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**FEATHER IDENTIFICATION AND A NEW ELECTRONIC SYSTEM FOR REPORTING  
US AIR FORCE BIRD STRIKES**

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**Abstract**

The number of bird strike cases received from U.S. Air Force bases for identification has increased from 640 in 1996 to more than 840 in 1998. The additional workload, together with staff shortages on the BASH team, created a need for a more efficient reporting system. Previously, all bird strike remains were funneled through the Safety Center at Kirtland Air Force Base where they were logged into a database, forwarded to the Smithsonian Institution for identification, and then sent back to Kirtland for data entry of results before being returned to field personnel. This system facilitated a bottleneck in the turnaround time for identification results.

Bird strike remains are now sent directly to the Smithsonian, an electronic bird strike form is submitted from Safety Offices via email, and the identification results are forwarded directly to the base. This new system significantly decreases data-entry efforts, return time of results, and provides a more accurate and consistent database.

The feather identification process is discussed in conjunction with instructions and tips for using the new electronic reporting system.

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### **Introduction**

The need for a more efficient way of receiving bird strike remains, as well as reporting and providing results to U. S. Air Force bases has been evident for many years. In the past, bird strike remains were sent from Air Force bases to the Safety Center at Kirtland Air Force Base. The reports were standardized and entered into a database, the feathers were associated with the reports and then sent to the Smithsonian Institution for identification. After the feather remains were identified, the reports were mailed back to Kirtland and the species names and weights were added to the database. The reports were then mailed back to the base of origin. This system was adequate for many years because the number of bird strike cases with remains was manageable, and BASH team personnel were available to manage the database and organize the feather identification program. Last year (1998), over 840 bird strike cases were identified from feather remains. In addition, the BASH team experienced an increase in workload and travel requirements. These circumstances made an overhaul of the feather reporting system a top priority.

This paper describes the bird strike feather identification procedure from the time the feathers are collected until the results are returned to the base. The new electronic reporting system (designed by Lt. Curt Burney) is introduced, and recommendations for proper feather collection and reporting are addressed.

### **Collecting Feather Samples**

Bird Strike remains include whole feathers, feather fragments, bones, talons, beaks, or any other biological material that is collected from the aircraft after a strike occurs. Often, only tiny bits and pieces of feather fragments, which are barely visible to the naked eye, are available for analysis. Sometimes, these fragments are collected by swiping the aircraft part with damp paper towels, or by picking off the small fragments with forceps. Feathers can also be collected from birds that are found on the airfield or runway. If a whole bird is found and it is not convenient to send the whole carcass, the best rule is to use common sense and collect a large number of feathers that have diagnostic characteristics such as size, color, or patterns. Many times bird strike reports indicate that the whole carcass was found on the runway and yet only a single small, brown feather is included with the report. Whatever the case, it is important to remember to collect as much of the material as is possible. Feather identification relies on matching fragmentary evidence to reference collections of museum specimens and microslides of known species - therefore, the more evidence that is available, the quicker the identifications can be done.

The best way to send feathers is to place the sample in a zip-lock bag and attach it to the report. If the sample is extremely small, it is best to place it in a folded piece of white paper and then seal it in a zip-lock bag so it is easier to locate.

Feather remains are generally received in large enough quantities and in good enough condition to make identifications possible. However, there are a few situations that hamper the identification process:

- Never use Scotch™ tape to collect or send feathers - barbs get stuck in the adhesive and are difficult or impossible to remove.
- Never cut feathers from the bird's body or cut the tips away from the whole feather - sometimes it is necessary to examine the fine structures in the fluffy part of the feather. If that part has been cut away, it can be impossible to do the analysis.
- Never use post-its in direct contact with feathers - feathers get stuck in the glued edge and are damaged when removed.

### **Sending Feathers to the Smithsonian Institution**

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After feather remains are collected and turned in to the base Safety Office, the report detailing the strike is entered into the Access™ database/reporting program that is now available for downloading from the BASH website

[http://www-afsc.saia.af.mil/AFSC/BASH/report\\_wmenu.html](http://www-afsc.saia.af.mil/AFSC/BASH/report_wmenu.html). Safety Offices e-mail bird strike reports as an attached Excel™ spreadsheet directly to Carla Dove at [dove.carla@nsmnh.si.edu](mailto:dove.carla@nsmnh.si.edu). Information and questions concerning the new electronic system can also be obtained by contacting Curt Burney at AFSC, DSN 246-5673 or e-mail [burneyc@kafb.saia.af.mil](mailto:burneyc@kafb.saia.af.mil). After the Excel™ spreadsheet is received at the Smithsonian via e-mail, it is simply copied to the Access Feather Report Form. When the feathers arrive, they are matched with the information that was received via email (i.e., date, base location, damage amount, tail number). When the identification is completed, the database is updated and the information is sent to the specific base.

### Filling out the Form

Some common misinterpretations or data entry errors that have been noticed on the new form include:

Time: The time that should be recorded is the actual time that the strike occurred, not the time the feathers were found, or the time that it was discovered that the aircraft suffered a bird strike.

Cost: If the cost of damages changes, or is realized later, please let BASH know so that we can update our records. Oftentimes the damage is not immediately known, or is grossly estimated. We are striving to maintain a more accurate database and this information is vital.

Tail Number: This number should include the two-digit year number followed by a dash and a four digit number (i.e., 94-0024). Many times only the last four digits are reported.

Telephone Number: The Smithsonian does not have a DSN connection so please include a commercial telephone number.

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Figure 1. Topography of a contour feather (from Laybourne et al. 1994)

Feather identification relies on the use of museum collections of specimens, and on the expertise of specialists to do microscopic analysis to positively identify species of birds from fragmentary evidence. Summarizations of the BASH database show that more than 97% of the identifications are done using either whole feather characters, or a combination of whole feather fragments and analysis of the microscopic characters in the plumulaceous barbs (figure 1). Only the most diagnostic

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species (i.e., swift, doves, robin) can be accurately identified by using the microscopic characters alone, and sometimes these identifications rely on single representatives of that species living in certain geographic areas. It is therefore of utmost importance to provide as much feather evidence as possible.

The first step in feather identification involves cleaning feathers. Methods developed by Laybourne and Dove (1994) and Sabo and Laybourne (1994) are used for bird strike analysis. Feathers are first washed in hot, soapy water to clean and allow the feather to return to a natural shape. Drying is done with compressed air alone, or by blowing compressed air through a mesh strainer inverted over the feathers. Care is taken during washing to remove tissue and other large pieces of debris that may get tangled in feather barbs. The washing time is dependent on the condition of the sample and can take anywhere from fifteen minutes to many hours.

After the feathers are cleaned, they are examined for diagnostic characters of size, color, pattern, and texture. If the sample is not diagnostic or if the remains are minute, microscopic analysis is used to provide possible clues to the group of birds (i.e. waterfowl, passerine, gull).

Feather identification using microscopic characters follows the original work of Chandler (1916). Variation in microscopic characters of downy barbules has more recently been quantified in studies by Robertson et al. (1984), Horton (1990), Brom (1991), and Dove (1997, 1999). Additionally, many other studies have described qualitative differences in microscopic variation of feather characters among many groups of birds. However, feathers are known to show variation according to the part of the body or feather tract from which they come (Gilroy 1987), and barbs are known to vary according to the plumulaceous region of the feather (Dove, 1997). Therefore, it is important to know the type of feather (i.e. body, wing, tail, flank) that is being examined as well as the variation that exists in the microscopic structures of the downy barbules. This identification technique is complex because it is impossible to document the variation in every feather (macro- and microscopically) of every bird that is involved in bird strikes. However, generalizations can be made of some feather characters in some groups of birds and can provide a 'road map' for identifying feathers. Oftentimes, the simple "process of elimination" is used in the initial identification stages to "weed out" unlikely species. However, extreme caution must be used in any identification because the results of a recent phylogenetic study shows that some microscopic feather characters are convergent (Dove, 1999). Convergence means that some unrelated species have evolved similar feather characters due to such factors as environmental influences. Hence, species may have similar looking feather structures but could actually represent completely different orders or birds. Other groups need to be studied to determine the degree of homoplasy in feather structures.

## **Conclusions**

The new electronic reporting system has tremendously facilitated the efficiency of bird strike reporting. It has significantly decreased the turnaround time of identification results, and lessened the amount of data entry time required for each incident. This system represents a model program for the identification of bird strike remains.

Bird strikes are usually identified by matching the whole feather characters with examples of museum specimens, and/or using the microscopic characteristics of the down. This is the most efficient, economical, and practical method at this time.

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