COMMANDER NAVY INSTALLATIONS COMMAND

BIRD/ANIMAL AIRCRAFT STRIKE HAZARD (BASH) MANUAL

Published By
CNIC Airfield Operations Program Director

FOREWORD

This Bird/Animal Aircraft Strike Hazard (BASH) Manual is a non-binding addendum to the CNIC, "Navy Bird/Animal Aircraft Strike Hazard (BASH) Program Implementing Guidance" (CNICINST 3750.1). The contents herein present additional recommended guidance, procedures, and instructional material to serve as an aid to CNIC shore aviation commands in development and implementation of a successful BASH Program. The contents of this manual were compiled by CNIC Air Operations Program from historical data, from inputs by Navy BASH Subject Matter Experts, from reviews by major Naval Aviation stakeholders, and from comparison with existing BASH Programs at other agencies including the US Air Force.

This Manual, though primarily focused on improving BASH effectiveness at CNIC shore commands, is open for review by any command, in or outside of the Navy, desiring to mitigate BASH risks at shore air facilities.

This Manual will be maintained and periodically updated by CNIC Air Operations Program Director. It can be accessed through the Naval Safety Center portal, Airfield Operations tab, at: http://www.public.navy.mil/NAVSAFECEN/Pages/aviation/AirfieldOperations.aspx

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INTERIM CHANGE SUMMARY

INTERIM CHANGE NUMBER(S)	EFFECTIVE DATE	REMARKS/PURPOSE
18-1	1 OCT 18	Adds this interim change page. Modifies APPENDIX 6 to clarify the type and purpose of an SOP.
19-1	1 JUN 19	Modifies APPENDIX 6 by removing the term “SOP” and simplifying the format.

INTERIM CHANGE NUMBER(S)	AFFECTED PAGES
18-1	Index page numbers and APPENDIX 6, page 6-3
19-1	APPENDIX 6, all.

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ABBREVIATIONS AND ACRONYMS

AA&E.	Arms, ammunition and equipment
AFM.	Airfield manager
AGL.	Above ground level
AIR OPSO.	Air operations officer
ASAP.	Aviation Safety Awareness Program
ASO.	Aviation safety officer
ATIS.	Automatic terminal information service
AVOC.	Airfield vehicle operator's course
BGEPA.	Bald and Golden Eagle Protection Act
CAC.	Common access card
CAPA.	Cartouche Anti Peril Aviaire (bird hazard pyrotechnic cartridge)
CECOS.	US Navy Civil Engineer Corps Officer School
CNIC.	Commander, Navy Installations Command
DNA.	Deoxyribonucleic acid
ESA.	Endangered Species Act
ERDC.	US Army Environmental Research and Development Center
FAA.	Federal Aviation Administration
FAR.	Federal Aviation Regulations
FIL.	Smithsonian Feather Identification Laboratory
FOD.	Foreign Object Damage
HAZREP.	Hazard report
IFR.	Instrument flight rules
INRMP.	Integrated natural resources management plan
IPMP.	Integrated pest management plan
IWDM.	Integrated wildlife damage management
JQR.	Job qualification requirement
MBTA.	Migratory Bird Treaty Act
NAVAIR.	Naval Air Systems Command
NAVFAC.	Naval Facilities Engineering Command
NAVFACLANT.	Naval Facilities Engineering Command Atlantic
NAVSEA.	Naval Sea Systems Command
NEPA.	National Environmental Policy Act
NOSSA.	Naval Ordnance Safety and Security Activity
OPNAV.	Chief of Naval Operations staff
OP 5.	NAVSEA Ammunition and Explosives Safety Ashore
PIREP.	Pilot report
USDA APHIS.	US Department of Agriculture Animal and Plant Health Inspection Service
USFWS.	US Fish and Wildlife Service
VFR.	Visual flight rules
WDDT.	Wildlife detection and dispersal team
WHA.	Wildlife hazard assessment
WHMP.	Wildlife hazard management plan

1. Environmental Policy, Planning and Organization

1.1 Scope

1.1.1 Manual

This manual supports Navy Bird/Animal Aircraft Strike Hazard (BASH) policy, identifies key BASH statutory and regulatory requirements, and provides advisory information for management of a BASH program at Navy airfields. The intent is to support the Navy mission by safeguarding air operations assets and flight crews by decreasing the probability of bird or wildlife strikes with aircraft.

1.1.2 Applicability

This manual describes the internal management of the BASH program as it primarily applies to shore-based air operations, and is not intended to create any right or benefit, substantive or procedural, enforceable at law by any party against the Navy, its officers, employees, or any person.

1.1.3 Precedence

This manual is supplemental guidance for the Navy BASH program. This manual is consistent with all applicable statutes, Executive Orders (EO), Department of Defense (DoD), directives, and Navy instructions. Any apparent conflict between this manual and other Navy instructions, manuals, and similar directives on environmental, safety, and operational programs will be resolved with the best interest of Navy flight crews in mind.

1.1.4 References

- OPNAVINST 3750.21, Policy for Administering the BASH Program in the US Navy
- OPNAVINST M-5090.1, Environmental Readiness Program Manual
- OPNAVINST 3750.6S, Naval Aviation Safety Management System
- CNICINST 3750.1A, Navy BASH Program Implementing Guidance
- FAA Advisory Circular 150/5200-32B
- NAVFAC Natural Resources Management Procedural Manual, P-73, Vol. II
- 32 CFR 190, DOD Natural Resources Management Program
- 50 CFR 17, Endangered and Threatened Wildlife and Plants
- 50 CFR 17.11 & 17.12, Fish and Wildlife Service List of Endangered and Threatened Wildlife and Plants
- 50 CFR 10.13, List of Migratory Birds
- CNO ltr of 25 September 1998, Sikes Act Improvement Act with Guidelines for Preparing Integrated NRM Plans
- Conserving Biodiversity on Military Lands – A Handbook for Natural Resources Managers, 1996 SECDEF MOU: Guidance to Implement the Memorandum of Understanding to Promote the Conservation of Migratory Birds, 03 April 2007
- SECNAVINST 5090.8, Policy for Environmental Protection, Natural Resources, and Cultural Resources Programs

- GAO Report GAO-03-639, June 2003; Environmental Compliance, Better DOD Guidance Needed to Ensure That Most Important Activities Are Funded
- FAAO JO 7110.65S, Feb 08; Air Traffic Control
- NAVAIR 00-80T-114, Air Traffic Control NATOPS Manual
- NAVAIR 00-80T-124, CNIC Airfield Operations NATOPS Manual
- MCO 3570.3 (Draft), Range Safety for Aviation Operations
- NAVSEA OP 5, Volume I, Ammunition and Explosives Safety Ashore

1.1.5 Legislation

- Bald Eagle Protection Act, 16 U.S.C. 668
- Coastal Zone Management Act of 1982, 16 U.S.C. 3505
- Conservation Programs on Military Reservations (Sikes Act), 16 U.S.C. 670
- Endangered Species Act (ESA), 16 U.S.C. 1531 et seq
- Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 136
- Federal Noxious Weed Act of 1974, 7 U.S.C. 2801
- Fish and Wildlife Conservation Act, 16 U.S.C. 2901
- Fish and Wildlife Coordination Act, 16 U.S.C. 661
- Forest Resources Conservation and Shortage Relief Act, 16 U.S.C. 620
- Migratory Bird Treaty Act, 16 U.S.C. 703
- National Environmental Policy Act (NEPA), 42 U.S.C. 4321
- Outdoor Recreation – Federal/State Programs Act, 16 U.S.C. 460 P-3
- Soil Conservation Act, 16 U.S.C. 3B
- U.S. Fish and Wildlife Service, 50 CFR Part 13 and 21.41

1.2 Policy

1.2.1 Executive Orders (EO)

- 11990, Protection of Wetlands of 24 May 1977 as amended
- 13112, Invasive Species, of 3 February 1999
- 13186, Responsibility of Federal Agencies to Protect Migratory Birds of 17 January 2001

2. Awareness

2.1 Overview

The BASH Program is of vital importance to the safety of Navy flight crews and must be an integral part of safety training for all personnel involved with every aspect of flight operations. All aviation personnel should have a BASH awareness mind-set. Pilots in the cockpit, control tower and ground electronics personnel, aircraft and grounds maintenance personnel, firefighters and security personnel, even the duty sweeper collecting dead birds and turning them in for identification; all have an integral responsibility to making the entire BASH program effective. The Naval Aviation Safety Management System (SMS) provides the framework on which an effective installation BASH awareness culture is built. See NAVAIR 00-80T-124, chapter 4, for a more complete discussion. Three critical documents produced for each airfield provide the science and procedures to manage local wildlife hazards to aviation—a BASH instruction, a wildlife hazard assessment (WHA), and a wildlife hazard management plan (WHMP). Multi-

layered management oversight and repetitive annual training sustain the persistent awareness required to make the BASH program effective.

2.1.1 Installation BASH Documents

An installation BASH instruction provides the concept of operations for managing and executing a local BASH program. Guidance on content is provided in CNICINST 3750.1A. A WHA is a year-long study conducted by a qualified expert, such as a USDA APHIS biologist, of wildlife hazards in a specified geographic area associated with an airfield. At Navy airfields with no USDA support, NAVFACLANT staff, station biologists or contractors will perform these studies using formats developed from FAR Part 139.337 guidelines. A WHMP is developed to provide the integrated wildlife damage management (IWDM) strategy to minimize the impact of hazards identified in a WHA. A WHMP is produced by the BASH working group at each Navy airfield using a template in CNICINST 3750.1A, enclosure (1), reflective of FAA AC 150/5200-33b guidelines. Contact the CNIC N32 BASH program coordinator at 904-542-6969 for assistance in developing any of these documents.

2.1.1.1 Identification of Hazardous Species

Due to the open environment and the frequency of birds and wildlife inhabiting an airfield environment, removal of all birds and wildlife is not feasible. The BASH program manager, the Air Operations Officer (Air OPSO), must know which birds or wildlife species are the most hazardous to aviation safety and charge the BASH working group to develop a WHMP to mitigate the risk. Surveys of birds and wildlife found on runways and taxiways will assist in determining hazardous birds and wildlife. The initial survey for an installation airfield (a WHA) is conducted over the four seasons of a year to provide the airfield environment baseline data identifying hazardous birds and wildlife as well as habitat conditions that may attract these species. Thereafter, monthly surveys are conducted by USDA or installation biologists to provide the BWG a continuous update of wildlife activity on the airfield. The combination of monthly surveys and WHA baseline data also supplement development of an installation's Integrated Natural Resource Management Plan (INRMP), Integrated Pest Management Plan (IPMP), and even Navy flight planning publications.

2.1.2 BASH Prevention and Awareness Training

All airfield users must receive annual BASH refresher training either in the classroom or on-line. Several sources for BASH Program awareness training exist within the Navy's training system and in the public arena. These sources are outlined below. This training is also available on-line and at national symposiums, seminars, and meetings.

2.1.3 Safety Stand Downs

Presentations on the Navy's BASH Program should be a regular part of all installation, air wing and squadron safety stand down agendas. Navy and installation BASH programs should also be presented in other forums such as annual functional conferences and training seminars. Naval Safety Center (NSC) BASH experts and both local and regional biologists should be involved to present the aspects of the BASH Program, explain its importance, present program requirements, and provide updates.

2.1.4 CECOS BASH Training Module

A BASH awareness training module was developed by the U.S. Navy Civil Engineer Corps Officers School (CECOS), Interactive Multimedia Instruction/Distributed Learning Program, Port Hueneme, California. This training module can be reviewed individually or in a classroom setting. Modules in a compact disc format can be obtained by contacting CECOS at 805-982-2383 or DSN 551-2383. The training module may be viewed at http://www.denix.osd.mil/. After logging in to DoD Environmental, Safety, and Occupational Health Network and Information Exchange (DENIX) secure site (CAC required); select Conferences and Training from the drop down menu bar, select Naval Civil Engineers Corps Officers School (CECOS) Environmental Training, select Environmental Conservation on the left side menu, select Bird/Animal Aircraft Strike Hazard, and finally select Take Module to start the training course. This module has been designed for individual use or for a presentation to an entire squadron during safety stand downs.

2.1.5 BASH USA/Canada Meetings

Bird and wildlife strikes to aircraft cause over $600 million annually in damage to U.S. civil and military aviation. Furthermore, these strikes put the lives of aircraft crew and passengers at risk. In the past there was no one forum within the United States where information or concerns dealing with this problem could be addressed. Bird Strike Committee USA was formed in 1991 to facilitate the exchange of information, promote the collection and analysis of bird and wildlife strike data, promote the development of new technologies for reducing bird and wildlife hazards, conduct training and promote advocacy of high standards of conduct by airport biologists and wildlife control personnel, and be a liaison to similar organizations in other countries. This group holds an annual workshop in different locations that alternate between Canada and the United States. Presentations regarding the many aspects of a BASH program are offered along with a one day hands-on training of bird deterrent systems and vendor product displays including pyrotechnics, bioacoustics, and new technologies. CNIC N32 also conducts an extensive training session on Air Operations Program BASH policies, initiatives and best practices. Since this workshop is the lone annual event for all CNIC stakeholders to discuss and train on BASH, air operations and natural resources personnel from all echelons are strongly encouraged to attend. For additional information contact the CNIC N32 BASH program coordinator at 904-542-6969 or go to http://www.birdstrike.org/.

2.1.6 Installation Bird/Animal Aircraft Strike Hazard Working Groups

To coordinate an installation's BASH program, a Bird/Animal Aircraft Strike Hazard Working Group (BWG) shall be established in accordance with CNICINST 3750.1A and attended by key representatives from all airfield BASH stakeholders, especially the Air OPSO, Airfield Manager (AFM), Aviation Safety Officer (ASO), Wing/Squadron ASO's, key members of Public Works (Natural Resources and Facilities Maintenance), and USDA personnel if assigned. Information on program execution status, wildlife strike statistics, WHMP progress, and emergent wildlife hazards should be regularly shared among members. Annual refresher training should also be coordinated and tracked through this group. The BWG shall collectively perform an annual self-assessment using the checklist in Appendix 1 and submit to the installation Commanding Officer. BWG meetings shall be held quarterly and typically in alignment with the seasons and avian migration. This meeting should not be held concurrently with other required meetings. It should have its own agenda with meeting minutes issued to all participants afterwards.

2.1.7 Installation Safety Officer's Meeting

Monthly Safety Office meetings are an excellent method of disseminating BASH program information to all airfield users on a regular basis. The BASH program should be a standing agenda item at these meetings and include information on current wildlife conditions, the forecasting of upcoming seasonal conditions, remains collection, and NSC requirements and reporting procedures.

2.1.8 Aircraft Maintenance Personnel Training

Tenant Wing/Squadron aircraft maintenance personnel involvement in the BASH program is integral to the program's success. Many bird and wildlife strikes occur without the knowledge of the pilots or crew and are discovered by maintenance personnel during pre- and post-flight inspections of the aircraft. Maintenance personnel need to be aware of the bird strike reporting requirement, the importance of collecting remains, and the procedures for turning the remains into the appropriate department for identification. The discovery of remains should also lead to further inspection of the aircraft for collateral damage.

2.1.9 Airfield Vehicle Operators Course (AVOC)

To fully understand and communicate bird and wildlife issues at an airfield, all personnel working on the airfield must know that it is their responsibility to notify the tower of problem birds and wildlife. The AVOC course is required by NAVAIR 00-80T-124, and is the platform used to educate all airfield personnel on tower notification requirements for problem birds and wildlife and the prevention of bird or wildlife-related Foreign Object Damage (FOD). All birds or wildlife found dead within 1000 feet laterally of the runway centerline or in the overrun areas, whether the result of a bird strike or not, should be turned in to the installation Air Operations Department (Air OPSO/AFM/ASO). This strike data should be entered into the NSC Web-enabled Safety System (WESS) database to provide data for future BASH management procedures and to discourage predators from being attracted to the airfield.

3. Reporting Bird and Wildlife Strike Events

3.1 Overview

Everyone involved in the conduct of aviation, to include flight crews, maintenance personnel, and field support personnel; has a responsibility to report a wildlife strike event locally to the installation Air Operations department. The documentation and reporting of bird and wildlife strike events in a particular geographic location is necessary to determine which bird and wildlife species cause the greatest problems in that area so limited resources can be directed toward mitigation of the most significant risks. The reporting of bird strikes and near-misses along low-level routes and on ranges is also a valuable dataset for determining trends in location, timing, and species of birds involved in strike events. Once a trend is identified, measures can be taken to avoid that particular area by flying to the edge of the corridor, changing altitude, slowing down, or avoiding the area completely. OPNAVINST 3750.6 (series) promulgates specific reporting procedures.

3.2 Naval Safety Center Reporting

All BASH incidents shall be reported to NSC via WESS (see Appendix 2). BASH incidents must NOT be reported into the Aviation Safety Awareness Program (ASAP) system, which is

not affiliated with the NSC. Incidents include bird and wildlife strikes, regardless of whether damage occurred, near misses, and all birds found dead on the runway surface or within the airfield environment even if the aircraft involved in the strike event is unknown. Most BASH incidents shall be reported via a hazard report (HAZREP) in accordance with OPNAVINST 3750.6. The link is: https://wess.safetycenter.navy.mil/portal/#/home. All reports, whether damaging or non-damaging, must contain a cost assessment. The cost estimate shall encompass clean-up materials, repair components, and manpower expended to clean and/or repair all bird strike events. Those strike events exceeding the cost threshold for a Class C mishap shall be reported via a Safety Investigation Report in accordance with OPNAVINST 3750.6. Bird and bat remains for all actual strikes shall be submitted to the Smithsonian Institution's Feather Identification Laboratory (FIL) in accordance with current procedures established by NSC and Appendix 3 of this manual. Appendix 4 also addresses overseas reporting.

3.3 Who Should Report Bird and Wildlife Strikes to the Naval Safety Center?

All bird and wildlife related strike events must be reported to the NSC by a designated installation or squadron point-of-contact (usually installation ASO and/or squadron ASO), preferably within one month of the event. The reporting custodian shall be responsible for reporting bird and wildlife strikes of known origin (e.g. bird remains found on an aircraft, bird remains found on the runway and correlated to a specific aircraft), collecting/forwarding remains to the Smithsonian FIL, and notifying local air operations personnel. Installation air operations personnel shall be responsible for reporting bird and wildlife strikes and submitting remains for strikes of unknown origin (e.g. bird remains found on a runway and not correlated to a specific aircraft). This will provide the greatest assurance of accuracy and standardized reporting.

3.3.1 BASH Incidents Away From Home Airfield

If a bird or wildlife strike occurs while a squadron is visiting or training at a military or non-military facility, the squadron involved in the event is responsible for notifying local air operations personnel of the strike, reporting the event to the NSC via WESS (see Appendix 2), and sending in any bird or wildlife remains found on the aircraft.

3.3.2 Contract Aircraft Maintenance and Airfield Ground Support

The reporting custodian of an aircraft is responsible for reporting/collecting remains of birds and wildlife strikes discovered by contract maintenance. It is vitally important therefore, that Air Operations work with local tenant Wings and Squadrons to ensure all maintenance contracts contain specific language mandating contractor compliance with remains collection procedures in support of BASH strike reporting. The same applies for contractors who conduct work on or around the airfield. Airfield-related contract maintenance contracts should specify immediate reporting of a bird or wildlife strike or evidence of remains to the installation BASH Program Manager or designated agent, usually the ASO, Natural Resources Manager (NRM) or USDA Wildlife Biologist as specified in the local BASH instruction.

3.4 Damaging Strike Event

A damaging strike event is any damage to an aircraft by impact with any species of bird or wildlife. This type of event can range from a small dent, or a cracked taxi light lens to a Class A mishap. Mishap classifications are in Table 3-1. The NSC bird strike database shows that approximately ten percent of all reported strike events involve some kind of damage. Damaging

events normally contain more remains of the species involved than do non-damaging strike events. All damaging and non-damaging strike event remains must be collected and submitted to the Smithsonian FIL for identification. If post-maintenance shows blood and or feathers on any part of the aircraft, the post-flight maintenance person shall also report this discovery to maintenance control so the strike event can be reported to the NSC.

Table 3-1

Mishap Class	Total Property Damage	Fatality/Injury
A	$2,000,000 or more and/or aircraft destroyed	Fatality or permanent total disability
B	$500,000 or more but less than $2,000,000	Permanent partial disability or three or more persons hospitalized as inpatients
C	$50,000 or more but less than $500,000	Nonfatal injury resulting in loss of time from work beyond day/shift when injury occurred
D	$20,000 or more but less than $50,000	Recordable injury or illness not otherwise classified as a Class A, B, or C

3.5 Non-Damaging Strike Event

A non-damaging strike event is one where birds or wildlife are hit by an aircraft but results in no damage to the aircraft. NSC data shows that approximately 90 percent of reported strike events are non-damaging. Remains of the bird or wildlife discovered should be collected and submitted to the Smithsonian FIL for identification to assist in bird and wildlife management on the airfield. If the aircraft has to be cleaned of bird or wildlife remains because of the strike event, then all costs associated with cleaning (materials and man hours) shall be totaled and reported via a HAZREP (see Appendix 2) into WESS.

3.6 Remains Found on Runway Surfaces

Many incidences of bird and wildlife strikes occur without the knowledge of the flight crews and evidence of these strikes is often found by airfield personnel and removed to the side of the runway to reduce the FOD hazard. Strike remains left in place potentially create an attractant for other birds or wildlife that feed on carcasses and valuable data is lost for BASH management. These bird and mammal remains should be collected and sent to the Smithsonian FIL for identification and an accompanying HAZREP submitted into WESS. Installations should make every effort to coordinate with aircraft reporting custodians to determine if the strike can be correlated to a specific aircraft. Installation personnel are responsible for reporting and submitting bird and wildlife strikes of unknown origin even though the aircraft type, squadron, and actual time of strike are unknown. These species identification and remains locations are integral data for airfield and species management. Annual refresher training, the AVOC program, and wildlife dispersal Job Qualification Requirement (JQR) training should educate all personnel within the airfield environment to collect and submit strike remains discovered on the runway or airfield environment to the installation BASH Program Manager or designated agent, typically the ASO, NRM or USDA Wildlife Biologist as specified in the BASH instruction.

3.7 Near-Miss Reporting

In addition to the requirement for the reporting of damaging and non-damaging strikes, the reporting of near-miss events in WESS (and not in ASAP) adds valuable data for an installation BASH Program. By NSC estimates near-miss events exceed actual strike events by a margin of 3 to 1. Even though most birds and wildlife involved in the near-miss event cannot be identified, the exact location of such events can be recorded and used as a data point in trend analysis of known wildlife activity. Near-miss data is of particular value along low-level routes, on ranges, and within training areas. If a known topographic feature along a low-level route (i.e. a dam, ridge top, or lake) has a history of strikes and/or near-miss events, the feature or area should be avoided if feasible.

4. Remains Collection and Identification

4.1 Overview

Bird and wildlife strike remains collection, reporting and identification are the most important elements of any installation BASH program. An installation cannot effectively manage a BASH program if the most hazardous species for that airfield are not known. Effective and efficient reporting coupled with analysis of strike data and observed wildlife activity enable identification of the wildlife species that pose the greatest hazard to aircraft and flight crews. Once these specific hazards are known, the BWG can develop specific mitigations to increase the margin of safety to flight crews.

4.1.1 Remains Identification

4.1.1.1 Local Procedures

All bird and wildlife strike remains should be transferred to the installation BASH Program Manager or designated agent, usually the ASO, NRM or USDA Wildlife Biologist, as specified in the BASH Instruction. All bird and wildlife strike remains shall then be sent to the Smithsonian FIL for processing and identification as soon as practicable. If the bird or wildlife remains are intact and the installation has a staff or USDA biologist who is proficient in bird and wildlife identification, they may assist with an interim identification.

4.1.1.2 Smithsonian Feather Identification Lab Procedures

Procedures for collecting and sending feather and DNA (tissue) samples to the Smithsonian FIL are found in Appendices 3 and 4. Specimens forwarded to the Smithsonian FIL for identification must include a copy of the NSC's Wildlife Strike Report. Only feather material and dry feet or beaks containing non-fleshy material or alcohol wipes with blood remains are to be forwarded. Once the remains are identified, the Smithsonian FIL personnel will input the species identification into the NSC strike database where the results can be queried and accessed at any time. Aviation safety officers and/or USDA biologists should monitor the strike database monthly and keep a running file of identifications for the conduct of periodic trend analysis.

All remains shall be sent to the address below.

Address for ALL US Postal service mail:

Feather Identification Lab

Smithsonian Institution
NHB E600, MRC 116
P.O. Box 37012
Washington, DC 20013-7012

Address for shipping carrier (sent via FedEx, UPS, or DHL):

Feather Identification Lab
Smithsonian Institution
NHB E600, MRC 116
10th & Constitution Ave NW
Washington, DC 20560-0116

4.1.1.3 Overseas Remains Shipping Procedures

Procedures for collecting and sending overseas feather and DNA samples to the Smithsonian FIL are found in Appendix 4. Specimens forwarded to the Smithsonian FIL for identification must include a copy of the NSC's Wildlife Strike Report; Certificate of Treatment; Certificate of Origin; and a copy of the USDA APHIS permit (see CNIC G2 BASH website at https://g2.cnic.navy.mil/tscnichq/N3/N32/bash/default.aspx for current year version). Only feather material and dry feet or beaks containing non-fleshy material or alcohol wipes with blood remains are to be forwarded. Like those at U.S. bases, once the remains are identified the Smithsonian FIL personnel will input the species identification into WESS where the results can be queried and accessed at any time for trend analysis.

5. Birds and Wildlife Management for Safer Aviation Operations

5.1 Overview

Per USDA APHIS WS Directive 2.105, IWDM encompasses the integration and application of all approved methods of prevention and management to reduce wildlife damage. The IWDM approach may incorporate cultural practices, habitat modification, animal behavior management, local population reduction, or a combination of these approaches. The selection of wildlife damage management methods and their application must consider the species causing the damage (from the WHA) and the magnitude, geographic extent, duration, frequency, and likelihood of recurring damage. In addition, consideration is given to non-target species, environmental conditions and impacts, social and legal factors, and relative costs of management options.

5.1.1 Wildlife Control Techniques

Wildlife damage management techniques are either active or passive controls. A fully developed IWDM strategy will usually involve a combination of both. Active control involves forced dispersal of bird and wildlife from an airfield to give short-term relief from an immediate safety hazard. Active control methods must be coordinated with airfield tower personnel and in some cases with base security to prevent otherwise loafing or foraging birds from taking flight during flight activities and becoming a strike hazard. Passive controls are methods of discouraging birds and wildlife from visiting or utilizing an airfield through the modification or removal of attractive habitat features and manmade structures. Passive techniques are key for long-term

management of the airfield facility, airspace and/or flight operations to reduce habitat or other conditions birds and wildlife find attractive.

5.2 Active Controls

Hazardous bird and wildlife species observed foraging and loafing immediately on and around the runways, taxiways, and infield during flight operations may require immediate and aggressive action to mitigate the hazard. Active controls can range from various dispersal techniques to actual depredation described in the sections below. Note that active controls as a form of bird or wildlife management may require permitting and/or coordination with USFWS for Migratory Bird Treaty Act (MBTA) and Endangered Species Act (ESA) compliance. Additionally, there may be National Environmental Policy Act (NEPA) compliance requirements.

5.2.1 Personnel and Equipment

Each Navy shore installation or facility that conducts air operations shall have designated personnel trained and certified in bird and wildlife dispersal and removal techniques. These personnel, collectively known as the Wildlife Detection and Dispersal Team (WDDT) as defined in CNICINST 3750.1, serve as an on-call team ready to disperse hazardous birds and wildlife to mitigate BASH risks regardless of whether a USDA biologist is assigned to the installation. Per the CNIC BASH instruction and the template provided in Appendix 5, Air Operations departments owning BASH-related equipment shall develop and publish a local Job Qualification Requirement (JQR) to standardize training and certification in the use, safe operation, and maintenance of all equipment. All such training course certifications must be retained in WDDT personnel training files. Dispersal equipment must be located near the personnel tasked with the dispersal activities to ensure adequate response time. Storage and handling of all BASH-related arms, ammunition, and explosives (AA&E)—to include pyrotechnics and pyrotechnic launchers—must be coordinated with the installation Explosives Safety and Security Officers to ensure compliance with OPNAV and NOSSA directives. Using the guidelines established in the CNICINST 3750.1A enclosures (2) and (3), and following the template in Appendix 6, Air Operations departments shall develop safe handling procedures addressing local AA&E practices and procedures for inclusion in the local BASH instruction.

5.2.2 Pyrotechnics

Pyrotechnics are sound producing devices launched from a variety of platforms designed to scare birds and wildlife away from a certain area. These devices come in four types: the 15mm bird banger, 15mm screamer siren, a 15mm screamer banger rocket and a 91mm CAPA cartridge. The 15mm screamer and banger are small cardboard firework type units launched from a hand held pistol type launcher. The screamer leaves the launcher and produces a continuous screaming sound out to approximately 50 meters. At the end of the sound producing event the screamer cartridge remains intact and can become a FOD hazard. These units remain intact and must be picked up if fired over runways and taxiways to prevent FOD. The banger rocket leaves the launcher and travels approximately 50 meters and explodes with a loud bang. The CAPA cartridge is also launched from a hand held pistol type launcher but with a sub-caliber sleeve insert. This pyrotechnic leaves the launcher and travels approximately 300 meters (1,000 feet) and explodes with a loud bang. Upon usage, both the banger rocket and CAPA cartridge

completely destroy themselves producing no FOD. Proper training is required to use pyrotechnics in an airfield environment and shall be addressed in the JQR cited in Section 5.2.1.

All types of pyrotechnics are a fire hazard if fired into dry vegetation. Also, since any form of harassment constitutes a "take" under the provisions of the Endangered Species Act, contact the NRM prior to the use of pyrotechnics for consultation with the U.S. Fish and Wildlife Service (USFWS) if potential take use could affect any Federally-listed threatened or endangered species.

5.2.3 Bio-acoustics

This dispersal technique utilizes broadcasts of recorded bird distress and/or predator calls. Depending on the species of birds, bioacoustics can be used to attract birds or repel birds from the sound source. Bio-acoustic recordings should not be used as a sole means of scaring or attracting birds, because with overuse and time birds and wildlife will become habituated to the calls and effectiveness will dramatically decrease. Often the best methodology for use is to deploy randomly in different locations with no set schedule and to use in coordination with other harassment techniques such as air-cannons or pyrotechnics (Section 5.2.2). If the birds are attracted to a bio-acoustic device, then this device should be turned off (and removed), or moved to new location, or reprogrammed with new sound recordings. Bio-acoustics as a form of bird or wildlife control may require a permitting and/or coordination with USFWS if any federally-listed threatened or endangered species are involved or potentially affected.

5.2.4 Noise-producing Propane Cannons

These harassment devices are either stationary or mobile and are used to make an extreme noise designed to startle birds or wildlife into leaving the airfield environment. They are most effective if used during the first few hours past sunrise and the few hours prior to sundown when birds (or wildlife) are making early and late dispersal movements searching for daily feeding or evening roosts for the night. Cannons should be moved frequently and used sparingly to avoid habituation by birds and wildlife. Also, to avoid habituation, other harassment techniques such as pyrotechnics and depredation may be used to enhance the effectiveness of the cannons. Cannons must be maintained to keep operational.

Computer controlled cannon systems, known as "SCAREWARS", should not be procured by installation Air Operations departments due to significant Information Assurance security protocols and certification costs.

5.2.5 Falconry

The use of falconers as a harassment technique can be an effective tool for bird dispersal in the airfield environment. A falconry program is effective when the bird species being dispersed are prey species of falcons (or other raptors) and therefore, have an innate predator response to a flying falcon (or other raptor). Ideally, using falcon (or other raptors) endemic to a region and for prey species that are a typical food source of these species increases the efficacy of the falconer for dispersing hazardous species. Typical target hazardous bird species for the falconry program are pigeons, doves, gulls, terns, shorebirds and smaller waterfowl. The WHA and/or bird strike data for an installation may indicate if a falconry program should be considered and if the program would be an effective tool. Prior to implementation of a falconry program it is

recommended that a trial demonstration occurs to demonstrate effectiveness since these programs are expensive requiring full-time personnel, and on site facilities.

5.2.6 Dogs

Dogs are an effective harassment technique for many species of birds. Typical target hazardous birds for a dog program are ground feeding species especially those that feed in flocks such as geese, gulls, pigeons, shorebirds, and others. The WHA and/or bird strike data for an installation may indicate if a dog program should be considered and if the program would be an effective tool. Prior to implementation of a dog program it is recommended that a trial demonstration occurs to demonstrate effectiveness since these programs are expensive requiring full-time personnel, and on site facilities.

5.2.7 Radio-controlled Scale Models

The use of radio-controlled scale model aircraft, all-terrain vehicles, and boats has proved successful in harassing and dispersing birds. Typical target hazardous birds for radio-controlled units are most species since these tools are loud and can be run directly at a bird in the air, on a perch, on the ground, or in the water. This may be especially helpful for birds or wildlife in difficult to reach locations. Approval should be obtained prior to any use of radio-controlled units since they may be subject to Information Assurance concerns noted in 5.2.4 or Navy unmanned aerial vehicle guidelines.

5.2.8 All-terrain Vehicles

The use of all-terrain vehicles is a successful tool for harassing and dispersing birds. Due to the many diverse habitats found on a military airfield, the use of an all-terrain vehicle may prove invaluable for accessing all areas of the airport for the control of birds and wildlife. Typical target hazardous birds for radio-controlled units are most species that are on or near the ground since these tools are loud and can be run directly at a bird on a perch or on the ground. Proper training is required to drive in an airfield environment.

5.2.9 Effigies

The use of effigies to scare birds away from roosting and perching areas has proven highly successful in certain situations, especially to dissuade certain species from using a particular space. Effigies are fresh dead birds, taxidermy birds, or replicas that are hung in a “distressed” position in problem areas. Successful effigy programs have included species such as gulls, crows, and vultures.

5.2.10 Non-lethal Trapping and Relocation

The active controls described above are effective tools to harass and disperse a variety of hazardous species of birds and wildlife. At times however, certain types of birds and wildlife (such as raptors, Endangered Species Act (ESA)-protected species, waterfowl, mammals, sea birds, etc.) may persist in the airfield environment and require non-lethal trapping and relocation as the most effective (or regulatory compliant) techniques for removal. A Federal Depredation Permit, coordinated by the Natural Resources Manager (NRM) and authorized by the U.S. Fish and Wildlife Service (USFWS), is required before the trapping and relocation of any protected bird species. All bird species in the United States are protected under the Migratory Bird Treaty Act (MBTA) except the Rock Pigeon, European Starling, and House Sparrow. Additional bird

(and wildlife) protections are afforded by the ESA and the Bald and Golden Eagle Protection Act (BGEPA), therefore, no federally-listed threatened or endangered species, or Bald or Golden Eagles are authorized for trapping and relocation without federal permitting specific to these species.

5.2.11 Depredation

Most of the harassment techniques described above are effective tools to harass and disperse a variety of hazardous species of birds and wildlife. At times however, certain types of birds and wildlife (such as raptors, ESA-protected species, waterfowl, mammals, sea birds, etc.) may persist in an airfield environment. In such cases, non-lethal trapping and removal or depredation may be required. Periodic depredation can also enhance other techniques by reinforcing the danger of using the airfield environment to those individual birds not lethally taken. A Federal Depredation Permit, coordinated by the NRM and authorized by USFWS, is required before the depredation of any protected bird species. All bird species in the United States are protected under the Migratory Bird Treaty Act (MBTA) except the Rock Pigeon, European Starling, and House Sparrow. Additional bird (and wildlife) protections are afforded by the ESA and the Bald and Golden Eagle Protection Act (BGEPA). The application for a depredation permit is a USFWS Form 3-200-13 and must be accompanied by information requested by the USFWS information sheet 50 CFR 21.41. A State Depredation Permit may also be required for the depredation of a certain state-protected species. Depredation permits are coordinated by installation environmental departments with USFWS and issued with specific conditions for a specified period of time. A permit typically specifies the numbers of birds that can be depredated during a specified period of time and the methods to be used. A copy of the State and/or Federal Depredation Permit must be carried by the individual exercising the depredation activities. Military personnel will not be assigned the duty of depredation using firearms. This responsibility will be limited to those fully educated in approved IWDM practices and permits, and properly trained and certified in weapons storage, handling, and usage. This is typically the USDA biologist assigned to the airfield but may also include Natural Resources personnel. An approved arms, ammunition and equipment (AA&E) storage container should be located in or near assigned work spaces for USDA or other personnel authorized to perform bird and wildlife depredation on the airfield in support of BASH efforts.

5.2.11.1 Emergency Depredation Permits

The USFWS may add an additional emergency depredation clause to Depredation Permits for some airfields with specific safety circumstances. This clause allows airfields to depredate, capture or relocate up to ten (10) migratory birds on an emergency basis. An emergency is defined as an immediate danger to public safety and/or immediate hazard to aircraft. Any emergency activity must be reported to the Depredation Permit issuing office (usually by Natural Resources) within 24 hours. This emergency clause is only approved in certain regions of the country, so contact the Depredation Permit issuing office before engaging in this activity.

5.2.12 New or Improving Technologies

Many new or improved technologies are being introduced and marketed to the BASH community. Many of these technologies may prove effective as tools for BASH management such as bird-imitating drones, airfield-based sound deterrents, aircraft-based sound deterrents, laser deterrents, precision grass cutting, perch deterrents, aircraft-based pulsing lights, radar

systems, underground storm water detention and retention systems, and engineered grasses. If new technologies are demonstrated or used at an airfield for BASH management, it is important for this airfield to evaluate and share the successes and failures of these technologies so other airfields can either add or avoid their usage. Inform the BASH program coordinator to advise and disseminate information and/or make a presentation at the annual Bird Strike USA meeting to share with the BASH-wide community.

5.3 Passive Controls

Passive controls are long-term methods of discouraging birds and other wildlife from visiting or utilizing an airfield such as managing habitat features through alteration, treatment, and other management techniques. Methods to reduce bird attractants are listed below. Any that are deemed relevant to an airfield by the local BASH working group should be fully captured in the installation WHMP and any specific vegetation management requirements included in grounds maintenance contracts.

5.3.1 Vegetation Management

5.3.1.1 Grass Height

Grass and other forms of vegetation make up the majority of the habitats found around airfields, therefore, the mowing and maintenance of grass and vegetation is the most important passive tool used to manage birds and wildlife. The management of vegetation is dependent on the hazardous species of birds and wildlife at an airfield. Accordingly, there is no grass height standard that fits all installations. A review of the airfield's historical strike data, WHA, and other observational surveys will identify the most hazardous species at the airfield and determine grass and vegetation management for inclusion in the WHMP. A recent grass height study provided by the U.S. Army Engineering and Research and Development Center (ERDC) also contains installation-specific grass height recommendations. It is located on the CNIC G2 BASH website at: https://g2.cnic.navy.mil/tscnichq/N3/N32/bash/default.aspx for reference. Since different species of grasses, weeds, and other vegetation all grow at various rates, produce seeds and fruits at varying heights, and attract different species of birds and wildlife; it is important to plan and maintain a mowing program tailored for each airfield. Additionally, the most hazardous species at an airfield may change seasonally and this may affect the grass and vegetation management prescriptions for the installation. BASH working groups therefore, should determine specific airfield mowing requirements, map them out, and ensure they are included in the WHMP and in airfield mowing contracts. In the execution of airfield mowing plans, airfield management should coordinate with the tower since mowing may attract birds and wildlife to the mowed areas in search of newly exposed food. If mowing attracts hazardous species that have a negative effect to a safe airfield environment, then a night-time mowing schedule should be considered. The goal of all mowing programs should be to produce an area that contains low plant diversity, high plant density, equal vegetation heights throughout the mowing area and no un-vegetated areas. More succinctly, the aim is to produce vegetation areas that are uniform, monoculture plant communities designed to attract less birds and wildlife. To do so, mowing should begin nearest the runways and proceed away from the runways. Avoid mowing grasses to different heights, since this difference in grass heights produces an "edge effect" and is an attractant to birds and wildlife. Fertilization will promote grass growth and with a regular mowing program will even out grassy areas to promote a uniform cover. If the

installation is large or if adjacent lands are available, grassy areas may be managed to attract birds and wildlife away from the airfield environment.

5.3.1.2 Herbicides and Growth Retardants

Decreasing vegetation diversity on and around the airfield is an important aspect of grass and vegetation management. Also, limiting the plant diversity to species that produce fewer seeds or fruits should be an additional goal. Application of herbicides to decrease or retard plant varieties that attract birds and wildlife may be necessary if data shows that they are an attractant to a hazardous species at the airfield. Application of herbicides should be done in accordance with the installation IPMP by a certified applicator. Growth retardants for certain species of plants should be tested for efficacy on small areas prior to a full or partial airfield application.

5.3.1.3 Habitat Transition Areas

The limiting of areas with significant change of vegetation height, density, and type is an important vegetation management technique. These "edge" areas are generally higher in bird and wildlife diversity as they are a transition between two habitats and used by the species mixture of both adjacent habitats. These areas are attractants because they have shelter and food resources for many species. These habitats in the airfield environment generally exist at the edges of the mowed areas, near roads, or ditches. If deemed necessary, removal of edge effect can be accomplished by increasing the mowing areas, herbicide application, or by hand or mechanical clearing if necessary.

5.3.1.4 Un-vegetated Areas

Areas of sparse or no vegetation (i.e. bare ground) are attractive to many species of birds. These areas are attractants for many reasons including providing grit for doves and pigeons to aid in their digestion of seeds, access for ground feeding birds, and dust-bath sites. Un-vegetated areas should be tilled and planted with a grass or vegetation adapted to the area that does not produce a food source for the birds. As stated in Section 5.3.1.1, the goal of all mowing programs is to produce vegetation areas with uniform, monoculture plant types that will not attract birds to the airfield environment. Another option for small areas where re-vegetation has not worked or cannot work is the process of soil cementing.

5.3.1.5 Soil-Cementing

Soil-cementing can be used in certain circumstances if other techniques are not available. Soil-cementing can be used to eliminate bird dust bath sites, ponding areas, and certain nesting areas. This process adds materials to the existing soil that results in the soil becoming hardened and cement-like. Once an area becomes hardened, lose soil is eliminated, water does not pond, and food resources such as seeds and insects may be less available. This may decrease the cemented area as a bird attractant.

5.3.1.6 Native Vegetation

In locations where environmental conditions do not support grassy vegetation, such as desert environments, alternative vegetation management will be necessary. Possible management recommendations include allowing native vegetation to remain undisturbed, or planting of a native plant that is an effective ground cover and not a bird or wildlife attractant, or the removal

of all vegetation. Each of these (and others) should be considered and implemented based on the hazardous species at the airfield.

5.3.1.7 Forest Management

Forest can be a significant habitat for birds and wildlife and should be considered for management if it is determined as an attractant for hazardous species near the airfield environment. The BWG must ensure that management of forest to reduce habitat for hazardous bird and wildlife species is consistent with the installation's INRMP. Management techniques may include removal of all trees (clear-cutting), thinning, removal of bird and wildlife attractant species of trees (fruit or nut bearing), removal of dead trees that attract certain species (woodpeckers, cavity nesters), removal of nesting tree or trees (rookery), removal of undergrowth (prescribed fire, mechanical, or hand removal), removal of insect infested trees, and others. A Federal Permit, assigned by the USFWS, maybe required as certain bird and wildlife protections are afforded by the MBTA, ESA, and BGEPA. No MBTA listed, federally-listed threatened or endangered species, Bald or Golden Eagles, or their roost trees (bats), active nest (chicks, eggs) tree, active nests are authorized for removal without federal permitting specific to these species.

5.3.1.7.1 Planting New Forested Areas

Areas to be planted near an airfield should be of native tree species and managed as an even-aged forest. This will provide the least attractive stand of trees for birds and wildlife. In practice, however, the BWG should discourage planting of any trees in the airfield environment.

5.3.1.8 Landscaping

Shrubs, ornamental trees, hedgerows, and vegetated noise suppression barriers are important plantings on an installation. However, the airfield and clear zones are not areas for landscape plantings. These types of plantings encourage birds and wildlife and their movements around the airfield. Abandoned fruit orchards and homestead areas remaining from before the airfields were built can attract large numbers of birds and should be removed if feasible. Proper planning of vegetation for landscaping around buildings must be taken to ensure the vegetation does not produce food and cover for birds and wildlife.

5.3.1.9 Wetland/Water Management

Water habitats whether they are seasonal or permanent, fresh or saltwater are one of the most attractive habitats for birds and wildlife on an airfield. These areas attract many species of birds and mammals providing food, cover, nesting areas, and resting areas. These water areas can be managed to decrease their attractiveness as habitat for hazardous species on an airfield.

5.3.1.9.1 Stormwater Management

Stormwater management conveyance systems move water from certain surfaces and manmade structures into common drainage ways of holding facilities. Any standing water in retention/detention ponds or water flowing through drainage ditches creates habitat that provides water and food sources for birds and wildlife. Therefore, drainage ditches should be designed to (1) drain quickly and not hold water and, (2) be easily accessible for regular clearing of vegetation growth and cleaning of debris to avoid drainage issues. After rain events, areas that hold water should be monitored since they will attract birds and wildlife. Initiate active controls

as required to disperse hazardous species. During routine airfield surveys, identify problematic stormwater areas for future management projects. These areas may be protected by federal and state regulations, check with installation Public Works and Environmental Departments for all issues pertaining to wetlands protection and modification efforts. National Environmental Policy Act (NEPA) analysis and permitting may be required prior to implementation of a project.

5.3.1.9.2 Construction Run-off Management

New construction projects are now required to capture storm water to allow sediments and pollutants to settle out before the water is discharged into a natural body of water. These may include silt-fencing, bioswales, and other tools that may become a BASH hazard by attracting birds and wildlife. BASH issues should be brought forward during the design phase of construction projects to avoid future issues during construction.

5.3.1.9.3 Wetlands

The classifying of wetlands is done broadly for the purposes of BASH management in order to include all natural or naturalized bodies of seasonal or permanent water in the airfield environment. These wetlands may include marshes (tidal and non-tidal), swamps (forested and shrub), bogs, pocosins, fens, vernal pools, wet meadows, prairie potholes, creeks, rivers, lakes, ponds, and others. Wetlands are a significant attractant for birds and wildlife and should be monitored and managed in or near the airfield environment. Many large bodied birds are attracted to wetlands including egrets, herons, ducks, geese, swans, pelicans, gulls, cormorants, raptors, and others. Most wetlands are protected by federal and state laws. The installation INRMP typically includes a map of the known wetlands and any other wet areas not mapped should be considered a wetland. Prior to any vegetation clearing, modification, or construction the Public Works and Environmental Offices should be contacted in order to determine wetland status and the appropriate regulatory procedures to follow to implement management of the wetland. Ideally the removal of the wetland is the best way to eliminate the bird and wildlife attractant. Other techniques may include vegetation changes (removal or additions), moving water underground (piping and culverts), or adding restrictive barriers (such as fences, wires, netting, balls, etc.) over the wetland or on the shoreline to reduce bird and wildlife usage of the area. If a wetland area cannot be removed, altered, or modified and must remain as a bird and wildlife attractant in or near the airfield environment then other BASH techniques should be implemented including harassment and depredation. Propane cannons used sparingly along with depredation may be used effectively together. Using dogs and all-terrain vehicles to run the edges and/or dogs to swim after birds is another good harassment tool. Pyrotechnics, bio-acoustics, and falconry may also be considered for harassment.

5.3.1.10 Wastewater Treatment Facilities

Wastewater treatment facilities located on or near an airfield are a significant attractant for birds. Waterfowl, gulls, wading birds, and shorebirds are often attracted to wastewater treatment ponds. Birds use these ponds for resting and feed on the aquatic vegetation and insects. The placement of retention or treatment ponds must be carefully planned so not to attract birds and wildlife anywhere in the airfield environment. New technology in sewage treatment is making the large sewage pond system obsolete and installations should investigate the replacement of the ponds with this new technology. Existing ponds can be made less attractive to birds be steepening the pond sides, removing all vegetation, overlaying rip-rap, and reducing the surface area. The

addition of restrictive barriers (such as fences, wires, netting, balls, etc.) over the ponds or on the shoreline to reduce bird and wildlife usage of the area may be considered if feasible. If a wastewater treatment facility cannot be removed, altered, or modified and must remain as a bird and wildlife attractant in or near the airfield environment then other BASH techniques should be implemented including harassment and depredation. Propane cannons used sparingly along with depredation may be used effectively together. Pyrotechnics, bio-acoustics, and falconry may also be considered for harassment.

5.3.1.11 Landfills

Landfills located on or near an airfield are a significant attractant for birds and wildlife. Birds use landfills for feeding on food-based waste products and the insects that are attracted to the waste. Gulls, vultures, crows, ravens, and some wading birds are often attracted to wastewater treatment ponds. Operate disposal sites according to FAA Advisory Circular 150/5200-33 and state and federal laws. Old landfills that do not meet current FAA guidelines should be planned for relocation. If landfill relocation is not feasible, efforts should be taken to make the site as unattractive to birds and wildlife as possible. The following methods should be considered including maintaining a small working area to minimize exposed wastes, incinerating food waste, operating the landfill as a pit or trench to limit access by birds and wildlife, and dumping waste at night when the airfield is non-operational. Birds and wildlife can be discouraged from the landfill by other BASH techniques including harassment and depredation. Propane canons used sparingly along with depredation may be used effectively together. Pyrotechnics, bio-acoustics, and falconry may also be considered for harassment.

5.3.1.12 Landfill Caps

When a landfill is closed and a permanent cap is constructed, design and maintenance of the cap is important to avoid attracting birds and wildlife if the cap is located at or near an airfield. Most landfill cap projects will incorporate birds or wildlife enhancement projects due to the creation of a new habitat. During the design of the cap, BASH should be considered to avoid designing a habitat that is a significant BASH attractant.

5.3.1.13 Agricultural Outlease

Many installations have agricultural outleases on and near the airfield to reduce maintenance costs and generate funding. Agricultural practices are broadly defined to include crops of grains, seeds, silage, vegetables, fruits, nuts, and other farming activities such as hay, sod, nursery, and tree production. The types of crops grown and the agricultural methods used in soil preparation, planting, and harvesting impact local bird and wildlife populations.

5.3.1.13.1 Crops

Agricultural outleases within the airfield environment, normally managed by the NRM or others in the environmental department, should be coordinated with the BWG to avoid creating an area that is attractive to hazardous BASH species. Prior to a final decision, potential crop candidates should be evaluated as BASH attractants during planting, harvesting, and during fallow periods. Additionally, the BWG must consider the effect on local wildlife of losing one kind of existing vegetation in favor of another. Most crops adjacent to or near the runway may not be recommended because they are an attractant to birds and wildlife. Consider crop choices that will reduce hazardous wildlife conditions in the airfield environment by adding a uniform,

monoculture, and non-food source. Consider others that, in very specific and limited situation, might be planted strategically at a distance to attract wildlife away from the airfield environment. Use of this latter technique should be closely monitored to avoid any increased BASH risks. Consult with available science and literature to determine acceptable crops at an installation. Soil preparation, planting, and harvesting may attract birds and wildlife through crop spillage and by exposing insects and others invertebrates. All agriculture outleases should be routinely monitored by the BWG to determine if unforeseen bird and wildlife hazardous species are attracted by the selected crops or agriculture activities. If wildlife hazards have increased as the result of an agricultural outlease, then adjustments to the crop type or agricultural activities must be made as soon as possible to include not renewing the outleasing contract. While an agricultural outlease remains in effect and continues to attract birds and wildlife in or near the airfield environment, other BASH techniques such as harassment and depredation must be implemented to manage aviation safety risk during active flight operations. Propane cannons used sparingly along with depredation may be used effectively together. Pyrotechnics, bio-acoustics, and falconry may also be considered for harassment.

5.3.1.13.2 Harvesting and Planting

Soil preparation, harvesting and planting can affect the numbers of birds attracted to the airfield through crop spillage and by exposing insects and others invertebrates. These activities should be coordinated with the installation BASH Program to avoid periods of high airfield activity. Harvested crops with spillage should be turned over immediately post-harvest to decrease the location as an attractant to birds and wildlife.

5.3.1.13.3 Agricultural Outlease Contracts

Agricultural outlease contracts should be developed with primary consideration given to the support of safe flying conditions. The BASH program should be involved in the contracting process. These contracts must be reviewed regularly and monitored for compliance. Specific BASH requirements such as crop preferences, agricultural activities, hazard mitigation potential, and BASH Program coordination should be incorporated into agricultural outlease contracts and WHMP for guidance and management purposes. Initial contracts should not be long-term so adjustments can be made if bird and wildlife hazards occur as a result of agricultural activities. If an increased BASH hazard is the result of agriculture outlease, then mitigation should be considered or the outleasing contract should not be renewed.

5.3.1.13.4 Animal Husbandry Operations

Animal husbandry broadly includes livestock (cattle, sheep, goats, pigs, chickens, etc.) farming (pasture and non-pasture), aqua-farming (fish, shrimp, crayfish, etc.), fur farms, and others. Animal husbandry activities can create a significant BASH hazard if animals escape captivity and gain access to the airfield area. Aqua-farming should not be considered in an airfield environment unless a proven system of bird exclusion is utilized. Livestock pasture grazing should also not be considered since birds are often attracted to feeding livestock that attract and expose insects and other invertebrates. Animal husbandry is not an attractive alternative for most airfields though exceptions may exist.

5.3.1.14 Fencing

Properly installed and maintained fencing can reduce airfield usage by larger wildlife species such as deer, foxes, coyotes, pigs, alligators, and others. Consult FAA Part 139 Certalert No. 16-03 for further guidance on fencing. In most circumstances an eight-foot chain link fence with an additional two to three feet buried, topped with outward facing outriggers and three strands of barbed wire will normally prevent larger animals from entering the airfield environment. The buried portion of the fence is designed to stop certain mammals from burrowing under the fence. Fences should be maintained for integrity and areas of erosion, or "dig unders", should be monitored to prevent access areas from being exposed. Additionally, keeping all gates secured can prevent animals from entering the airfield environment and thereby creating a significant animal removal problem. Preventing the fence outriggers and barbed wire from becoming nest locations is also an important maintenance activity. Removal of inactive nests during the non-breeding season is permitted in most circumstances but active nest (chicks, eggs) locations may require a permit to remove.

5.3.1.15 Perch Deterrents

Many species of birds like to perch on elevated surfaces to roost, loaf, or hunt. The best way to prevent this type of activity is to remove any obsolete or unnecessary airfield poles, signs, and other above ground fixtures, especially those nearest to the active runways. If removal is not possible, then perching can be eliminated or greatly reduced by application of perch deterrents.

Perch deterrents are generally metal or hard plastic spikes or other wire devices (spiders, coils, etc.) that prevent birds from landing or perching comfortably on a structure. Add perch deterrents to any necessary or required airfield poles, signage, or other above ground fixtures that can be used as perches or for nesting in an active airfield environment. Select perch deterrents to deter the most hazardous perching species identified by the airfield WHA. Monitoring of the usage patterns of each perch will help identify which species are the most common perching offenders and correspondingly which perch deterrents will be best suited to repel those species. Each surface in which deterrents are to be attached should be measured so the correct perch deterrent product and size can be selected. Improper size and installation can cause failure of the intended purpose of deterrence and may lead to unintended consequences such as nesting where nesting would not otherwise be possible. Once installed, monitor perch deterrents periodically to assess whether the type selected is producing the desired deterrent effects on the target species.

5.3.1.16 Ineffective Methods of Bird and Wildlife Control

5.3.1.16.1 Imitation Static Effigies

Plastic owls and other imitation static birds and wildlife effigies are ineffective BASH tools. Birds and wildlife become habituated to these static units and almost immediately lose their effectiveness.

5.3.1.16.2 Rotating Lights

Birds and wildlife quickly become accustomed to rotating lights as these units are currently found throughout the airport facility on existing airfield facilities and equipment.

5.3.1.16.3 Eye Spots and Balloons

Simulated eyes and balloons with eyes on them have a very short effective period because birds and wildlife become habituated to their presence. These devices should not be used since they can become FOD on the airfield.

5.3.1.16.4 Ultra-sonic Devices

Ultra-sonic and ultra-high frequency devices have not been shown to be effective in harassing birds and wildlife or from keeping birds from roosting or nesting inside hangar facilities. These devices are not, therefore, recommended for use around the airport facility.

5.3.2 Airfield Hangars and Buildings

Hangar and buildings near the airfield provide roosting and nesting habitat for many species of birds especially species such as pigeons, starlings, sparrows, swallows, and others. Control of birds in hangars is important to prevent FOD from nesting material, droppings, dead birds, and prey remains. These birds may also nest in aircraft under maintenance and control may prevent damage to these aircraft. Also, there is potential health risk to employees from fecal material and control will decrease this risk. Hangars are easily accessible to birds since the doors are usually left open for long periods of time, particularly in the evenings when birds are roosting. Denying birds access to the hangar by keeping the doors closed is the best prevention method. When not practical however, bird control, exclusion devices or both may be necessary.

Other buildings can also attract many species for roosting and nesting. Rooftops are often used for perching and should be monitored for hazardous species. BASH tools that can be used for these species include harassment, wire deterrents, perch deterrents, and effigies. Nesting can also occur in miscellaneous holes and gaps by cavity nesters (e.g. sparrows, starlings, etc.) and underneath the eaves of the roofs by species such as swallows. Removal of inactive nests during the non-breeding season is permitted in most circumstances but active nest (chicks, eggs) locations may require a permit to remove.

Abandoned or unused buildings should be monitored as the hangars and other buildings described above. Many abandoned buildings lose their exterior integrity with time (broken windows, holes in roofs, etc.) and can become roosting and nesting attractant for certain species of birds and wildlife (bats, owls, swallows, etc.). These locations should be demolished if feasible or monitored closely so BASH tools can be used if necessary. It is important to note, that many bat (and bird) species are protected and their removal should be coordinated with the NRM or others in the environmental department.

5.3.2.1 Netting

Installation of netting to the interior of the roof underside of a hangar provides a long-term defense against birds roosting and nesting. Netting will prevent birds from roosting and nesting inside the hangar while allowing the doors to be open during hangar operations. Proper installation is important and should be inspected prior to contractor release. Maintenance of netting is required and any holes or access points through the netting should be repaired or covered until the repair can be made to prevent birds from gaining access. Netting also requires periodic cleaning to prevent trash and other items from collecting in or above the netting and attracting birds or other wildlife to the hangar.

5.3.2.2 Air Rifles

In certain circumstances, the use of pellet rifles to remove birds from a hangar or buildings may be an effective BASH tool. These circumstances may include immediate threat to airfield safety or human health risk and when funding for long-term measures such as netting is not feasible in the short-term. This type of depredation must adhere to the same restrictions described in section 5.2.11 except that air rifles do not fall under the technical definition of firearms. As a result, they are not subject to firearms handling and storage procedures specified in NAVSEA Ammunition and Explosives Safety Ashore (OP 5) and other higher guidance. Their handling and storage procedures however, should be covered in local safe handling procedures and training guidelines so that personnel using them are properly trained and certified.

Before depredating inside a hangar, the following additional procedures are recommended:

- Coordinate and obtain approvals from all installation departments involved.
- Coordinate with facilities manager for sensitive or dangerous areas to avoid such as gas pipes.
- Remove any aircraft from the hangar if possible.
- Have remaining aircraft covered, if possible.
- Removal of birds from hangar should take place at night when the birds do not want to fly outside into the darkness.
- Close all hangar doors.
- Use a scoped pellet rifle.
- Never shoot over or near or toward an aircraft.
- Do a FOD sweep after the depredating event and before any aircraft are brought back in the hangar.
- Collect all depredated birds and dispose of them properly.

5.3.2.3 Brush Weather Stripping

Brush weather stripping on the edge of the hangar doors will eliminate gaps and seal any open spaces, thereby eliminating entry points for birds.

5.3.2.4 Soffit Installation

A common place for birds to nest on hangars is on the upper door rails along the entrance of the hangar and in the spaces where the doors remain while open. Many upper door rails extend across the entire hangar entrance and do not have individual door panels that travel sections of the rails. This makes for an ideal location for nesting birds, particularly swallows. The installation of a permanent fixture like sheet metal soffits will block the areas from nesting.

5.3.2.5 Strip Curtains or Door Netting

These devices produce a soft barrier to the hangar doors and allow hangar doors to remain open while keeping birds out of the hangar. This method is effective if personnel following standard procedures for opening and closing the netting.

5.3.2.6 Nest Removal

All inactive (no chicks or eggs) nests should be removed. Persistence is the key since birds will attempt to nest at the same location several times before going to another location. Nests may

only be removed without a permit prior to egg-laying. Once eggs have been laid, a permit is required to remove a nest. After nesting is completed and the nest is inactive (no chicks or eggs), the nest can be removed though bald and golden eagles and other ESA-listed species may have additional protections that should be coordinated with the installation NRM or environmental department.

5.4 Flight Operations Considerations

5.4.1 Overview

When BASH control measures do not reduce specific bird or wildlife hazards for the airfield or training airspace, then operational activity may have to be modified to reduce the risk of bird and wildlife strikes. The feasibility of operational changes is dictated by the severity of the problem, the performance capability of the aircraft, and mission training and readiness requirements. Birds and wildlife hazards, like any other safety hazards, must be assessed by ASOs with respect to operational requirements. During contingency operations or advanced stages of mission readiness, birds and wildlife hazards may have minimal safety priority. During training to maintain operational readiness; however, certain changes can be made to improve safety, reduce costly repairs, and protect aircrews.

5.4.2 Wildlife Activity Advisories

Bird and wildlife advisories are an important part of every installation BASH Program. These advisories can provide valuable information to the aviators operating in the local airfield environment, on low-level routes, and in training areas. Real-time wildlife advisories can provide the aviator with important information in order to make sound decisions regarding flight safety. Bird and wildlife information directly observed from pilots, ground personnel, tower personnel, contractors, fire department, air traffic control, USDA biologist, natural resources biologist, and others should be relayed to the tower with as much specificity as possible so the tower can advise flight crews operating in the affected areas.

5.4.2.1 Wildlife Advisory Examples

Advisories should include but not be limited to: species observed, numbers, specific location, heading, altitude and behavior. When an advisory is broadcast, the installation WDDT or anyone else designated to respond, harass, or depredate the problem birds and wildlife should respond immediately to resolve the situation.

Examples:
“12 Canada geese, flying 500 feet above midfield heading northwest”

“Two deer feeding on the infield area 100 feet north of Distance Remaining Marker Number 4, Runway 04”

“Large flock of shorebirds heading south along shoreline heading for the departure end Runway 25”

“Approximately 100 swallows feeding along the drainage ditch adjacent to Taxiway Charlie”

5.4.3 General Advisories

General advisories should include information regarding birds and wildlife trend information. This type of advisory should be placed on Airport Terminal Information System (ATIS) as a general warning and can include local morning and evening movements of birds moving from roosting to feeding areas, night-time migration movements, seasonal documentation of large concentrations of birds over lakes, landfills, and wetlands. These advisories should be updated on a regular basis to reflect daily changes in bird and wildlife activity.

5.4.3.1 Typical Examples of Operational Recommendations:

- Reduce low-level flight time (below 3,500 AGL)
- Reduce formation flying
- Reduce air speed at low-levels
- Raise pattern altitude (above 3,500 AGL)
- Raise altitude enroute to low-level or training areas (above 3,500 AGL)
- Change pattern direction to avoid bird concentrations
- Avoid flight operations at dawn (one hour before, two hours after) and dusk (two hours before, one hour after)
- Limit or prohibit formation takeoffs and landings
- Depart the pattern in trail
- Reschedule local training or transition elsewhere
- Select low risk routes or training areas based on bird hazard data
- Limit night-time operations during migration periods. This can vary by location.

5.4.4 Pre-flight Briefings

Bird and wildlife hazard information should be incorporated in the information disseminated to the air crews during pre-flight briefing. At a minimum, aircrews should be briefed the following:

- Potential bird problems along their proposed route of flight.
- Current BASH Advisory status
- Recent strike information
- High risk strike areas on flight route
- Use of doubled helmet visors or sunglasses during daylight hours, the clear visor at night during low-level operations.
- Locking of shoulder harnesses of injured crewmembers to prevent them from falling forward into flight controls.
- Avoidance maneuvers at low altitude.
- Actions if flocks of birds are encountered (for example, initiate a climb since most birds dive to avoid a potential collision).
- Engine failure procedures if birds are ingested.
- Lost communications including change of aircraft control and aircraft recovery procedures.
- Procedures for a controllability check to determine ability to control the aircraft if the airframe is damaged.
- Crew egress procedures if control cannot be maintained.
- Controllers shall inform transient flight crews or aircraft in flight of local bird hazards. Transient aircrews are often unfamiliar with airfield hazards, including birds. At some bases, the

most damaging bird strike incidents happen to transient aircraft. Information in the Flight Information Publication (IFR Enroute Supplement, VFR Enroute Supplement, and Area Planning/IB), and broadcasts of information on either the ATIS or on the initial radio contact can alert the aircrew of potential hazards. Advisory reports from the tower, approach control, range control, or other pilot reports (PIREP) can update airborne flight crews of the threat and location of local bird hazards.

5.4.5 Bird Hazard Avoidance

In the past, bird strikes that initially appeared to have caused minor damage later proved to be much more substantial. Had the aircrews continued the mission, serious emergency would likely have resulted? Structural damage such as a dent in the wing caused by a bird, has led to fuel and hydraulic system failures through damaged lines. Bird strike damage cannot be accurately assessed in flight and flight crews are strongly recommended to return to base if struck in flight. Only maintenance personnel on the ground can make accurate damage assessments. Continuing with the mission may result in a complex airborne emergency.

5.4.5.1 Dawn and Dusk Flight Restrictions

Bird and wildlife strike data reveals that a majority of bird and wildlife strikes occur during dawn and dusk hours, when bird activity is normally at its peak. Birds, especially, are making daily movements flying to and from roosting and feeding areas. Limiting or delaying flight operations during this period of high bird and wildlife activity should reduce the strike potential at the airfield. The target period for flight limitations or delays includes one hour before and two hours after sunrise and two hours before and one hour after sunset. This type of information should be in pre-flight briefings and bird advisories.

5.4.5.2 Night-time Flight Restrictions

Night-time flight operations have an increased bird strike hazard. Studies have shown that 1.8 more strikes occurred per aircraft movement at night than during the day and a seven times greater strike occurrence per aircraft movement above 500 feet AGL at night compared to daytime flights (Dolbeer, 2006). This night-time strike risk is increased during certain periods of the year that coincide with peak bird migrations. These migrations occur during the spring and fall with timing varying slightly by installation location but generally include the periods of mid-February to mid-May and mid-August to mid-November. Much of the migratory bird movement occurs at night and may include large flocks of birds. Data shows that the months of September to November and April to May had proportionally more strikes over 500 feet AGL. The increase of above 500 feet AGL strikes during the September to November and April to May periods may be attributed to migratory movements of birds which generally occur at a higher AGL than daily bird non-migratory movements. FAA Aeronautical Information Manual (AIM) states that “Bird strike risk increases because of bird migration during the months of March through April, and August through November” (FAA, 2012). Therefore, if feasible, limiting or delaying night-time flight operations during migratory periods should reduce the strike potential at the airfield.

5.4.6 Flight AGL

There is a direct correlation with flight height and bird strike hazard. From a total of 38,961 strike reports from 1990 to 2004, 74% (28,806) of bird strikes occurred below 500 feet AGL, 19% (5,448) between 501 and 3,500 feet AGL and 7% (2,355) above 3,500 feet AGL (Dolbeer,

2006). Based on modeling of this data, it was found that strike frequency decreased by 32% every 1,000 feet AGL gained from 501 to 20,500 feet AGL (Dolbeer, 2006). Dolbeer, 2006 suggests an increase from 1,500 feet AGL to 3,500 feet AGL would decrease the mean probability of a bird strike by 54%. Therefore, if feasible, flight operations should remain at the highest AGL acceptable for their training or mission requirements.

5.4.6.1 Low-level Operations

Low-level operations have an increased potential for bird strikes. This increase is because the general abundance of birds increases as you approach the ground level. During these low-level missions, flight crews are involved in flight duties that may not allow sufficient time to monitor bird activity. "Heads up" flying should be stressed as much as possible during these critical operations. Based on historical strike statistics, certain areas or land features along a given low-level route should be avoided or the course rules modified to avoid known problem areas. Certain weather conditions may promote the loitering or soaring of larger birds as they ride the thermals generated from the highways or bare spots on ranges. Examples of avoidance tactics along a low-level route include flying at the edge of the corridor, changing altitudes, slowing down, or avoiding the area altogether. This type of information should be regularly addressed in pre-flight briefings and bird advisories.

5.4.6.2 Range Operations

Ranges contain a variety of environments that may provide bird attractants. Range operators must be aware of BASH concerns and continually assess the bird activity, reporting it when necessary, or restricting operations if flight safety is an issue. Conditions that may warrant advisories for the range include large numbers of birds moving through the airspace, high numbers of hazardous BASH species using various habitats, large-bodied species (raptors, pelicans, etc.) riding thermals in the range air space, and poor visibility due to low clouds, fog or other weather patterns. If an aircraft experiences a bird strike, the strike must be reported to the Naval Safety Center via HAZREP with as many details as possible and if found, strike remains must be submitted to the Smithsonian FIL.

5.4.7 Weather Fronts and Bird Movements

Research has shown that large movements of migrating birds occur just behind a weather front moving through an area. Generally, during spring migration more birds will move when a weather system moves through that contains south to north winds. During the fall, the opposite is typically true. Flight planning should consider avoiding operations during these conditions especially during migration periods of mid-February to mid-May and mid-August to mid-November. This type of information should be in pre-flight briefings and bird advisories.

5.4.8 Daily and Local Bird Movements

Many hazardous species of resident (winter, spring/summer, and year-round) birds make local, daily movements from roosting and nesting areas to locations to feed and back again. These movements typically occur one hour before and two hours after sunrise and two hours before and one hour after sunset. Movements of birds should be observed and documented by biologists during WHA and daily BASH observations. This data should be part of the WHA and continually monitored during daily airfield observations. These birds are moving through the airspace in flight so BASH deterrents are limited, therefore, if patterns of hazardous species are

observed then movements should be avoided through flight planning efforts. This type of information should be included in pre-flight briefings and bird advisories.

5.4.9 Take off and Departure Restrictions

Whenever flight operations are under review or being revised at air installations, BASH shall be taken into consideration with regards to new flight planning that potentially route aircraft into hazardous BASH areas (coastlines, rivers, landfills, refuges, agricultural lands, etc.) and to recommend operational adjustments such as flight AGL, time of day, and others that may reduce bird and wildlife strike hazards.

5.4.10 Avoiding Coastlines and Shorelines

Many species of migratory birds follow major land features (i.e. coastlines, river-ways) during migration. Airfields with runways parallel to or starting or ending at a shoreline should take special precautions. During periods of peak bird movement (daily movements and migration), aircraft are recommended to make operational adjustments such as increasing flight AGL, time of day limitations, and others that may reduce bird and wildlife strike hazards. Other adjustments could include shortening of take-off and landing roll to avoid the ends of the runways nearest the shorelines to avoid the greatest area of bird hazard for coastal species. A "quicker" take-off and "later" landing pattern will increase AGL over these coastal areas. This type of information should be in pre-flight briefings and bird advisories.

5.4.11 Flight Crew Awareness

Information concerning birds and wildlife issues on or near the airfield should be regularly updated and communicated to flight crews via the installation ATIS. These general warnings will alert flight crews of possible bird and wildlife hazards in their local flying area. Air Traffic Controllers should also transmit immediate warnings in accordance with FAA Order JO 7110.65 series when either observing birds or wildlife activity directly or when receiving instantaneous reports from flight crew or observers on the airfield.

5.4.12 Flight Crew Responsibility to Follow-on Crews

Communication and awareness are the best tools to avoid a BASH event. Flight crews, if airborne and directly observing hazardous bird or wildlife activity, should immediately notify the tower and provide type and location of the hazard on or about the airfield. Post landing, flight crew shall also inform the tower or following aircraft of a potential aircraft hazard in the airfield pattern, along a low-level route, or on a range.

5.5 Technical Assistance

5.5.1 CNIC BASH Point of Contact

CNIC N3 Operations Director is the Navy Program Manager. The principal point of contact for BASH issues is James Higgins, N32 BASH Program Coordinator. His contact number is 904-542-6969 (DSN 942) and email is james.higgins2@navy.mil. The CNIC/NAVFAC BASH Natural Resources Program Manager is Paul Block. His contact number is 757-322-8499 (DSN 262) and email is paul.block@navy.mil.

5.5.2 Naval Safety Center

The Naval Safety Center (NSC) maintains the WESS database for all strike reports so historical data can be accessed and used to develop local BASH documents and bird and wildlife hazard management strategies to reduce the probability of a strike. This installation specific data is key to identifying the most hazardous species to aircraft safety in the local area. Someone in each air operations department, usually the ASO, will need to have a WESS account to enter HAZREPs and access strike data. To obtain an account, call the NSC Help Desk at 757-444-3520, extension 7048. NSC will also evaluate and summarize annual BASH data and post the findings on its website at: http://safetycenter.navy.mil. During an Installation Safety Assessment, the NSC shall evaluate the local BASH program and provide recommendations in writing to the installation Commanding Officer.

6. Airfield Bird and Wildlife Hazards

6.1 Overview of Airfield Bird and Wildlife Hazards

The following is a summary of specific types of birds and wildlife that may present a strike hazard to operating aircraft. A brief description of each bird and wildlife group is included and how each group can be mitigated, managed, or avoided. Permits may be required for some of the recommended BASH control activities. See Appendix 7 for a listing of the top 20 most hazardous species to military aircraft.

6.2 Birds

6.2.1 Loons, Grebes, Pelicans, Cormorants, and Mergansers

These are fish-eating birds. Control is best accomplished by removing the habitat attractant (wetland) or if not possible removing the fish from these areas. Pyrotechnics, noise-producing cannons, dogs, and depredation in any combination are effective control techniques. The wiring or covering of smaller areas may be another option to consider for discouraging usage by larger birds. Avoid scheduling flying activities at one hour before and two hours after sunrise and two hours before and one hour after sunset to avoid these birds flying to and from feeding and roosting areas.

6.2.2 Pelagic Birds (Albatross, Petrels, Shearwaters, Auks, etc.)

Control of these birds is difficult since natural predators are rare and the birds exhibit little fear of man or aircraft. Species only come to land during nesting and remain at sea the remainder of their lives. Deterrent of using the airfield environment during the breeding season is the best mitigation and management strategy for these species. Nesting habitat management (changes or removal), trapping, relocation, egg-addling, harassment, and depredation should all be considered to this group. Avoid flying near nesting sites during the nesting season. Many of these species only access their nesting sites at night so limiting night-time operations during breeding season may also be an option to decrease flight hazard. Avoid flight patterns low over any known nesting colonies where many thousands of birds may concentrate. At sea these large birds fly very close to the surface of the water gliding on small updrafts created by the ocean swells. Avoid flying low over the water to avoid these low-soaring birds.

6.2.3 Long-Legged Waders (Herons, Cranes, Egrets, Ibises, and Storks)

Wading birds are attracted to shallow wetlands, wetland edges, and sometimes grasslands, meadows, and fields where they feed on fish, amphibians, reptiles, rodents, and arthropods. One control technique is removing the habitat attractant (wetland) or if not possible removing the fish from these areas. Steepening the sides of drainage ditches and ponds (eliminating shallow water), draining seasonally flooded areas, and removing emergent vegetation will drastically reduce accessibility to food sources. Also, allowing a wetland edges to overgrow in tall dense vegetation (reeds, cattails, etc.) may reduce or eliminate edge access and limit usage of these habitats. In narrow corridor wetlands such a creeks and drainages, allowing tall dense vegetation to overgrow and lean in over the water may also exclude use by these species and other waterfowl. It should be noted that these overgrowth areas should be limited in width and not allowed to become larger than a few feet in width or they may otherwise become habitat attractant for other large-bodied species such as rails and bitterns. Pyrotechnics, noise-producing cannons, dogs, and depredation in any combination are effective control techniques. The wiring or covering of smaller areas may be another option to consider for discouraging usage by larger birds. Lastly, many of these species are colonial nesters and roosters using trees and large shrubs for both of these activities. Prevention of this activity on or near the airfield environment is an important BASH management tool. Removal of these trees and shrubs is the best way to reduce not only usage of this area for nesting and roosting but it will also likely decrease usage of other habitats around the airfield. These species would need to travel further to access wetlands and other habitats to feed and thus may find closer areas (off airfield) for daily feeding forays.

6.2.3.1 Cattle Egrets

Cattle Egrets though considered wading birds are significantly different in habitat and food attractants, and social requirements that they necessitate separate consideration. This species is native to Africa but is a worldwide invasive species that has expanded its range to most areas of the world. The cattle egret, if present at an airfield, is one of the most hazardous species at the airfield because it is a medium-sized flocking species, shows little fear of aircraft, is hard to harass, and is attracted to the grassy habitats of an airfield where it feeds on insects and other invertebrates. Cattle egrets are attracted in large flocks to follow grazing livestock and grass mowers for the insects and other invertebrates exposed by the activities. When cattle egrets are present, no livestock outleases should be entered into for the installation. Limit flight activities during mowing, or mow during periods of reduced flight activities such as during the night. If nearby livestock grazing is occurring on private lands, limit low-level flights over these areas. On airfield, pesticide application may be necessary for insect control in the grassy areas next to the airfield. Pyrotechnics, dogs, and depredation in any combination are effective control techniques though this species is less susceptible to non-lethal techniques than other species. Like other wading birds, this species is a colonial nester and rooster using trees and large shrubs. Locating and eliminating roosting and nesting sites on or adjacent to the facility is an important method of decreasing the BASH risk by this species. Do not allow cattle egrets to establish use of the airfield for feeding, roosting, and nesting. Once established, the egret numbers will increase and become a greater risk to airfield safety and harder to deter.

6.2.4 Waterfowl (Swans, Geese, and Ducks)

A distinction must be made between resident and migrating populations.

6.2.4.1 Resident Waterfowl

Resident waterfowl may be winter, spring/summer (breeding), or year-round residents and are attracted to an area to rest, breed, and/or feed. Ponds, lakes, ditches, etc., may attract waterfowl, particularly if these areas contain emergent or submerged vegetation for feeding, nesting, or shelter. Control is best accomplished by removing the habitat attractant (wetlands) but if this is not feasible, then steepening ditch and pond banks and removing submerged and emergent vegetation may reduce waterfowl numbers. Wetland mitigation projects that include development of a new wetland should be located as far from the airfield as possible. The wiring or covering of smaller wetland areas may be another option to consider for discouraging usage by waterfowl. One species, the Canada goose, is especially attracted to short grass areas such as lawns, golf courses, and parks were it feeds on the frequently mowed grasses. If feasible, grass management may be one option for deterring this species by allowing grass to reach a taller height to impede their movement and limiting species visual communication. Research and literature may identify grass type plantings and additives that could limit grass as an attractant to certain this species too. Agricultural outleases must be reviewed by the BWG to ensure that crops grown do not attract waterfowl during soil preparation, planting, harvesting, and post-harvest. Pyrotechnics, gas cannons, dogs, and lethal control should all be used together to ensure that waterfowl do not become accustomed to any single technique. Waterfowl are also candidates for capture and relocation during their yearly molting in which they lose the ability to fly. Waterfowl hunting programs are excellent methods of control as long as hunting is performed during non-flying hours. Resident waterfowl act as live decoys for migrating waterfowl and should not be allowed to linger on or near the airfield. Resident waterfowl are most active at dawn and dusk, moving at low altitudes to and from feeding and resting areas. Avoid flying near wildlife refuges, public hunting areas, ponds, lakes, or rivers with known waterfowl concentrations during these periods of the day.

6.2.4.2 Migrating Waterfowl

Migrating waterfowl are dangerous to aircraft due to the large numbers and generally higher altitude of the birds in flight. Large flocks of waterfowl travel along migration flyways to their breeding and wintering grounds during the spring and fall, respectively. Large flocks may stop along the routes to feed and awaiting favorable weather conditions to continue. Migration periods include mid-February to mid-May and mid-August to mid-November but vary slightly by location. Migrating birds are most active from sunset through midnight, with numbers decreasing in the early morning hours. Avoid flying during the night if possible. Wintering concentration areas such as coastal wetland complexes, post-harvest wheat and corn fields should be avoided especially by low-level flights. Winter agricultural outlease areas on or near the airfield should be monitored as they can be an attractant to large flocks of migrating waterfowl. If a large flock is present, then an immediate bird advisory should be issued and all flight limited or restricted until the flock can be dispersed. Use of many BASH tools described for resident waterfowl would be effective for migratory waterfall too.

6.2.5 Raptors (Vultures, Falcons, Eagles, Kites, and Hawks)

Raptors are hazardous to aircraft because of their size, and soaring flight tendencies. Many raptors fly using thermals in search of prey and for transiting to other areas. Flight operations should avoid areas with thermals generating terrain such as ridgelines, rolling hills, and near large bodies of water. Landfills are particularly attractive to vultures and should be avoid during

flight operations. In the fall, large numbers of raptors will migrate in large concentrations riding thermals in large groups called kettles. Aircraft operating from airfields in known raptor migration concentration areas should avoid ridgelines, rolling hills, and large bodies of water during the fall migration period. This information should be in pre-flight briefings and bird advisories. Removing dead animals on and around the airfield, proper management of landfills, and rodent and insect control on airfields can help control raptors. Any obsolete airfield poles, signs, other above ground fixtures, and trees that can be used as a perch location should be removed especially those nearest to the active runways. Inactive nests should be removed. Pyrotechnics, propane cannons, and depredation can disperse or remove these birds. Radio-controlled model airplanes can be effective in dispersing raptors from an airfield. Edge habitats should be limited in the areas near the airfield as these are small mammal habitats. Grass management for raptors is unsettled science. Longer grasses may increase small mammal populations but may also greatly decrease hunting effectiveness while shorter grasses may decrease small mammal populations but increase hunting effectiveness. Each airfield should be proactive if they have a raptor issue due to the threat to airfield safety. Grass management should be considered adaptive and written that way in maintenance contracts so adjustments can be made if one grass length is determined ineffective for raptor control. Research has discovered that juvenile or first-year birds present the highest risk for a bird strike. Problem raptors, especially juveniles and first-year birds, can be removed by capture and relocation, but certain individuals may require depredation if relocation does not work. Special permitting procedures are required for harassing and depredating eagles.

6.2.6 Grouse, Quail, Dove, and Pheasants

Game birds are most effectively controlled through proper grass height management. Do not allow grass to exceed 14 inches and eliminate all brush, weed patches, and areas of bare ground on the airfield. Pyrotechnics, propane cannons, dogs, falcons, live ammunition or periodic hunts can effectively disperse or remove these birds. Remove all dead birds on and around the airfield during the hunts. Depredation of these birds outside the normal hunting seasons requires depredation permits.

6.2.7 Shorebirds

Shorebirds can be a BASH hazard because of their medium-size, dense body, and propensity to form large dense flocks. These large flocks of shorebirds fly in tight coordinated formation and have a tendency to be nervous often taking to the air with the smallest perceived threat. In the air these tight flocks fly randomly with unpredictable directional movements which makes them difficult to anticipate and a hazard to flight operations. Shorebirds are often attracted to the airfield habitats especially after rainfall events that leave ponding on the hard surfaces of the airfield (freshwater) and in the short grass areas. They may also be attracted to the airfield hard surfaces on cold sunny days for thermal regulation. Pyrotechnics, propane cannons, dogs, falcons, and depredation can disperse or remove these birds. If a shorebird flock is in an airfield location that makes it particularly hazardous to flight operations then a limitation or flight restriction should occur until the flock can be dispersed. Drainage improvements should be considered if it is determined that the attractant involves water ponding after rainfall events. Also, consider pre-flight and pre-landing runway sweeps on rainy days, post rainfall events, and on cold sunny days.

6.2.8 Gulls

Gulls are a significant hazard to aircraft safety due to their large size, omnivorous feeding habits and preference for flat, open areas such as airfields. Gulls are most active one hour before and two hours after sunrise and two hours before and one hour after sunset as they move to and from feeding and roosting areas. Gulls are often attracted to the airfield habitats especially after rainfall events that leave ponding on the hard surfaces of the airfield (freshwater) and in the short grass areas looking for insects and other invertebrates. Saturated soils force insects and other invertebrates from the soils and onto the runway and taxiway surfaces. They may also be attracted to the airfield hard surfaces on cold sunny days for thermal regulation. Pyrotechnics, propane cannons, dogs, and depredation can disperse or remove these birds. If a gull flock is in an airfield operating area, then flight operations should be suspended until the flock can be dispersed. Drainage improvements should be considered if the attractant involves water ponding after rainfall events. The maintenance of grass around the airfield should include higher grass heights nearer the 14 inch height since gulls do not like to feed in taller grass. Also, pre-flight and pre-landing runway sweeps on rainy days, post rainfall events, and on cold sunny days can be an effective policy to establish. Coastal areas and landfills are the most significant attractant for gulls and should be avoided during flight operations. Do not allow gulls to establish use of the airfield for feeding, roosting, and nesting. Once established, the gull usage will increase becoming a greater risk to airfield safety and harder to deter.

6.2.9 Terns

Terns are fish eating birds common to coastal areas and along some major rivers and lakes sometimes feeding in smaller water bodies if fish are present. One control technique is removing the habitat attractant (wetland) or if not possible removing the fish from these areas. Terns are colonial nesting species that generally nest on sandy, sparsely vegetated coastal areas. At coastal airfields BASH personnel should monitor tern populations and not allow establishment of a nesting colony on or near the airfield. Flight operations should be avoided where these birds are active, such as nesting colonies or piers. At times, terns (and related species such as skimmers and oystercatchers) may be attracted to the airfield habitats especially after rainfall events that leave ponding on the hard surfaces of the airfield (freshwater) and on cold sunny days for thermal regulation. If a tern flock is in an airfield operating area, then flight operations should be suspended until the flock can be dispersed. Pyrotechnics, propane cannons, dogs, falcons, and depredation can disperse or remove these birds. Drainage improvements should also be considered if determined that the attractant involves water ponding after rainfall events. Also, pre-flight and pre-landing runway sweeps on rainy days, post rainfall events, and on cold sunny days can be an effective policy to establish.

6.2.10 Pigeons

Pigeons are a BASH hazard because of their medium dense bodies, flocking tendencies, abundance near manmade facilities, and attraction to habitats common in airfield environments containing short grass. Pigeons are seed eaters and are attracted to seed producing weeds, grasses, and shrubs. Pigeons are most active one hour before and two hours after sunrise and two hours before and one hour after sunset as they move to and from feeding and roosting areas. Open short grass areas or bare spots are attractive as grit-gathering, resting, and feeding sites. If observational data shows large groups feeding in the airfield grasses, then grass height should be adjusted. The maintenance of grass around the airfield should include higher grass heights

nearer the 14 inch height since pigeons prefer short grass areas to feed. If a pigeon flock is in an airfield location that makes it particularly hazardous to flight operations, then a suspension of flight operations should occur until the flock can be dispersed. Pyrotechnics, propane cannons, dogs, falcons, and depredation can disperse or remove these birds. Pigeons frequently congregate in hangar facilities and on other airfield structures. If these birds are not controlled, they can become a long-term pest by roosting and nesting on these structures. Hangar management for bird control is described in Section 5.3.2. Rock pigeons are not federally protected and may be depredated without permits.

6.2.11 Owls

Owls are a BASH hazard since they are primarily active during decreased visibility (night). They are slow flyers and have limited maneuverability. Owls can be diurnal (daytime) but the majority are nocturnal (nighttime). Owls use airfield environments for hunting, roosting, and nesting. Most owls eat small mammals, reptiles, frogs, lizards but smaller species may also eat insects and other invertebrates. Rodent and insect control may be necessary in controlling owl populations. Any obsolete airfield poles, signs, or other above ground fixtures that can be used as a hunting perch should be removed especially those nearest to the active runways. Any single tree or small grove of trees, alive or dead, and abandoned buildings in or near the airfield should be removed as these can be used for nesting and roosting locations. Grass management activities should include limiting edge habitats near the airfield environment as these can be a small mammal attractant. Smaller insect eating owls may be attracted to outdoor lighting that attracts insects. Reducing or changing the type of lighting near the active airfield may reduce owl movement across the airfield. Pyrotechnics and depredation can disperse or remove these birds.

6.2.12 Nightjars

Nightjars are active fliers, particularly at sunset and early evening when insects are abundant. Nightjars are especially attracted to insect attracting lighting. Reducing or changing the type of lighting near the active airfield may reduce nightjar movement across the airfield. A few species of nighthawk have been known to nest on flat graveled roofs. If nighthawks are abundant at an airfield, then roof-top nesting may be occurring. Once located and prior to re-nesting the following season, this species should be actively harassed to deter from re-nesting on the roof-top. Avoid flying at times when these birds are abundant, particularly near lakes, streams, or other areas with large insect populations.

6.2.13 Woodpeckers

Bird strikes with this group of birds are extremely rare since they prefer forested areas and rarely leave these areas. The removal of forested areas close to the airfield should keep these birds away from the runways. Migrating woodpeckers may be encountered, but are rarely struck.

6.2.14 Flycatchers

These birds are present on airfields, feeding on insects. Strikes are infrequent, but should not be overlooked. Controlling insects and removing perches such as fence posts, dead tree limbs, and bushes should keep these birds away from the runways.

6.2.15 Meadowlarks and Horned Larks

These birds are very difficult to control and are commonly hit by aircraft. They are attracted to bare spots, such as those along runway edges, to eat weed seeds and insects. The best defense against these birds is thick, uniform grass with no bare spots. In the southwest, this may not be possible, as grass cannot be maintained without intense irrigation. Consider coating bare spots, particularly along runways, with oil-base or asphalt cover. Pyrotechnics can be used, but these birds will tend to fly only short distances and settle back down into the grass. Persistent active control measures with this species are the key to control.

6.2.16 Swallows

Swallows eat insects in flight and are commonly found above airfields and water gleaning insects while flying. Swallows are small agile birds that normally fly in very small loose flocks and often show up in the bird strike database due to their abundance near airfield environments. Pyrotechnics are only a short-term fix as the birds habituate to them very fast. These birds do not respond to bioacoustics or any high frequency devices. Insect control will reduce swallow numbers, but nest management is the best methodology. This species often nests on manmade buildings and structures located on building eaves, under tiles, under bridges, and inside culverts. BASH biologists should locate nesting locations either while the birds are active or during the non-breeding season. Prior to a new breeding season, remove all nests with a water hose or long-handled scrapping tool. As breeding season begins, continue to remove partially built nests. Harassing birds as they work on nest-building can discourage nesting. Special permits will be required to remove nests with eggs. Large nesting areas under eaves or hangar doors may be fixed by installing anti-nesting devices such as netting, soffits, and wires or spikes.

6.2.17 Ravens and Crows

These omnivorous birds are common around airfields and open areas. They may occur in large flocks, particularly one hour before and two hours after sunrise and two hours before and one hour after sunset as they move to and from feeding and roosting areas. Notify the tower of any daily movements, so they can advise pilots of the situation. Remove any known roosting sites on or around the airfield. Ravens and crows are opportunistic feeders and maybe attracted to the airfield habitats especially after rainfall events that leave ponding on the hard surfaces of the airfield (freshwater) and in the short grass areas looking for insects and other invertebrates. Saturated soils force insects and other invertebrates from the soils and onto the runway and taxiway surfaces. They may also be attracted to the airfield hard surfaces on cold sunny days for thermal regulation. Also, pre-flight and pre-landing runway sweeps on rainy days, post rainfall events, and on cold sunny days can be an effective policy to establish. Pyrotechnics, propane cannons, dogs, and depredation can disperse or remove these birds.

6.2.18 Starlings, Cowbirds, Grackles, and Blackbirds

This group can be particularly hazardous because they frequently occur in large flocks, sometimes numbering in the thousands. Blackbirds and starlings are attracted to flat, open areas to feed, and rest. Many of these species can form large night-time roosts that can hold thousands of birds. These areas are a significant strike hazard as large dense flocks move in and out the locations especially during one hour before and two hours after sunrise and two hours before and one hour after sunset as they move to and from feeding and roosting areas. These roosts are generally located in vegetation areas such a reed beds, cattail areas, tree stands, or dense areas of

other vegetation. Remove these areas on or near the airfield. Prune or remove roost trees, brush, reed beds, or cattails and monitor to observe if roost is moved to another area. Grass management may help mitigate this species. Maintain dense tall grass with heights over 10 inches to limit grass habitats for these species. Agricultural outleases should be reviewed by the BWG to ensure that crops grown do not attract hazardous species during soil preparation, planting, harvesting, and post- harvest. Blackbirds and starlings respond well to an intense harassment program using bioacoustics and pyrotechnics. Use other methods to supplement this program as necessary. Starlings are not federally protected and may be depredated without permits. Permits are required for other species. Occasional depredation will reinforce other harassment techniques. Trapping and euthanization may also be effective tools if the numbers are not too large. Avoid at all costs flying near known blackbird and starling roosting areas, especially during one hour before and two hours after sunrise and two hours before and one hour after sunset.

6.2.19 Warblers

Many different species of warblers can thrive in a variety of habitats found on an airfield. Most of this group does not present a threat to aircraft operations, but occasionally large flocks can be encountered, particularly during migration periods. Most warblers prefer shrubs, trees, or wetland habitats where they feed, nest, and roost. Control and maintenance of these habitat types are a major controlling factor of warblers. Warblers tend to migrate at night and can travel in extremely large flocks. Controlling the preferred habitat of warblers is the only way to discourage these birds from an airfield. Pyrotechnics, bioacoustics, dogs, and even depredation will have limited effect.

6.2.20 Sparrows, Finches, Grosbeaks, and Buntings

Most of this group does not present a threat to aircraft operations, but occasionally large flocks can be encountered, particularly during migration periods. These birds are seedeaters as a rule, and most prefer weedy, brushy, or forested areas. Proper grass height management and brush control is the best means of control. Tall sparse grass will attract many of these types of birds. Pyrotechnics can be used to frighten these birds, but success with this and other methods is usually very limited.

6.3 Mammals

While strike hazards are generally thought of as a bird issue, several mammal species also pose a significant threat to flight operations and must be considered. Unlike birds that require federal permits to control, many mammalian species require state permits for harassment and control.

6.3.1 Deer

Members of the deer family (including moose, elk, and caribou) may be a rare visitor or a regular visitor to an airfield depending on the airfield location. Depending on local population, deer may pose a severe threat to flight operations. As a result, mitigations must be developed by the BWG and included in the WHMP. Deer species are generally browsers, preferring broad-leaf weeds, shrubs, and trees. Deer, in particular, are also attracted to agricultural fields. Tall fences can discourage these animals from entering the airfield area. Fencing should be secured to the ground as deer will often push under a fence with little more than an 8 to 10 inch opening. Installation hunting programs will help to eliminate deer within the airfield area. The goal of an

airfield hunting program is the elimination of deer in the airfield environment and not to develop a sustained hunting program for recreational purposes. During the non-hunting times of the year, an aggressive pyrotechnic and depredation program should be initiated. During night-time and low-visibility operations, airfields with significant deer populations should perform pre-flight and pre-landing runway sweeps. Deer will also take advantage of forested areas near an airfield for cover. If tree stands are located in the airfield environment and no fencing is on site, then tree line vegetation (edge effect) and forest understory need to be routinely cleared to enable effective harassment.

6.3.2 Feral Pigs

Wild or feral pigs (or hogs) can either be escaped domestic pigs or non-native-introduced wild boar. Wild pigs can be attracted to an airfield environment to feed on a variety of foods that may be available in the vegetated areas. These animals will eat virtually anything from acorns, roots, grain, invertebrates, small mammals, carrion, and other food items. Rooting for underground vegetation can be damaging to the ground surface leaving areas of ground disturbance. Such disturbances can gather water and may create an additional bird or wildlife attractant. Control for this species is difficult. .Fence exclusion is effective if the fence is sturdy and made of metal with a buried bottom fence edge (at least two feet) to prevent 'dig-unders'. Harassment noise makers such as bangers and screamers may have a short-term effect. The most effective methods are trapping with euthanization or depredation with proper disposal of all remains.

6.3.3 Coyotes and Foxes

These animals are attracted to airfields by rodents, rabbits, and other food sources. Dens may be found in mounds, banks, culverts, and other suitable areas. Chain link fencing used for deer control will also be effective as long as it is securely attached to or buried in the ground. Rodent control may reduce the numbers of these animals. Use pyrotechnics to scare these animals supported by an aggressive depredation program.

6.3.4 Rabbits and Hares

In addition to the direct hazard to aircraft, these animals often attract raptors, coyotes, and foxes into the airfield environment. The only really effective control program for these animals is to initiate a poison bait station program along with an aggressive depredation program. All carcasses should be removed from the airfield environment and properly disposed.

6.3.5 Bats

Data shows that bats make up a significant number of aircraft strikes. Bats are usually observed and struck during the evening when leaving the daytime roosts and during the night while hunting for insects. Bats also roost in buildings, airfield structures, under the bark of trees, rocky areas, and caves. Control of bat colonies is best accomplished by locating the daytime roosts and eliminating or modifying the structures. Many of these roosts have been found inside the large stormwater drainage culverts running under the airfield complex. Many bat species are federally protected and special permits may be required. Bats are often observed feeding near lights that attract insects and over water. Reducing or changing the type of lighting near the active airfield may reduce bat usage the airfield. Removal of open water near the airfield can also decrease bat usage near the active runway.

6.3.6 Rodents (Squirrels, Woodchucks, and Rats)

Rodents are the primary food source for many for the larger species of birds and mammals that present the real threat to aircrews and aircraft. Control of these animals is best performed through the installation's Pest Management Program. Control may include poison and traps. Depredation of the larger rodents (i.e. woodchucks, nutria) is recommended.

6.4 Reptiles

6.4.1 Snakes, Alligators, and Turtles

Although rarely struck by aircraft, reptiles have been reported to the NSC. A large alligator can present a serious problem to the landing gear of an aircraft. Other smaller reptiles are a threat when wrapped up into landing gear or tossed into the air by landing gear. Reptiles should be looked for during airfield sweeps and if found returned to their habitats. Care should be taken since some snakes are venomous.