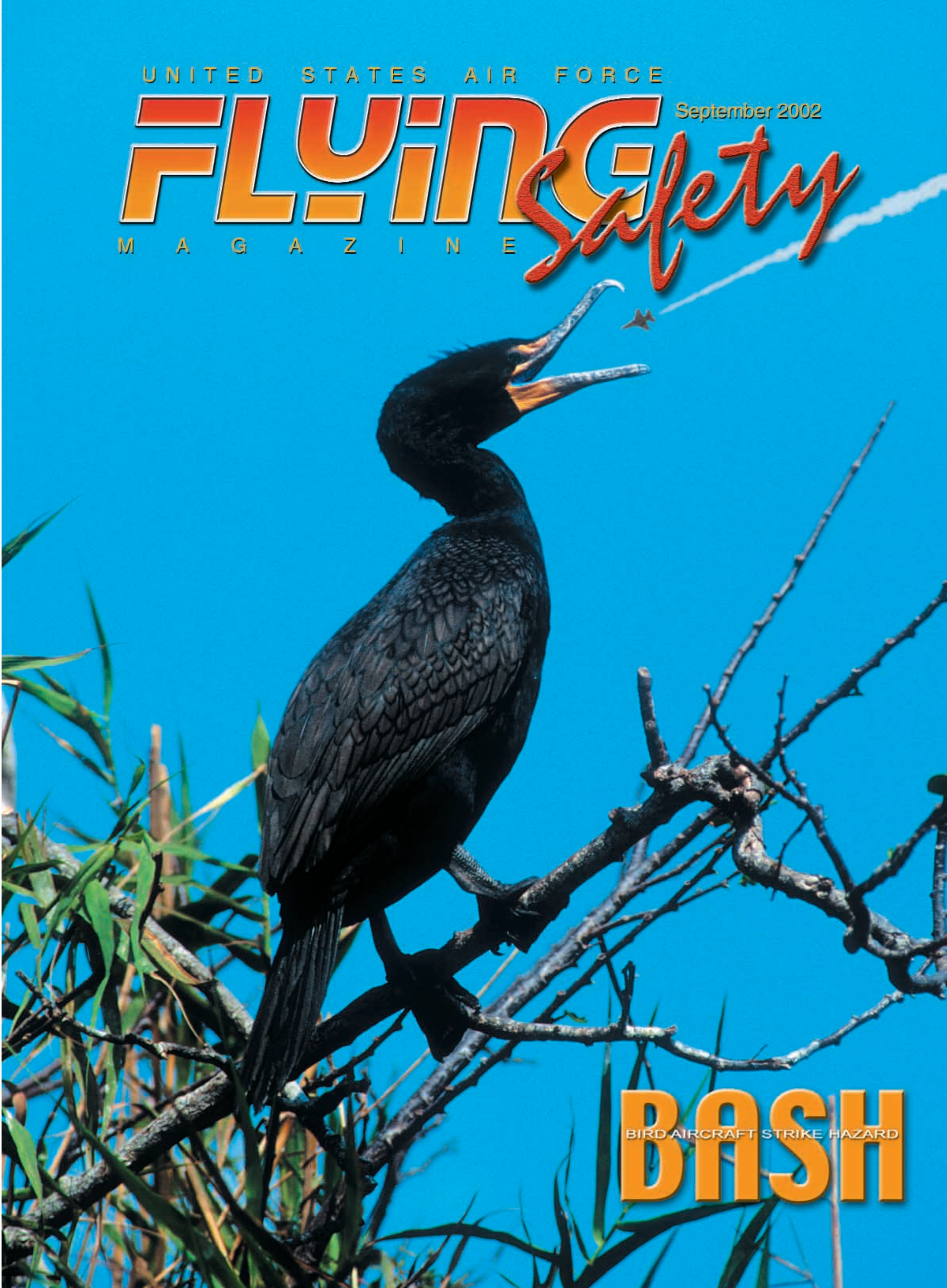
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September 2002
BASH
BIRD AIRCRAFT STRIKE HAZARD

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UNITED STATES AIR FORCE

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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.

FSM notams

GOT FEEDBACK?

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

Do you have:

Questions about flight, ground or weapons safety?

Feedback on FSM and how well we're doing?

Complaints on FSM and what we're doing wrong?

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

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

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

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

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

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

Or you can **e-mail** the Safety Sage at: safety.sage@kafb.saia.af.mil

Or you can **phone** DSN 246-0950 or (505) 846-0950

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We're looking forward to hearing from you.

Managing Birdstrike Risk with The Avian Hazard Advisory System

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

T. ADAM KELLY
AHAS Project Manager, Avian Research Laboratory

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

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

Military aviators know and understand risks. Combat is an inherently risky undertaking. The United States military goes to extraordinary lengths to load the odds in the favor of our personnel over those of a potential adversary. We are not as accepting of bad odds in combat as it may seem at first glance. Overwhelming power, beyond-visual-range-detection, AWACS and other reconnaissance resources, stealth, electronic warfare and a host of other hardware and tactics are all designed to stack the odds in favor of our military forces. When something goes wrong, we have ejection seats and rescue forces to ensure that our aircrews do not pay for the risks with their lives.

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

What is the US BAM?

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

What is AHAS?

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

What's the probability of birdstrike?

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

continued on next page

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

AHAS and the US BAM provide a consistent measure-ment of birdstrike risk across the CONUS.

AHAS does not provide recommendations for managing birdstrike risks

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

What are the risk management options during increased bird activity?

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

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

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

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

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

Having a comprehensive BASH plan is a good first step, but it must be implemented and used by aircrews in all day-to-day training missions. To go back to risk and human behavior, we generally avoid areas we know will be congested during rush hour. Similarly, we should avoid the "rush hour" when many birds are active. In general terms, this is the migratory season, and when birds move from roosting to feeding grounds on a daily basis. The best tools to understand when this occurs are the US BAM for long range planning and AHAS for near-real-time assessments of bird activity aloft.

What is the future for AHAS and Birdstrike Risk Management?

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

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

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

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

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

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