS should not be confused with airfield bird watch condition (BWC) codes. Continental-scale bird movements considered in the risk layers of the BAM and AHAS present different hazards than local bird activity reflected in BWC codes. BWC codes determination and associated operational decisions are based on number of birds, size, location, behavior and type of aircraft.

NEXRAD doesn't cover every square inch of the United States. Birds may move through gaps in radar coverage, decreasing the accuracy of bird strike risk assessments. There are known gaps in the NEXRAD coverage over the entire US, but it doesn't affect our bird strike risk assessments. The gaps are relatively small and we assume the migration will pass evenly across the gaps as we pick up the birds at each radar site. The foundation risk level is from the BAM, which is based on bird counts and not radar returns. One way of improving the radar "picture" used by AHAS is to bring FAA radars into the mix. AHAS was developed with a very careful understanding of radar horizon and point target suppression limitations. We are trying to gain access to additional radar systems, such as Level II NEXRAD (we are using level III now), terminal Doppler weather radar (TDWR), airport surveillance radar (ASR) and Air Route Surveillance Radar (ARSR) radar data.

There is another bird advisory system available on the Internet called BirdCast. Are BirdCast and AHAS the same? Can I refer to BirdCast for bird hazard advisories? The same contractor who developed AHAS, Geo Marine, Inc., conceived the BirdCast system. They are vastly different. The radar data currently used in BirdCast is nowhere near as robust as that used in AHAS. AHAS radar data is one kilometer resolution, whereas BirdCast uses a significantly lower resolution. AHAS has a specially-developed method to mosaic multiple radar sites so information from one radar image does not remove information from another site where the images overlap. BirdCast uses two data scales, making it hard to differentiate between intensities. AHAS uses a single data scale, the standard adopted by Lockheed Martin for all new NEXRAD radars. Radar data on BirdCast includes weather, chaff, smoke and airborne particles, creating images which can be easily misinterpreted. BirdCast focuses on small birds of interest to "backyard birders" and not on large birds, which cause more damage to aircraft and constitute the primary risk to aviation safety during low-level flight operations.

AHAS is designed specifically for aircrews. Aircrews don't have the time or expertise to look at raw NEXRAD radar images, as found in BirdCast, and try to discern what the bird risk is for their planned low-level route or special-use airspace. AHAS does that for them. AHAS relies on the historic bird risk layers in the BAM, whereas BirdCast has no such model. AHAS uses the same quantifiable data from NEXRAD that BirdCast uses, only AHAS updates the risk values from the BAM to a "near-real-time" risk value. Flying units should incorporate the BAM and AHAS into their scheduling and mission planning processes. The BAM is primarily a scheduling tool and AHAS allows flexibility in last minute scheduling adjustments based on updated bird activity predictions.

Hopefully I've answered your particular questions about the BAM and AHAS. Perhaps I've generated even more questions. For more information you can explore the AHAS (http://www.ahas.com), BAM (http://bam.geoinsight.com/Models/) or USAF BASH (http://safety.kirtland.af.mil/AFSC/Bash/home.html) Web sites. You can reach the USAF BASH team by e-mail at: bash@kafb.saia.af.mil. We'll do whatever we can to help.

The USAF's BAM and AHAS are the only bird hazard avoidance tools of their kind in the world.

What is the Risk of a Bird Strike at Your Airfield?

T. ADAM KELLY
BASH Project Manager,
Geo-Marine, Inc.

You have a BASH (Bird Aircraft Strike Hazard) plan that addresses airfield grass height and habitat management. You have obtained bird-scaring equipment and identified personnel to harass birds on or near the flightline. You feel you have a pretty good BASH program. But do you know the risk of a bird strike at your airfield?

For every bird strike on the BASH database we had eight near misses where a bird passed within a distance of one wingspan from the aircraft.

Assessing Risk at Your Airfield

Risk management and risk assessments are now fundamental steps in safety programs for both military and civilian aviation and non-flying programs. The first step in a risk assessment is to quantify the risk. Most bases are now doing an outstanding job of reporting all bird strikes to the USAF BASH Team, and the number of feathers provided to the Smithsonian Institution for identification each year is steadily growing. So why not base a risk assessment on your airfield's bird strike record? The BASH database is an important record of what we have hit in the past and provides a fairly accurate indicator of the scale of the BASH problem in terms of damage costs and species that frequently cause problems. This database was used extensively in the development of AHAS (Avian Hazard Advisory System) and the US BAM (Bird Avoidance Model).

The BASH database is limited in its ability to fully describe the risk of a bird strike at your airfield. Simple geometry says that for every bird strike on the BASH database we had eight near misses where a bird passed within a distance of one wingspan from the aircraft. The further out you go in distance from the aircraft, the number of birds that passed, but did not strike the aircraft, grows exponentially. This would appear to support the big sky theory that "we only get unlucky occasionally." We have a very good example of how flawed this theory is in the 1995 E-3B AWACS crash at Elmendorf AFB, Alaska. Canada Geese had been noted on or near the airfield for years, but they were not struck by aircraft so did not appear on the BASH database—until an aircraft was lost. So, just like the stock market, past performance can't guarantee future returns. The BASH database can't fully describe where the next airfield bird strike loss will occur.

Human Limitations, Technology Innovations

Some airfields do a good job of documenting all bird harassment runs on the airfield, recording time, location and species of bird found. Useful data are provided for improving the habitat management of the airfield by finding areas that birds consistently return to. But do these data provide an accurate description of risk? These observations are made with the human eye, an instrument which has problems seeing birds when they are more than 500 feet above the ground (40 percent of airfield bird strikes occur above this altitude). The eye also cannot detect flying birds at night. It may surprise you to know that 24 percent of all airfield bird strikes occur during the hours of darkness! When was the last time you harassed birds on your airfield at night? Do you know how many birds fly over your airfield at night? Birds may be more active at night than during the day, especially during the migration seasons. We know this from radar studies that indicate up to a 90 percent increase in birds flying at night than during the day. We would see a significant increase in the number of bird strikes reported if, when night flying, we flew all night rather than stopping before midnight.

Between 1995 and 1999 three studies of bird activity were conducted by the United States Air Force with small, powerful, high-resolution radars modified for bird detection. These studies were conducted at the Dare County Bombing Range, NC, Moody AFB / Grand Bay Weapons Range, GA and Offutt AFB, NE. Each of these studies found bird

activity that was previously unknown or of a magnitude not appreciated before the study was started. These specialized radars can precisely count birds, determine their altitude or ground track and be used to calculate the frequency and risk of a bird strike. It is for this reason that the Air Force Safety Center recently recommended use of mobile radars for airfields to conduct a baseline bird strike risk assessment.

The studies conducted in the late 1990s were not cheap. The technology available at the time meant that the data were recorded to videotape and then reviewed by an expert technician, who then logged bird targets in a computer database. Data from one six-hour recording session could take as long to review and record to the database as the session itself! If multiple radars were used to record both in the horizontal and vertical planes, then the post-processing time doubled.

The radar equipment itself has not become cheaper with time, but conducting radar-based risk assessments has. These are now about 30 percent less expensive, and are more accurate. Software has been developed that can find moving bird targets as effectively as the best expert technician. In the past, expert technicians would measure one parameter related to the size of the target. With current technology, software can make seven measurements on each target with much greater precision in a fraction of the time. The radar measurements can be made in real time so that the radar can be left running for extended periods without creating a huge backlog of data to process. The methods used to collect the data have also changed. A new scanning technique has been developed that takes a vertical slice through the atmosphere, counting birds as they pass overhead and recording their altitude and position.

What Questions Will a Radar Study Answer?

Once the radar data of bird activity has been collected, how can it be used? The first step of a risk assessment is to determine how many bird strikes are likely and how severe they are likely to be. These values can easily be calculated based upon the frontal area of the aircraft at the airfield and the number and size of birds recorded by the radar.

The data can also be applied in other ways to enhance your base BASH plan and Bird Hazard Management. Radar can be used to observe and quantify the level of bird activity over your airfield, and through your local traffic pattern, departure and arrival corridors. Are there local attractions to birds you had not previously noted? If you have a landfill in the area, you may be concerned with how many birds fly to and from that location through your airspace or how high they fly over the landfill. The radar data can also be used to determine if you are located on a major migration corridor, as well as how many birds are active around your airfield at night.

Even short-term radar studies conducted at key times of the year can collect data to shape management decisions and determine the appropriate responses. For example, the birds that have been causing nighttime strikes at your airfield may cross at altitudes below 500 feet. Under these circumstances, an alteration in flying schedules may be warranted. Equipping and manning your Bird Control Unit (BCU) for nighttime bird harassment operations would be justified, but harassment operations during darkness are difficult to execute properly. If, on the other hand, birds were only seen above 500 feet, actively harassing birds at night may have little or no effect. Reducing bird strikes at night under these circumstances will require operational changes based on the size, height and ground track of the birds. Such data can only be collected by radar! The data can be used to determine whether you will have more or fewer bird strikes if you change your traffic pattern altitude. Radar can be used to find optimum altitudes for your particular location and circumstances.

Use of radar when conducting a bird strike risk assessment at your airfield can aid in preventing future damaging bird strikes. Past experience has taught us that very few airfields fully understand the exposure they have to birds because they lack the information to conduct a full risk assessment. New technology may soon provide a more accurate way to quantify this risk.

Radar can be used to observe and quantify the level of bird activity over your airfield, and through your local traffic pattern, departure and arrival corridors.

"Feather detectives" Carla Dove (left) and Marcy Heacker (right) of the Smithsonian Institution, Division of Birds

Feathers, Feathers, Feathers!

Simply stated, you are the first link in proper identification of the species of bird.

DR. CARLA DOVE AND
MS. MARCY HEACKER
Smithsonian Institution, Division of Birds

"Why do we have to send in every feather for identification?"

That is the most commonly asked question regarding bird strike identification. The simple answer is this: "If we don't know which birds we're striking then we don't know how best to manage the problem." Birds represent a very diverse group of vertebrates. Even members within the same family—ducks, for instance—can have different distributions, behaviors, diets, and migratory habits. Knowing exactly what type of bird it is, and working out its eating, sleeping, and "leisure" desires, can go a long way in helping to prevent catastrophes. Careful collection and preservation of feather evidence by you, and then sending it expeditiously to us at the Smithsonian Institution for identification could help avert a future catastrophic bird strike. Simply stated, you are the first link in proper identification of the species of bird.

How Are Birds Identified?

As you might expect, there isn't much "bird" left after it has been sucked through an engine or penetrated a fuselage, so identifications can be quite difficult.

USAF Photo

That's why when analyzing an unknown sample we need as much of the feather evidence you can gather as possible. Bird strike identification usually involves matching pieces of whole feathers with museum specimens that have been preserved specifically for research.

That's where the Smithsonian Institution's research collection of more than 620,000 bird specimens comes in handy.

This collection of museum "study skins" is one of the largest in the world and represents about 85 percent of the 9000 known species of birds. A collection of this magnitude, representing many individuals of the same species, is fundamental to accurate bird strike identification because some birds of the same species may look different based solely on the variation in sex, age, and where the bird happens to live.

Although more than 90 percent of the bird strike cases we deal with are identified using the specimen collection, we sometimes have to rely on the microscopic structures found in the downy barbs of feathers to help us figure out the group of birds we're dealing with.

Microscopic view of a Kestrel feather (left) and a Gadwall Duck feather (right).

continued on next page

Even the tiny pieces of fuzz mixed in with blood smears can provide us with identification clues.

So, even the tiny pieces of fuzz mixed in with blood smears can provide us with identification clues. (We invite you to check the USAF BASH Team's web site at http://safety.kirtland.af.mil/AFSC/Bash/home.html and select the "Wildlife Info" tab for feather collecting methods.) We also rely on your reporting of accurate circumstantial information—such as date, locality, damage amount and altitude—to corroborate identifications.

Reporting

We've already stressed the fact that reporting every bird strike is essential. 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. But there are many other vital reasons for identifying the exact species of birds that present hazards to aviation safety.

You Put The "Data" In Database

Few would argue that the USAF has the best bird strike program in the world. All of the information gathered from each reported bird strike and species identification is compiled into a comprehensive—and invaluable—database. Information from this database can answer questions you may have concerning strike hazards at different airfields, help analyze bird strike trends at your base and enable you to compare your bird strike problems to those of other bases.

Statistics produced by this data get quite a workout. From individual airfield BASH programs to the development of the BAM (Bird Avoidance Model) and AHAS (Avian Hazard Advisory System), information provided by the bird strike database is a powerful tool for understanding and predicting bird activity. Field-level users can monitor species trends and modify their BASH plans using this data. The USAF BASH Team can use it to assess regional, national and global patterns of bird strikes, make bird control recommendations and continue building on their efforts. In collaboration with Ms. Roxie Laybourne, who founded "Featherology" nearly 40 years ago, aircraft engineers have also used species identification information to analyze bird weight data and improve the design of T-38 Talon and F-16 Fighting Falcon windscreens.

The database, however, is only as good as the data that's in it. This is why the USAF BASH Team and we place such emphasis on the need for comprehensive, accurate data and recording of all bird strike activity. Occasional reporting, or reporting just those bird strikes which cause damage, provides only a glimpse of the "big picture" of bird strike activity, ultimately resulting in an incomplete—or worst case, misleading—database.

Legal Considerations

Legal issues, ranging from permit hearings on landfills to U.S. Fish and Wildlife Service concerns, often rely on the USAF BASH Team's database for species-specific information. For example, McChord AFB, WA, is replacing its C-141 Starlifter fleet with C-17 Globemaster IIIs, and this has resulted in a 33 percent increase in low-level flight activity around the base. The U.S. Fish and Wildlife service was concerned that this sudden change in low altitude flight patterns would have a negative effect on resident and migratory Bald Eagles and Peregrine Falcons. By using the bird strike database, the USAF BASH Team was able to provide the statistical data needed to verify that these species are rarely involved in bird strikes. Result? C-17 flight training at McChord continues with little increased risk to the resident and migratory eagles and falcons.

The database has also been used to help build strong cases against constructing landfills near airfields. Because the USAF bird strike database spans 15 years, we can simply look at species trends of the past and confirm that larger birds, like gulls and vultures, frequent garbage dumps and are more liable to cause major damage to aircraft.

Although depredation is only recommended as a "last resort" to birds that pose a direct hazard to flight operations, it is sometimes necessary. If you ever need to apply for a depredation permit, it's a good idea to be educated about what species you actually want to remove. Again, the value of the database becomes evident. After all, if you

can't confirm that the birds on the airfield are causing problems—as opposed to the birds that are five miles out—then you shouldn't expect the permitting officials to approve your application.

In order to keep "muscle" in the bird strike data, we need to work together to assure the continued accuracy and consistency of the bird strike database—you are the ultimate beneficiary! BASH reporting via the Safety Automated System (SAS) became available in July 2000 at: http://einstein.saia.af.mil/HOME/lovuser.frm_sas_home.html_main. Please report all bird strikes—not only because it's a good thing—but because AFI 91-204, *Safety Investigations and Reports*, requires it. (Note: Generally speaking, it's your Safety Office personnel who log into the SAS and do the bird strike reports for your unit. Ed.)

Proper Feather Collection

Some people have apparently heard we can identify feathers from microscopic examination, so they send only a part of the feather even if the whole carcass is available. Bird identification is almost always done using whole feathers. The more feather evidence we have, the quicker we can do the identifications and with greater confidence. There are special cases where we have to identify species based on the microscopic structure of the downy part of a feather. Therefore, it's important to send any and all feather fragments found. But remember: Whether it's mostly feathers, or the whole bird, it's crucial to send as much of the remains as possible to aid identification.

What to Collect

- Any and all feather material found in an engine, on an aircraft or on the runway. Send animal remains from non-bird strikes, as well.
- Any bird parts—feet, talons, bones, feathers.
- Send as much material as possible, even if it's smelly. At the least, include the feet, beak, wing, tail, breast and back feathers.
- If you have a whole bird, place it in a freezer and contact Dr. Carla Dove at (202) 357-2334, to see if we in the museum can use the specimen in our collection.

How to Collect

Place unknown material in some type of re-sealable bag. Placing small samples in large bags often makes it very difficult to find the feathers, so please place tiny bits of feathers in a clean white envelope and then put it in a re-sealable bag.

Documenting and Reporting

Log on to SAS and complete the electronic report. If you don't have a password you'll need to contact your MAJCOM SAS administrator. The list of the administrators can be found on the USAF BASH Web site by going to the "Guidance" page and selecting "BASH/SAS Instructions."

Include a hard copy of the SAS report along with the feather remains.

When to Send

The tissue will decompose, so send us your bird/feather samples as soon as possible, with a hard copy of the SAS report.

What Not to Do

- Never use scotch tape on feathers. Downy barbules get tangled and glued, and are practically impossible to remove.
- Never use "Post-Its™" because feathers get stuck in the glued edge.
- Never cut feathers off the bird or cut the tips away from whole feathers. Sometimes it's necessary for us to examine the fine structures in the fluffy part of the feather. If that part has been cut away, it's impossible to do the analysis.

Where to Send

Mail remains to:
Dr. Carla Dove
The Smithsonian Institution, Division of Birds
NHB E-610, MRC 116
10th & Constitution Ave., NW
Washington, DC 20560

The more feather evidence we have, the quicker we can do the identifications and with greater confidence.

Photo by TSgt Michael Featherston

LT GEN GORDON A. BLAKE AIRCRAFT SAVE AWARD 3RD QUARTER, CY00

MSGT JONATHAN GRAY
ATC OPERATIONS AND PROCEDURES ANALYST
AFFSA

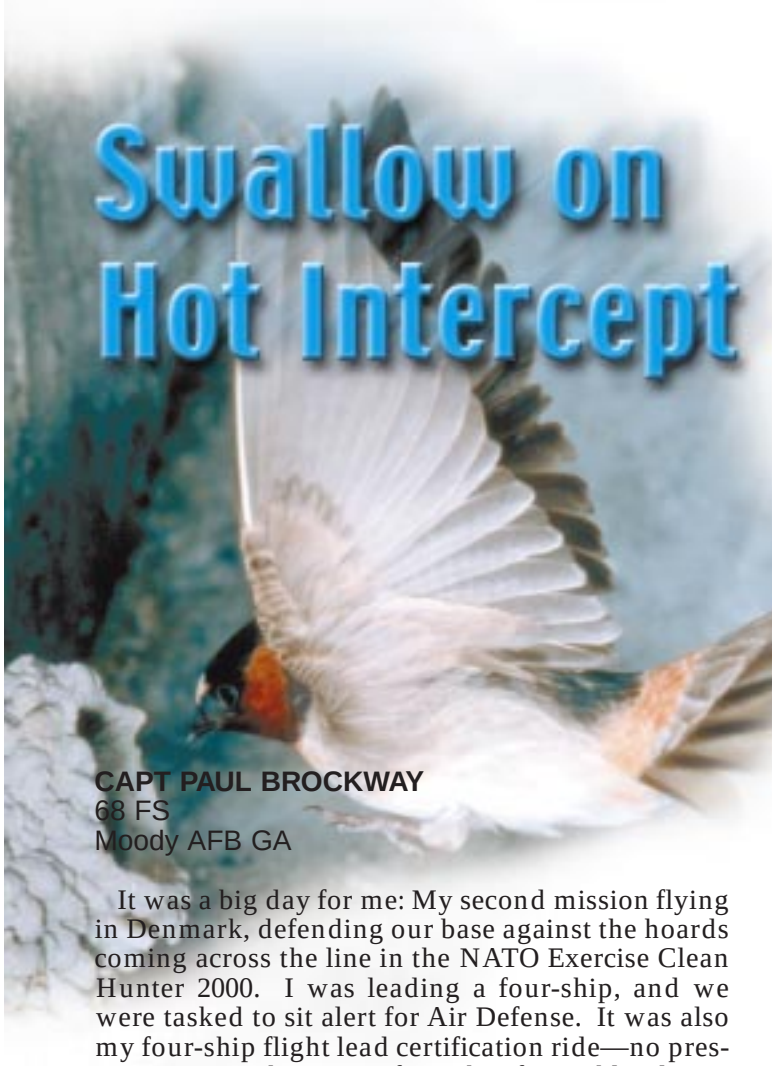
A1C Elke Ah Leong (RAPCON, Arrival Controller), 60th Operations Support Squadron, Travis AFB, California.

While working as Arrival Controller in Travis RAPCON, A1C Leong was controlling FRED 93, an H/C-5 departure remaining in the arrival pattern. She observed a pop-up primary radar target in FRED's 12 o'clock position and immediately issued an altitude restriction and traffic advisory to the crew, alerting them to the pop-up traffic. Her professional skill and accurate assessment of the radar environment ensured FRED 93 was able to react to the pop-up traffic and avoid conflict. Her quick reaction avoided a potentially hazardous situation and saved a $200 million asset.

SSgt Lance E. Davis (Tower, Local Controller), 14th Operations Support Squadron, Columbus AFB, Mississippi.

While working local control during wing recovery, SSgt Davis noticed SIRE 72, a T-37 on short final, recovering to the Runway Supervisory Unit (RSU) with its gear up. SSgt Davis immediately issued go-around instructions on "Guard" frequency, alerting SIRE 72 to execute a go-around. SSgt Davis' attention to detail avoided a potentially hazardous situation for a student pilot and a valuable trainer aircraft.

Swallow on Hot Intercept



CAPT PAUL BROCKWAY
68 FS
Moody AFB GA

It was a big day for me: My second mission flying in Denmark, defending our base against the hoards coming across the line in the NATO Exercise Clean Hunter 2000. I was leading a four-ship, and we were tasked to sit alert for Air Defense. It was also my four-ship flight lead certification ride—no pressure! From the start of my brief, my blood was pumping. I was looking forward to intercepting F-4s, F-15s, MiG-21s and MiG-29s. I ran through the rambling diatribe of "Motherhood," covering all required administrative aspects of the sortie, including all flight safety issues and how I would handle them as a flight lead that day.

With that all being said in about three breaths, I moved right into the exciting stuff—the air-to-air portion of the brief. As I was explaining my game plan, I pictured the aerial execution in my mind to mentally prepare myself for what was to come. My mind was focused, and the mission was all I could think about. We stepped out to the jets and got ourselves ready for the scramble call. As soon as I checked my flight in and called "On status," my mind was churning with thoughts of the weather, how I was going to get where I was going, who I needed to talk to, and how *not* to get violated.

Our squadron ops passed the alert order and my crew chief gave me the start engine signal. Four minutes later, I was taxiing my four-ship and we were ready to blast off! As we were preparing to take the runway, my mind was already in the CAP. All I could think about was killing MiGs! We got our clearance for takeoff, and I initiated the run-up for takeoff. I pushed up the power and checked my engine; everything was in the green. I checked my flight in on the departure frequency and they sounded pumped and ready to go.

I was psyched and couldn't wait anymore. I lit the blower and started down the runway. My engine looked good. I clicked off the nose wheel steering and got ready to rotate. Just as I began to rotate, I spotted a large European Swallow off to my left. It looked like he was running a pretty hot intercept on me. As I watched the swallow, I figured it would either abort the intercept or fly well in front of my aircraft. Either way, I never thought it would hit me. I thought to myself, "I wonder if I'm going to be able to tell if that bird hit me or not? I wonder if it will make a loud noise?" Then I heard an extremely loud "bang"! There was no question in my mind that I'd had a bird strike. I just didn't know the extent of the damage.

The TOLD for that day was such that my abort speed was pretty high, at least for what I was used to, so I knew I could go all the way past rotation and still be able to stop on the runway. I pulled the throttle back and got on the binders. I instinctively threw the hook down as a precaution. My only thoughts were to get the jet stopped and try to save the engine if I could. I stopped about 1500 feet before the departure end cable and let the tower know what was happening. I checked for any smoke or fire and shut the engine off to try to save it. The fire trucks arrived on the scene in no time and the emergency was over before I knew it.

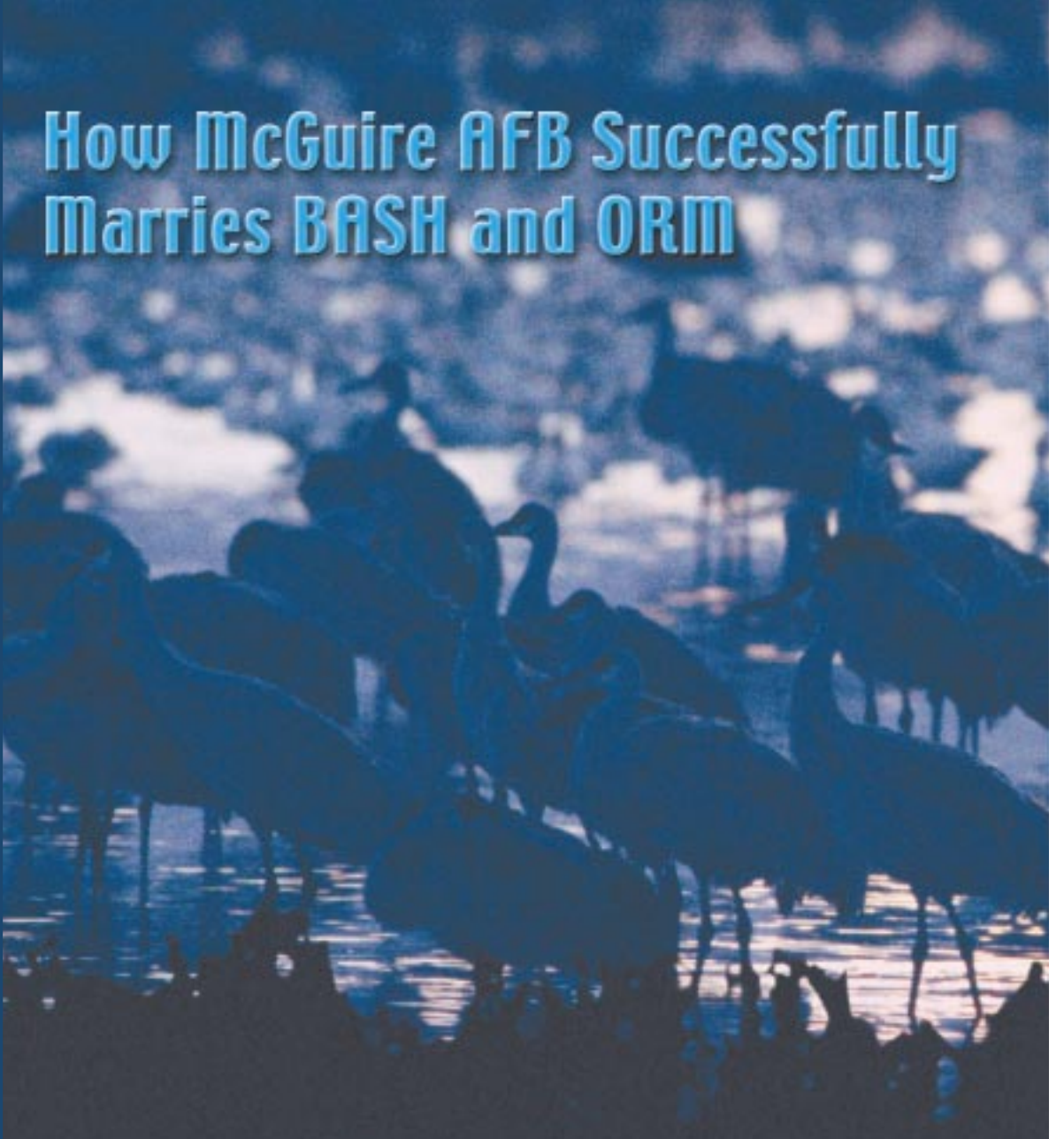
It turned out the bird had gone directly down the intake, and there was no structural damage to the jet. Our turbo maintainers checked the jet out, pulled the engine and replaced it with a spare. They put on two new tires and brakes as well. The jet was flying the very next day.

I was lucky in many ways with this strike. If the runway had been wet, or if I had taken the bird a few seconds later, things could have got messy. As a technique, I have rules of thumb for handling takeoff emergencies.

1. What are my speeds for the day (Rotate, Takeoff, Refusal)? I think of the max speed to abort for current configuration and runway conditions.
2. I review the "100-knot Rule" for a blown tire on takeoff (Blown tire above 100 knots; continue takeoff).
3. I imagine my aircraft at different speeds and consider the abort options I have at each speed (90 knots, 120 knots, 190 knots, cable or no cable).
4. I review the bird condition to determine what I can expect on takeoff.

These rules have kept me safe for some time. I review them after the brief and before I step to the jet, so that there is no hesitation in my actions. These rules of thumb, combined with a great deal of luck, saved the Air Force a weapons system—and a pilot—that day.

How McGuire AFB Successfully Marries BASH and ORM



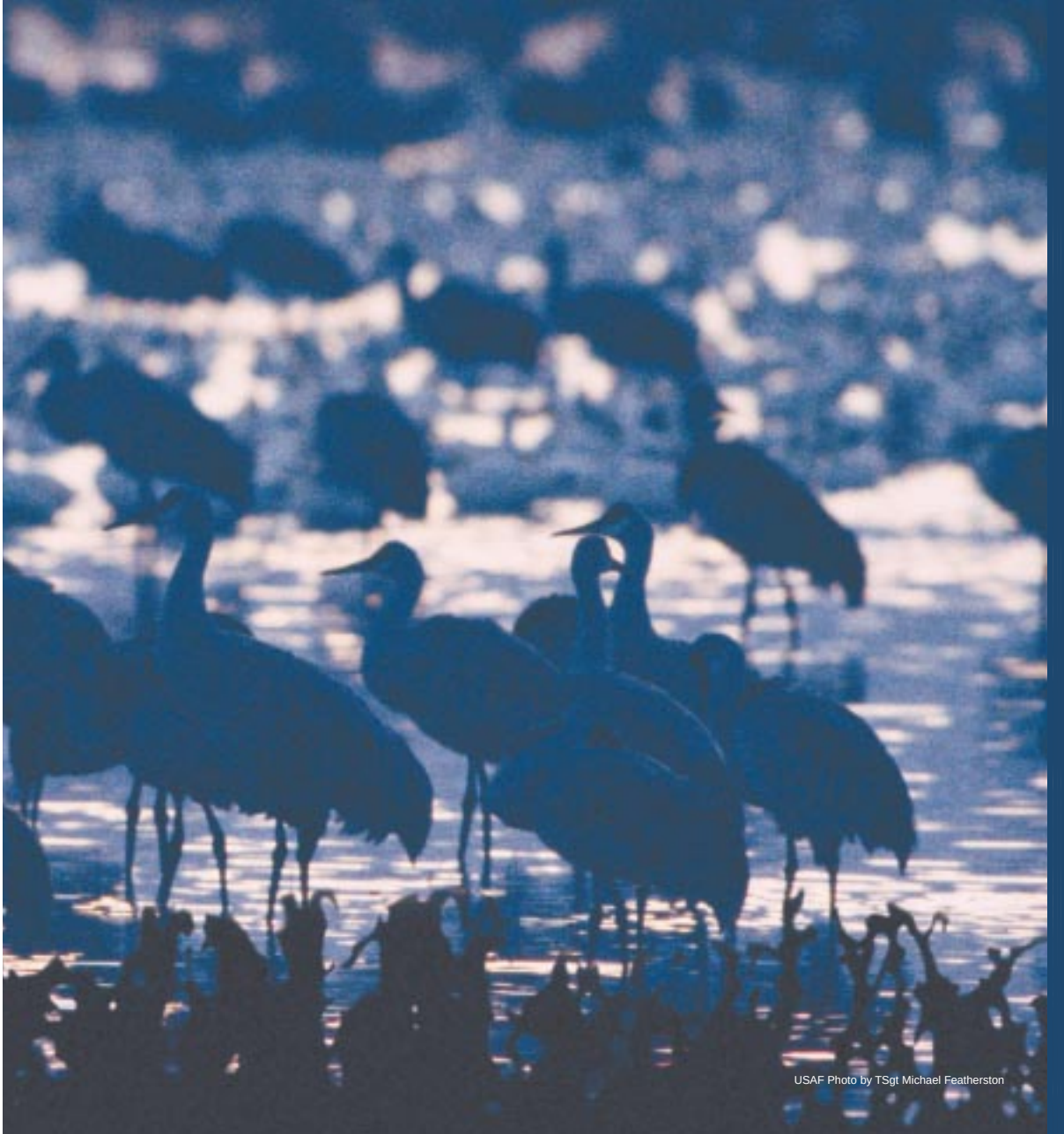
New Jersey and the McGuire AFB area are perfect stopping places for travel-weary migratory waterfowl.

CAPT MIKE SUNDSTED
305 AMW/SEF

Why do we place such emphasis on BASH and ORM at McGuire AFB? Besides recalling the lives lost in the E-3 that crashed as a result of striking several geese in 1995, McGuire's main reason comes from its location within the Atlantic Flyway. On one side of the state is the Delaware River; on the other, the Atlantic Ocean. The lower third of the state is a peninsula where the Delaware meets the Atlantic. Since waterfowl love water, New Jersey and the McGuire AFB area are perfect stopping places for travel-weary migratory waterfowl seeking rest and food on their way to a "winter cottage" in the south.

How can one mitigate the risk of geography and the natural avian instinct to fly south when it gets cold? We can't stop flying. However, McGuire AFB has successfully set the standard for BASH and ORM by applying AMC's Operational Risk Management (ORM) Process for Mission Planning and Execution and ensuring the process complies with the four guiding principles of ORM.

How do I get *birds* to understand ORM? I asked that question—or at least a similar one—when I accepted my position as Bird/Wildlife Aircraft Strike Hazard (BASH) Manager of a very successful program at McGuire AFB. When I arrived, we had an excellent BASH Program anchored by a birds-of-prey



USAF Photo by TSgt Michael Featherston

Here comes the "big picture" application of ORM to mitigating the risk of waterfowl strikes—don't fly when they are flying.

falconry contract team that spent almost 40 hours a week mitigating wildlife strike hazards on the flight line. This was McGuire's way of mitigating risk on a very large scale, and it was working! How could McGuire improve an already great program? Enter—Operational Risk Management.

Fortunately, the Air Force helped McGuire AFB out by emphasizing the use of ORM in its application of force. Through a basic application of ORM and a little technology, the 305th Air Mobility Wing continues to challenge operations commanders and crewmembers to rely on the four guiding principles of ORM (AFI 91-215, *Operational Risk Management (ORM) Guidelines and Tools*, 1 July 1998, p. 5, para. 4):

1. Accept no unnecessary risk.
2. Make risk decisions at the appropriate level.
3. Accept risk when benefits outweigh the costs.
4. Integrate ORM operations and planning at all levels.

McGuire's ORM program is centered on Air Mobility Command's (AMC) ORM Process for Mission Planning and Execution, a four-tier process. The levels of this process are:

1. Tanker Airlift Control Center
2. Wing Current Operations
3. Squadron Operations Officers / Schedulers
4. Aircraft Commanders.

A wing-level flight safety program can employ ORM through the last three tiers

continued on next page

to mitigate risk. This is where we first started to look at BASH as a target for ORM. Even though McGuire AFB had (and still has) an exceptional birds-of-prey program, it lacked an appropriate and much-needed ORM injection to BASH within the last three tiers.

Does this sound like it could get complicated? Not as long as one makes the effort to keep it simple! Let's take a trip back in time. The Air Force response to the E-3 crash at Elmendorf AFB was to ensure that bases instituted a BASH Program IAW AFPAM 91-212, *BASH Management Techniques*. The pamphlet provides guidance on active (pyrotechnics, bioacoustics, propane cannon, birds of prey and depredation) and passive (grass management, herbicides, growth retardants, controlling drainage, etc.) measures to manage the wildlife habitat around the airfield, as well as mitigate risks of bird strikes to aircraft. Another important restriction was to reduce flying during times of increased waterfowl migration (Phase II BASH window). How was safety supposed to inject ORM into BASH and focus on the most important part of AMC's Tier process (aircrews) while making the ORM guiding principles all-inclusive?

During increased waterfowl migration, crews flying low-level routes are limited to flying to a minimum of 1000 feet AGL during the daytime and 3000 feet AGL at night.

Fast forward to the year 2000! Notwithstanding the active and passive measures listed in AFPAM 91-212, McGuire AFB Wing Safety and the 305th Operations Group Standardization and Evaluation Office sought to work through AMC's four tiers to mitigate as much of the bird strike hazard as possible. We already knew the hazards (Canada and Snow Geese) and when they were most likely to be encountered. The waterfowl could be seen on neighboring Fort Dix and some McGuire AFB locations moving from their roosting areas to feeding areas and back during the hour before and after sunrise and sunset. All together, the total time for this process took a little less than two hours.

Here comes the "big picture" application of ORM to mitigating the risk of waterfowl strikes—don't fly when they are flying.

Tier One — TACC, transient and local crews are informed via NOTAM that McGuire AFB is closed during the periods +/- 1 hour from sunrise and sunset due to increased waterfowl activity. TACC limits taskings at McGuire AFB during these hours.

Tier Two — Current Operations limits scheduling flights during the periods +/- 1 hour from sunrise and sunset. Furthermore, Current Operations also highlights any increase in risk to the third tier with the initial mission assignment to the squadron.

Tier Three — Involves squadron Director of Operations (DO) and scheduler input. These individuals match the mission with the proper crews. If KC-10/C-141 Current Operations tasks a normal mission (i.e., a local sortie), the squadron scheduler accomplishes his risk assessment (RA) template. Most of the time, the RA comes out with an acceptable "low" number. If KC-10/C-141 Current Operations tasks one of the squadrons with a mission possessing "greater risk," the scheduler highlights the risk to the squadron Director of Operations. Between the DO and scheduler, an appropriately experienced crew is selected to mitigate the risk associated with that mission. When a mission is highlighted with greater-than-normal risk, the third tier matches experience to the associated risk.

Now for the most important tier—the aircraft commander (and aircrew)! Wing Safety and Operations Group Stan/Eval asked the question, "How could the aircrew be involved with risk management and BASH?" After all, aircrews aren't supposed to be flying during the peak periods. The aircrew is supposed to be the beneficiary of the BASH program, not the executor! We started with the AF Safety Center BASH site and noted that 96 percent of all reported bird strikes occurred at or below 3000 feet above ground level (AGL). We then targeted our crews who would be transiting below that altitude for extended periods of time during the BASH Phase II window. Take for instance a C-141B airdrop crew that takes off 1.1 hours before sunset, accomplishes a low level and arrives back at McGuire 1.1 hours after sunset. Even though the crew leaves the McGuire area before the hour preceding sunset and arrives back at McGuire an hour after sunset, it is still at the risk of migratory waterfowl because half its flight time is below 3000 feet AGL in a known waterfowl migratory corridor.

The 305 OG answer is to restrict crews

operating at low levels during the BASH window. During increased waterfowl migration, crews flying low-level routes are limited to flying to a minimum of 1000 feet AGL during the daytime and 3000 feet AGL at night. What about crews who transit areas outside of New Jersey, let's say in another state? What if an airfield in that state has no BASH window or BASH Program? What about when waterfowl migration has occurred and the Phase II program has ended for the year? How do these crews mitigate risk? Here is where McGuire utilizes a little technology to assist in mitigating risks.

The AF Safety Center BASH Web site contains a historical Bird Avoidance Model with nine levels of hazard identification. The hazards are listed from Low 1 to High 3. The 305 OG limits aircrews from operating below 3000 feet AGL outside McGuire's terminal area when the Bird Avoidance Model located on the Web site is "Moderate 3" or greater (with 305 OG/CC as the waiver authority).

Tier Four — Aircraft Commanders (and aircrew) check the Bird Avoidance Models during mission planning. If the area of flight is listed as "Moderate 3" bird activity (Phase II or Phase I) or greater, the aircrew must either change the routing if below 3000 feet AGL, fly the low-level route at 3000 feet AGL at night (1,000 feet AGL during the day), or apply for a 305 OG/CC waiver to fly below 3000 feet during "Moderate 3" or greater. Furthermore, the aircrews fill out the ORM Risk Assessment worksheets prior to departure. A Severe or Moderate Bird Hazard Condition (BHC) can be a showstopper for departures and arrivals, as well as on a low-level route. ORM at its best—simple and quick.

Let's give it a litmus test on the four guiding principles of ORM.

• First, accept no unnecessary risk. McGuire's BASH Phase II window of limited flying and low-level altitude restrictions cover principle number one!

• Second, make risk decisions at the appropriate level. The Operations Group Commander is the waiver authority for missions that fall within the BASH Phase II window or during flights that may encounter "Moderate 3" or greater bird activity on the historical AF Bird Avoidance Model.

• Third, accept risks when the benefits outweigh the costs. At McGuire, the Operations Group Commander determines the benefit of the sortie versus the probability of a bird strike based on local historical data, observations from tower, and our Falcon Team. Once the sortie is deemed as a "benefit," the OG/CC grants a waiver if the approach/arrival corridors are clear and the Bird Watch Condition (BWC) is low. Finally, integrate ORM operations and planning at all levels. Current Operations and TACC limit air traffic during known periods of migration. Squadron schedulers and DOs match experienced crews to the "greater risk" missions.

• Fourth, aircraft commanders and their crews highlight risks of wildlife strikes (as well as any other pertinent risk) to the crew, squadron DO, and OG/CC if necessary. The OG/CC (if needed) ensures the benefits of the sortie outweigh the risks, and then grants a waiver. Whether the hazards are highlighted by tier one, two, three or four, the bottom line is that the hazards (in this case, migratory waterfowl) are being identified, discussed and ultimately reduced.

Although McGuire AFB has successfully married ORM and BASH, 305 AMW Safety is still on the move to improve! There is still technology out there we are pursuing, such as bird avoidance radar. Prior to flying, our crews receive the most current bird avoidance information using the Avian Hazard Advisory System (AHAS). Once an alternate low-level route has been constructed during mission planning based on BAM bird hazard predictions, the route is rarely changed on the day of departure even if AHAS shows the risk level to be low. In cases where AHAS indicates the risk level is severe, we either alter our route to areas of low risk or we fly above 3000 feet AGL.

Through feedback from crews and commanders alike, McGuire AFB will continue to improve its BASH program and maintain its benchmark! Fly safely!

Prior to flying, our crews receive the most current bird avoidance information using the Avian Hazard Advisory System (AHAS).

3rd Joint Annual Meeting of Bird Strike Committee USA/Canada

August 27-30, 2001
Calgary, Alberta

Bird Strike 2001 Meeting Information History

This will be the third combined meeting of Bird Strike Committee Canada and Bird Strike Committee USA. Previous separate meetings of the two organizations have occurred over the last decade throughout the U.S. and Canada. The first combined meeting was held in Vancouver, BC in May 1999 and the second at Minneapolis/St. Paul International Airport (MSP) in August 2000.

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 to aircraft! For further information, contact Carol Liber of Pacific Northwest Planners at (604) 276-7471, fax (604) 276-9142 or email at pnwp@netcom.ca

Program

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

Call for Presenters

Presenters will be selected based on the quality of work or research related to biological, engineering, environmental, training or policy issues associated with wildlife, aircraft and airports.

Guidelines

Deadline for Submission: April 2, 2001
Notification of Acceptance: May 2, 2001
Please note: Upon receipt of acceptance, papers will be due by June 15, 2001. Papers are not to exceed 12 pages, single-sided, single-spaced, at 10-point font. Papers must be in electronic format in an MSWord doc or textfile. FYI: Conference proceedings will be produced and handed out to delegates at the conference.
Proposals must include the following:

1. Session Title (maximum 10 words)
2. Presenter's Name, Address, Phone, Fax and Email
3. Abstract (maximum 200 words)
4. Presenter's Bio (maximum 35 words)

Presenter Proposals should be forwarded to:

Bruce MacKinnon
Transport Canada, Safety & Security
Aerodrome Safety Branch
330 Sparks Street, Place de Ville,
Tower C
Ottawa, ON, CANADA K1A 0N8
Tel: (613) 990-0515
Fax: (613) 990-0508
Email: mackinb@tc.gc.ca

Exhibits

The program will include vendor exhibits featuring the latest in bird and mammal damage control technologies. Companies interested in participating should contact Carol Liber at Pacific Northwest Planners at (604) 276-7471.

Agenda Highlights

Sunday, August 26, 2001
Registration
Optional Tours
Calgary City tour
Columbia Icefield Tour

Monday, August 27, 2001
Registration
Keynote Address
Technical Sessions
Evening Reception

Tuesday, August 28, 2001
Optional Banff Wildlife Field Trip

Wednesday, August 29, 2001
Military-FAA Training Session
Technical Sessions

Thursday, August 30, 2001
Military-FAA Training Session
Technical sessions
Panel Session
Closing

Friday, August 31, 2001
Optional Calgary Airport Field Trip

Registration

Early Bird (if paid by 1 June 2001)
$275 CAD, $215 USD
Regular (if paid after 1 June 2001)
$325 CAD, $250 USD
Payment method—Money order, Visa, bank draft/check, Mastercard (credit cards are transacted in Canadian dollars)

Hotel Reservations

Must be made by July 25, 2001 to guarantee availability.

The Westin Calgary
320 Fourth Avenue, SW
Calgary, Alberta
(403) 266-1611; fax (403) 508-5240

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

"ALL EMPLOYEES MUST WASH THEIR HANDS..."

If you've worked around aircraft for more than a day or two, it's a safe bet that you, or someone you know, has come in contact with aircraft fuels. On the other hand, if you, or someone you know, hasn't come in contact with aircraft fuels, odds are pretty good that sooner or later, it will happen. Will you know what actions to take when it does?

AFOSHSTD 91-38, *Hydrocarbon Fuels—General*, (dated 1 Sep 97), is a good starting place for answers. AFOSHSTD 91-38 contains a wealth of information on hydrocarbon fuels—like JP-8—that's informative and useful. Paragraph 2.8, entitled "First Aid," directs specific actions to be taken if hydrocarbon fuels get on you or your clothing. This same AFOSH Standard includes a "Safety Guide for Hydrocarbon Fuels" as Attachment 3, which provides a short overview of hazards, safety precautions and first aid steps. Good stuff.

Here's the important thing to remember about splashed/spilled fuel, though: Because contact with hydrocarbon fuels causes skin irritation, you should *always* minimize the amount of time it stays in contact with your skin. From AFOSHSTD 91-38, here are the common-sense steps you/your troops should always take to protect yourself when working around aircraft fuels:

- If fuel gets in the eyes, immediately flush them with water for 15 minutes. Get medical attention as soon as possible.
- If fuel is swallowed, *do not* induce vomiting. Get medical attention as soon as possible.
- If splashed with fuel, thoroughly wash the affected skin with soap and water as soon as possible.
- Remove fuel-contaminated clothing, gloves or other items of personnel apparel as soon as possible and wash affected skin with soap and water.
- Thoroughly air out and then launder fuel-contaminated clothing before wearing it again. *Do not* place contaminated clothing in lockers or other confined spaces and *do not* hang contaminated clothing near sources of fire or heat. After thorough laundering, *allow clothing to air dry*.

SHORT BURSTS: PERSONAL INJURIES

- A couple of "Can Do" Maintainers were tasked to start some major maintenance on one of their aircraft. The heavy maintenance required accessing areas above ground level and, therefore, a maintenance stand, but none were immediately available. Eager to expedite the work and return the aircraft to action, they decided non-availability of "standage" wasn't going to slow them down, so... One of the troops clasped his hands together to form a step for his bud to use as a stepping point. Soon after stepping up to use the "human ladder," the Maintainer doing the "stepping," lost his balance and fell backward. Result? Treatment for an injured back, assorted bumps and bruises and a

short stay in the hospital for observation.

• A Maintainer was engaged in some off-duty R&R at a club off-base. Don't know if he had been partaking in any of the available alcoholic beverages or not, but we do know that he tumbled down several concrete steps to street level while departing the establishment. Fortunately (?), his nose broke his fall. The outcome: A concussion, a broken nose and an opportunity to enjoy the heretofore-unsampled cuisine at his local hospital.

• A Maintainer was doing some on-equipment maintenance and tightening a coupling using a long breaker bar for leverage. When it slipped, he slipped and fell into the equipment, breaking his nose.

• A Maintainer doing solo duty checking intakes on a heavy was pushing his maintenance stand from one engine to the next. He had completed one intake and was pushing the stand from the "inside"—that is, from under the stand platform—when "it" happened. "It" was the sound of a bone in his foot breaking as a stand cross-brace ran over the back of one of his feet…

• Talk about a productive FOD walk! This troop found a piece of debris weighing upwards of 60 pounds! Regrettably, while his FOD find likely prevented damage to aircraft or vehicles, lifting and carrying all that weight didn't prevent damage to his back.

• It was a max effort flying schedule and the Maintainer had been "stranded" on the flight line for an extended period, launching, recovering and thru-flighting aircraft. He finally got a couple minutes to excuse himself from the line and was making a beeline for his work center when—either because his hearing protection was doing a magnificent job of masking noise, or the urgency of the moment caused him to lose situational awareness—he walked a couple feet behind a jet with running engines before realizing it. He did, however, realize the aircraft's engines were running once the jet blast blew the ear defenders from his head. Luckily for this troop, other than a terrifying scare and a free pass to the hospital, the price for this lesson learned was relatively inexpensive.

• A couple of sheet metal Maintainers were doing some on-equipment work. It was hot that day, so they had a fan blowing their direction for cooling. Alas, the artificial breeze keeping them cool also carried a lightweight particle of debris into the eye of a nearby Maintainer, causing serious damage to one of his eyes.

• A Maintainer was airing up a split-rim tire assembly which just had its inner tube replaced. Since the split-rim assembly was held together by just a few lugs with loosely threaded nuts, it—you guessed it—exploded once enough air pressure was applied. Providentially, ballistic paths taken by various pieces of the fractured tire assembly were such that this lucky Maintainer suffered only "minor" injuries.


USAF Photo by TSgt Michael Featherston

• An on-equipment Maintainer doing some troubleshooting had to place himself in an awkward, cramped position. During the course of working the problem, he accidentally bumped the back of his head. If you've ever worked in tight quarters, you know that when you bump your head, it's reflexive to move your head—immediately—in the opposite direction. Which he did. And promptly hit something sharp with the front of his head, necessitating a trip to the hospital, stitches and limited duty.

• This Maintainer was preflighting his "heavy." One minute he's examining stuff on top of a damp wing—within the designated walkway—and the next minute he's scrambling to find purchase on the slick surface like a cat with no claws. He fell some considerable distance to the ramp and did his best imitation of a PLF (parachute landing fall) upon impact, but still suffered a back injury. Happily, the injury was minor and he made a full recovery, more cautious still in the ways of walking on slick surfaces in high places…

• Two Maintainers were dispatched to perform an op check that required motoring an engine. Everything was fine up to the point where Maintainer # 1 in the cockpit motored the engine and observed it stabilizing above 20 percent. As with many aircraft, rotating engines cause hydraulic systems to pressurize and primary flight control surfaces to drive to the "neutral" position. Which they did in this case. Maintainer # 2 was undoubtedly shocked to realize he had inadvertently placed his hand in the path of one of these moving flight control surfaces. As with all the other Maintainers mentioned here though, his injuries were painful, but not permanently disabling. ✈

FY01 Flight Mishaps (Oct 00 - Feb 01)

7 Class A Mishaps
1 Fatality
7 Aircraft Destroyed

FY00 Flight Mishaps (Oct 99 - Feb 00)

8 Class A Mishaps
4 Fatalities
5 Aircraft Destroyed

04 Oct	♣✶	An RQ-1 Predator UAV crashed while on a routine test mission.
12 Oct	♣	An F-16C crashed during a routine training mission.
23 Oct	♣✶	An RQ-1 Predator UAV went into an uncommanded descent.
03 Nov		An F-15C experienced engine problems on takeoff. The pilot successfully RTB'd. Both engines sustained damage from FOD.
13 Nov	♣♣	There was a midair collision between two F-16CJs. Only one pilot was recovered safely.
16 Nov	♣	An F-16CG on a routine training mission was involved in a midair collision.
06 Dec	♣	A T-38A impacted the ground while on a training mission.
14 Dec	♣	An F-16C crashed shortly after departure.
11 Jan	♣	An A-10A crashed short of the runway.

- 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 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, ground, and weapons safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/statspage.html
- **Current as of 27 Feb 01.**

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THE Well Done AWARD

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

CAPTAIN JAMES C. HARWOOD

20 SOS, 16 SOW
Hurlburt Field FL

Captain James C. Harwood demonstrated superior airmanship and flying skill in safely recovering his MH-53M after experiencing engine failure and radar malfunctions at a high gross weight, during night, IMC in mountainous terrain on a CSAR mission.

On 28 March 1999, Capt Harwood and his MH-53M crew were part of a three-ship formation performing a Combat Search and Rescue mission in support of NATO operation ALLIED force.

At approximately 0130 local time, the crew attempted to penetrate a cloud deck behind flight lead in order to avoid mountainous terrain in Bosnia-Herzegovina. The mountain tops in the area are over 7000 feet high and were obscured by the clouds, which extended from 4000 to 9000 feet. Further, icing conditions were present.

During the climb through 8000 feet MSL in IMC, the crew heard a loud bang from the right side of the aircraft, and the flight engineer reported flames and sparks from the number two engine.

Capt Harwood immediately directed the boldface emergency procedure for single engine failure, and began a return to the base they had just departed. Capt Harwood decelerated to 80 knots indicated (best single engine speed as per the technical order) and tried to maintain level flight with the remaining functional engine.

The aircraft weighed 47,000 pounds, 1000 pounds above normal peacetime maximum gross weight. This and the high altitude necessitated an extremely high torque setting on the remaining engine. To avoid an impact with the terrain and facilitate a safe recovery, Capt Harwood utilized the increased situational awareness provided by the MH-53M color Multi-Function Display and the Terrain Following/Terrain Avoidance Radar. Capt Harwood descended out of the icing conditions and threaded his crippled aircraft through mountainous terrain while IMC.

At approximately 17 miles from the base, the radar presentation was lost while they were still in mountainous terrain and IMC, so the crew used the digital map display to navigate the pilot to within seven miles of their destination. Capt Harwood flew the instrument approach down to the minimum approach altitude and landed the aircraft successfully by using a standard single-engine approach profile.

Faced with an aircraft emergency, extremely poor weather, icing, high gross weight operations, no operable radar and a lack of visibility, Capt Harwood and crew continued to perform their duties flawlessly. This demonstration of superb aircrew coordination in the face of dire circumstances saved the lives of six aircrew and nine Special Forces team members, and also a national asset to be flown another day.

ATTENTION MAINTAINERS!

Flying Safety magazine (FSM) isn't just for aviators—it's your magazine, too! We're looking to August 2001 to publish the annual "Maintenance and Maintainers" issue and solicit your inputs.

All maintenance-related articles and anecdotes are welcome, so if you've been thinking about sending one our way, now's the time to do so. Please keep the following guidelines in mind:

- "There I Was…" articles are particularly effective at conveying a "Work Safe, Be Safe" message. Sharing your misfortune is often a great way to help fellow Maintainers avoid the same pitfalls. We can run your story as "Anonymous," if requested.
- "Best Practices" oriented articles—focused on, for example, your base's Crash Recovery Program—are great, particularly if other units could use the information to strengthen their programs.
- Additionally, stories that provide background, or look ahead to the future—such as "Aircraft Maintenance Training Today and You," in the August 1999 issue—are great ways to keep the field informed and help others understand *why* a particular program is changing.
- Factual, informative, useful information is a perfect fit—see the "Maintenance Close-Up: The RQ-1A Predator System" article, from August 2000. But please remember FSM isn't intended to be a substitute for tech data or other directive information.
- FSM won't publish classified or sensitive information, nor can it be used as a forum to express personal disagreement with official policy.
- If you wouldn't want to read your own story, then it's a sure bet that others wouldn't either. Remember to write for *the reader*—keep it interesting!

Please feel free to e-mail or call us (contact information is on the inside cover) if you'd like to discuss a potential article. Likewise, you may submit your story using e-mail or fax. Please do so NLT the first week in May to meet publishing deadlines. All contributors will receive their choice of either the coveted *Flying Safety* magazine-logo'd coffee mug or mouse pad!

USAF Photo by TSgt Michael Featherston