FINAL
Biological Hazard Abatement Plan
Non-Time-Critical Removal Action for Polychlorinated Biphenyl (PCB) Contamination at
Installation Restoration (IR) Site 29, Hangar 1
Former Naval Air Station (NAS) Moffett Field, Moffett Field, California

Submitted to:
U.S. Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310
PERMAC Contract No. N62473-08-D-8816
Contract Task Order 0005

Submitted by:
AMEC Earth & Environmental, Inc.
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Document Control No. AMEC-8816-0005-0086

May 2011

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
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MAY 18 2011

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Dear Ms. Clarke and Ms. Beegle:

SUBJECT: BIOLOGICAL HAZARD ABATEMENT PLAN, NON-TIME-CRITICAL REMOVAL ACTION FOR POLYCHLORINATED BIPHENYL CONTAMINATION AT INSTALLATION RESTORATION SITE 29, FORMER NAVAL AIR STATION MOFFETT FIELD, MOFFETT FIELD, CALIFORNIA

The Department of the Navy is pleased to transmit the Biological Hazard Abatement Plan, Non-Time-Critical Removal Action for Polychlorinated Biphenyl Contamination at Installation Restoration Site 29. This document is being provided for informational purposes.

If you have any questions, please contact Mr. Bryce Bartelma, Project Manager at (619) 532-0975.

Sincerely,

SCOTT D. ANDERSON
BRAC Environmental Coordinator
By direction of the Director

Enclosure: (1) *Biological Hazard Abatement Plan, Non-Time-Critical Removal Action for Polychlorinated Biphenyl Contamination at Installation Restoration Site 29, Former Naval Air Station Moffett Field, Moffett Field, California, May 2011*

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FINAL

BIOLOGICAL HAZARD ABATEMENT PLAN FOR NON-TIME-CRITICAL REMOVAL ACTION FOR POLYCHLORINATED BIPHENYL (PCB) CONTAMINATION AT

Installation Restoration (IR) Site 29, Hangar 1 Former Naval Air Station (NAS) Moffett Field
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May 2011

Installation Restoration Site 29, Hangar 1 Former Naval Air Station Moffett Field
Moffett Field, California

Prepared for:

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1455 Frazee Road, Suite 900
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Prepared by:  18 May 2011

Michael Henry, PhD — Date
AMEC Earth & Environmental, Inc.
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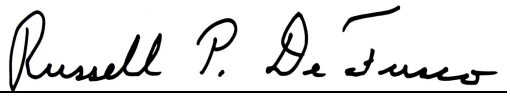
Reviewed by:  18 May 2011

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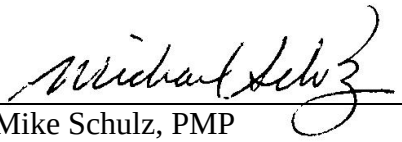
Approved by:  18 May 2011

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Project Manager

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ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
AMEC	AMEC Earth & Environmental, Inc.
ARC	Ames Research Center
ATC	Air Traffic Control
BASH	Bird/Wildlife Aircraft Strike Hazard
BHAP	Biological Hazard Abatement Plan
CANG	California Air National Guard
CDFG	California Department of Fish and Game
CNDDB	California Natural Diversity Data Base
NASA	National Aeronautics and Space Administration
Navy	[United States] Department of the Navy
PCB	polychlorinated biphenyl
PERMAC	Performance-Based Environmental Restoration Multiple Award Contract
RA	removal action
USDA	United States Department of Agriculture
USGS	United States Geological Survey

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1.0 INTRODUCTION

AMEC Earth & Environmental, Inc. (AMEC) has prepared this Biological Hazard Abatement Plan (BHAP) in support of the non-time-critical removal action (RA) for Hangar 1, which will be completed under the Department of the Navy (Navy) Naval Facilities Engineering Command Southwest Performance-Based Environmental Restoration Multiple Award Contract (PERMAC) No. N62473-08-D-8816, Contract Task Order 0005. This BHAP has been prepared to supplement the Work Plan for this RA (AMEC 2010a).

1.1 Purpose of this Plan

Implementation of the RA at Hangar 1 requires mitigation of wildlife-related hazards to human health during field activities as well as mitigation of hazards to aircraft operations during both construction and post-construction periods. This report discusses:

1. Species present in the project area,
2. Methods for investigation of biological hazards,
3. A summary of biological survey results,
4. A summary of potential biological vectors present,
5. A summary of existing Bird/Wildlife Aircraft Strike Hazard (BASH) Plans prepared by the National Aeronautics and Space Administration (NASA) and California Air National Guard (CANG) for Moffett Federal Airfield,
6. Methods for wildlife hazard mitigation that were eliminated from further consideration during the screening process,
7. Recommendations to minimize wildlife hazards during and after RA activities,
8. Detailed methods for wildlife hazard mitigation.

1.2 Project and Description

The objective of the RA is to mitigate known polychlorinated biphenyl (PCB) contamination at Hangar 1, thereby reducing the potential for impacts on human health and the environment from these materials. This objective will be accomplished through the implementation of RA Alternative 10, “Remove Siding and Coat Exposed Surfaces,” identified and evaluated in the Engineering Evaluation/Cost Analysis dated 30 July 2008 (Department of the Navy [Navy] 2008a). Alternative 10 was selected as the recommended alternative, as documented in the action memorandum issued by the Navy’s Base Realignment and Closure Program on 31 December 2008 (Navy 2008b).

The RA objectives will be accomplished by:

- Abatement of asbestos-containing materials and demolition of interior offices and shops inside the hangar,
- Removal and disposal of the hangar roof and siding materials which contain PCBs,
- Overcoating of the remaining steel structure with an epoxy coating to encapsulate the existing coatings that contain PCBs, and
- Washing and decontaminating the concrete slab.

At completion of the RA, the hangar slab and coated steel frame will remain. The building owner (NASA) will be responsible for any redevelopment of the hangar, and for a time the hangar frame may not have siding.

1.3 Property Description

Hangar 1 is on the western edge of the Moffett Federal Airfield within the NASA Ames Research Center (ARC). It is surrounded by Moffett Federal Airfield to the east and developed/disturbed lands to the north, west, and south. The NASA ARC/Moffett Federal Airfield staff is responsible for ensuring that Aircraft Movement Areas and other lands controlled by NASA, including vegetation and drainage, are managed to minimize bird and wildlife attractants. The mowing regime in place substantially reduces the abundance of insects, voles, mice, ground squirrels, and jackrabbits, which in turn reduces the prey base for predatory birds such as loggerhead shrikes (*Lanius ludovicianus*), American kestrels (*Falco sparverius*), peregrine falcons (*Falco peregrinus*), red-tailed hawks (*Buteo jamaicensis*), red-shouldered hawks (*Buteo lineatus*), northern harriers (*Circus cyaneus*), and burrowing owls (*Athene cunicularia*). The abundance of grassland nesting birds, such as western meadowlarks (*Sturnella neglecta*), horned larks (*Eremophila alpestris*), and ring-necked pheasants (*Phasianus colchicus*) is also reduced via these methods.

The area surrounding Moffett Federal Airfield also contains numerous features that are inherently attractive to a variety of birds and other wildlife and also potentially hazardous to nearby flying operations. Most notable is the extensive estuarine environment of the adjacent San Francisco Bay National Wildlife Refuge. Fresh water ponds, brackish water, salt marsh, and extensive tidal mud flats all attract a wide variety and large number of birds at the ends of the Moffett Field runways. Nearby parks and golf courses such as the Shoreline, Sunnyvale and Golf Course at Moffett Field attract resident and migratory geese, gulls, and other species.

2.0 METHODS

To obtain information on the species present or potentially present near Hangar 1, a records search and field biological surveys were completed as described below.

2.1 Records Search

A records search was conducted to identify special-status (as well as non-special-status) biological resources known from the vicinity of Hangar 1. The records search included:

- California Department of Fish and Game's (CDFG) California Natural Diversity Data Base (CNDDB) RareFind Application, Version 3.1.0. This review included all elements within the Mountain View United States Geological Survey (USGS) 7.5-minute quadrangle.
- *Pre-Draft Biological Assessment (Wildlife) for West-Side Aquifers Treatment System Diversion at Moffett Federal Airfield* (Foster Wheeler Environmental Corporation 2002).
- Appendix F: "Burrowing Owl Habitat Management Plan," from the *NASA Ames Development Plan, Final Programmatic Environmental Impact Statement* (Design, Community & Environment 2002).
- 129th Rescue Wing BASH Plan 91-212 for Moffett Federal Airfield (CANG 2006).
- *Wildlife Hazard Management Plan* (NASA 2009).

2.2 Data Collection

To determine the extent and types of wildlife currently occupying or visiting Hangar 1, three bird surveys were conducted on 28 to 29 January 2010, 22 February 2010, and 14 to 15 April 2010. The April surveys included inspection of the upper levels of Hangar 1 to identify nesting sites. Baited traps were also set on 28 January 2010 to survey the small mammal fauna. Detailed descriptions of the methodology and results of these surveys are provided in Final Biological Survey Letter Report (AMEC 2010b), and all species detected are included in Appendix A of this report.

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3.0 RESULTS

All wildlife species detected during the surveys were recorded in field notes and are included in Appendix A.

3.1 Records Search

Review of the CNDDB provided numerous occurrences of multiple special-status species present in the Mountain View USGS quadrangle (CDFG 2010). Aside from northern harrier, burrowing owl, pallid bat, and hoary bat, all the species recorded prefer coastal or salt marsh habitats, neither of which are at or near Hangar 1. Northern harriers may nest and/or forage in the grasslands and fields between and around the Moffett Federal Airfield. Burrowing owls are known to be year-round residents (see Section 3.2.1). The pallid bat and hoary bat were recorded approximately 3 miles southwest of Hangar 1 in 1945 and 1990, respectively.

Review of the other documents (CANG 2006; Design, Community & Environment 2002; Foster Wheeler Environmental Corporation 2002; NASA 2009) revealed similar results regarding special-status species, but also contributed to the local understanding of wildlife potentially present near Hangar 1.

3.2 Birds

Individuals or sign of the following bird species were observed inside or directly adjacent to Hangar 1 during surveys (refer to Appendix A for a complete listing of species observed):

Raptors and Ravens:

- Common ravens (*Corvus corax*) – Occupied and unoccupied nest sites were inside Hangar 1, and individuals were on top of Hangar 1. The one occupied nest is no longer occupied and the inactive nests were removed with CDFG approval.
- Barn owls (*Tyto alba*) – Known to use raven nests, but none were observed inside Hangar 1. One individual was heard near Hangar 1.
- Burrowing owls (*Athene cunicularia*) – One individual was observed at a burrow 317 feet southwest of Hangar 1.
- Other raptor species such as American kestrel (*Falco sparverius),* red-tailed hawk *(Buteo jamaicensis),* turkey vultures *(Cathartes aura)* – Observed near Hangar 1.

Swifts and Swallows:

- White-throated swifts (*Aeronautes saxatalis*) – Individuals were observed flying inside Hangar 1 and were heard roosting behind clamshell doors. The clamshell doors were inspected and no nests were found. Older nests appear to have been destroyed by common ravens, and no nesting was observed.
- Cliff swallows (*Petrochelidon pyrrhonota*) – Abandoned nest sites were found in Hangar 1. All inactive nests were removed with CDFG approval. One individual was observed flying the entire perimeter of Hangar 1, as near as 20 or 30 feet.

House Finches and Rock Pigeons:

- House finches (*Carpodacus mexicanus*) – One was observed inside Hangar 1, and one was observed on the rooftop of Hangar 1.
- Rock pigeons (*Columba livia*) – None were observed, but the framework of Hangar 1 showed much evidence (droppings, feathers) of past occupation.

Other Birds:

- European starlings (*Sturnus vulgaris)* – Observed adjacent to Hangar 1.

3.3 Mammals

Canids:

- Scat and tracks in Hangar 1 were abundant from coyote (*Canis latrans*), feral/domestic dogs (*Canis familiaris*), and gray fox (*Urocyon cinereoargenteus*) and/or red fox (*Vulpes vulpes*).

Rodents:

- Rodent droppings were not observed. On a previous visit (12 January 2010), a black-tailed jackrabbit (*Lepus californicus*) was observed in Hangar 1. California ground squirrels (*Spermophilus beecheyi)* occur near Hangar 1, and a detached tail of an individual was found inside Hangar 1.

Bats:

- Neither bats nor evidence of bat occupation (e.g., roosts and/or maternity sites) were observed.

4.0 BIOLOGICAL VECTORS

A biological vector is a carrier that transfers a pathogen from one host to another, thus spreading a disease. Infectious agents that could potentially be carried or facilitated by biological vectors present at or near Hangar 1 include the fungal infections cryptococcosis and histoplasmosis, the viral infections hantavirus and rabies, bacterial infections plague and psittacosis, and the microorganisms that cause murine typhus and toxoplasmosis.

There is no evidence that wildlife species at Hangar 1 are biological vectors for these zoonotic diseases. The appropriate control measures for minimizing health risk from biological vectors are contained in the Accident Prevention Plan for this RA project (AMEC 2010c).

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5.0 EXISTING BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD PLANS

BHAPs, or their equivalent, have been prepared for Moffett Federal Airfield by NASA (2009) and CANG (2006) to establish recommended measures to minimize aircraft exposure to potentially hazardous wildlife while assuring compliance with wildlife and wetland conservation laws, ordinances, and regulations. The procedures that are currently being implemented by NASA and CANG are sufficient to account for any wildlife species displaced by and/or attracted to RA activities at Hangar 1. This BHAP has been prepared in part to supplement the existing NASA and CANG plans by providing additional mitigation measures that are specific to the Hangar 1 RA project. The contractor or agency responsible for implementing this BHAP will communicate with Air Traffic Control (ATC), CANG Safety and Operations, NASA Safety and Operations, Airfield Management, CDFG, and the United States Department of Agriculture (USDA), as appropriate, to keep these agencies informed of ongoing bird/wildlife monitoring activities, threats, and control and mitigation procedures.

A variety of strategies to reduce wildlife hazards to aircraft are currently practiced at Moffett Federal Airfield and implemented by NASA and CANG personnel, as well as USDA contractors (CANG 2006; NASA 2009). These measures focus primarily on managing vegetation on the airfield, eliminating perching sites, and minimizing food waste or scavenging opportunities. Measures specific to various animal groups include:

- Large mammals – Controlling vegetation, installing fencing, conducting active harassment, and controlling rodents, rabbits, and other food sources.
- Small mammals – Proper grass management, trapping, poisoning, and lethal removal.
- Turkey vultures (*Cathartes aura*) – Removing dead animals from the airfield to avoid attracting scavengers.
- Canada goose (*Branta canadensis*) – Steepening banks and removing vegetation along water bodies, avoiding grain crops and implementing active harassment especially to disperse resident geese that may attract migratory geese. Pyrotechnics are also used to disperse geese from the vicinity.
- Eagles – Managing/reducing perching sites and using pyrotechnics and radio-controlled airplanes. A feral cat management plan and a tree and ground squirrel management plan are being implemented.
- Raptors – Managing rodent populations, removing perches, and active harassment.
- Gulls – Managing food waste, maintaining grass height between 7 and 14 inches, harassment with pyrotechnics, and grasshopper control.

- Owls – Removing perch sites and controlling rodents.
- Burrowing owls – If necessary, a qualified wildlife specialist with expertise in burrowing owl management will band individual birds and passively relocate individuals from the airfield outside of the nesting season. Although CAANG and NASA include passive relocation as a potential strategy for managing burrowing owls, the owls also provide rodent control and it may not be necessary to utilize this measure at the Hangar 1 site.
- Ducks and other waterfowl – Risk reduction measures include vegetation, water depth, and channel slope management. Active harassment is conducted with additional efforts focused on the stormwater retention ponds.
- Shorebirds – Avoiding operations near large flocks, managing grass height, eliminating puddles, and steepening ditch banks.
- Pigeons and doves – Removing perches or installing deterrents.
- Crows and ravens – Managing grass height, removing known roosting sites, managing food waste, and employing bioacoustics and pyrotechnics.
- Grassland passerines – Maintaining a dense, uniform grass cover with grass height between 7 and 14 inches, eliminating broadleaf weeds and perching sites to discourage western meadowlarks, and seeding bare spots or coating with an oil-based cover to discourage horned larks.
- Swallows – Employing active harassment and washing mud nests when swallows are beginning to build them near the airfield.
- Blackbirds, brown-headed cowbirds (*Molothrus ater*) and European starlings (*Sturnus vulgaris*) – Maintaining grass height between 7 and 14 inches, controlling for seed-producing weeds and grain crops, eliminating roosting sites, and employing bioacoustics and pyrotechnics.
- Rodents – Using rodenticides and controlling food waste. Controlling California ground squirrels using firearms, fumigants, rodenticides, cage traps and conibear traps. Removing carcasses on the airfield as soon as possible to avoid attracting scavengers.

6.0 EVALUATION OF POTENTIAL PERMANENT CONTROL AND MITIGATION TECHNIQUES AT HANGAR 1

In developing this plan, several types of permanently installed, engineered techniques were considered as potential bird/wildlife control and mitigation measures at Hangar 1. The intent for these techniques would be to minimize or eliminate the need for on-going labor-intensive activities, as is required with active harassment or depredation. Although some of these techniques such as strobe lights and bio-acoustics can be useful in combination with active harassment or depredation, they are largely ineffective as stand-alone solutions. Therefore, most of these techniques were ultimately eliminated from further consideration after initial evaluations determined that they were ineffective, impractical, or too costly given the expected duration of deployment. The permanent measures that were considered are described in this section for information only. Those techniques that could be useful in combination with active harassment or depredation (e.g., bio-acoustics), are noted below and are included as components of the recommended control and mitigation measures described in section 7.0.

6.1 Plastic Owls

Plastic owls or rubber snakes do not work within the airfield environment. Birds and other wildlife become accustomed to these static units in a very short timeframe and recognize that they pose no threat (Navy 2010). Models of predators also sometimes attract rather than repel birds. For example, blackbirds and crows often mob owls or owl models.

6.2 Rotating Lights

All wildlife become accustomed to rotating lights as these units are currently found throughout the airport facility on existing airfield facilities and equipment (Navy 2010). For that reason, rotating lights are often ineffective even upon initial use. Strobe lights have been shown to have some effectiveness, but mostly at night. Active dispersal techniques such as use of pyrotechnics must be used in concert with lighting in order for this technique to have any long-term effectiveness.

6.3 Eye Spots and Balloons

Simulated eyes and balloons with eyes on them have a very short effective period. Similar to plastic owls or rubber snakes described above, animals quickly realize that they do not represent a real threat and ignore them. Balloons should also not be used since they can also become hazards to aircraft around the airport (Navy 2010).

6.4 Ultra-sonic Devices

Ultra-sonic (frequency >20,000 Hz) and ultra-high frequency devices have thus far proven ineffective in deterring wildlife from colliding with aircraft or from keeping birds from roosting or nesting inside hangar facilities (Navy 2010). In addition to the usual issues with acclimation to stimuli with no biological relevance, most birds are unable to hear sounds at ultra-sonic frequencies, rendering these systems useless. These devices are not, therefore, recommended for use around the airport facility.

6.5 Netting

Though netting the superstructure of a hangar provides a long-term defense against birds roosting inside the hangar, netting a structure of the size of Hangar 1 would be prohibitively expensive, especially if the netting would only be deployed for a short period of time before new siding is installed. In addition, netting may not prevent birds from roosting on top of the netting itself. Cost quotations were obtained from two different vendors for installation of netting on the Hangar 1 structure, and total cost for materials and installation exceeded $600,000. Removal and re-installation of the netting would be required periodically in order to inspect and touch up the coating on the hangar structure. Long-term maintenance with netting is required and any holes or access points through the netting must be repaired immediately. 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 (Navy 2010).

6.6 Bio-acoustic Devices

Bio-acoustics are the recorded distress and alarm calls of species to be dispersed. The calls are projected over a speaker system that may be mounted on the roof or through the window of a vehicle. Many of these types of devices are on the market and are advertised as effective in driving birds from hangar spaces. However, testing of several of these products has indicated that they are ineffective as a sole means of deterrent (Navy 2010). Although animals take longer to become accustomed to these distress and alarm calls than they do nuisance sounds, acclimation can still occur with many species within the course of weeks or months if the calls are not associated with another threat (e.g., pyrotechnics or depredation). Further, in order to be effective, bio-acoustic devices must be mounted on a vehicle and driven to where the birds are located, and is thus labor-intensive. The initial curiosity of gulls and other species toward such calls can also make these calls a potential initial attractant rather than deterrent. Bio-acoustic techniques are most effective when used in conjunction with other active harassment techniques, such as pyrotechnics, as described in section 7.2.3 below.

6.7 Spikes and Wiring

Installation of spikes and wiring on a hangar superstructure is not feasible due to the high materials and installation cost (Navy 2010). The least expensive type of spike is the polycarbonate type, which costs approximately $120 for a 50-foot segment. Materials costs for installing these spikes on the large and intricate beam structure of Hangar 1 would be in excess of $240,000, and installation would be expected to exceed $200,000. Significant additional labor costs would be incurred to remove the spikes when siding is replaced. Further, gluing the spikes on the hangar superstructure would potentially invalidate the warranty on the protective coating which will be applied to the hangar and will make inspection and maintenance of the coating more difficult.

6.8 Adhesive Materials

Sticky formulations in liquid or paste form are available to make birds uncomfortable when they alight on them, which encourage the birds to look elsewhere to perch or roost. However, all perching surfaces on the superstructure must be treated or the birds will move a short distance to an untreated surface. Further, these substances have not been demonstrated effective in studies conducted to date. Under normal conditions, the effective life of these materials is as little as 6 months, and dusty environments can substantially reduce the life expectancy. Once the material loses effectiveness, it is necessary to remove the old material and apply a fresh coat (Federal Aviation Administration 2005). Further, applying an adhesive formulation on top of the protective coating for the hangar superstructure would potentially invalidate the warranty for the coating and will make inspection and maintenance of the coating more difficult.

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7.0 RECOMMENDED CONTROL AND MITIGATION TECHNIQUES SPECIFIC TO HANGAR 1 RA ACTIVITIES

The following recommendations address wildlife hazards specific to the physical conditions of Hangar 1 during RA implementation, and the time following the completion of RA activities when the hangar steel structure has no siding or roof. The bare frame that will remain after the removal of contaminated siding materials may present a bird-perching attractant until new siding is installed. Because this will represent a new condition at Moffett Federal Airfield, it is likely that some species not observed as utilizing Hangar 1 (e.g., gulls) may begin to do so upon completion of RA activities. The following mitigation measures, adapted from the existing 129th Rescue Wing BASH Plan (CANG 2006) and Wildlife Hazard Management Plan (NASA 2009), are therefore designed with flexibility in mind and will serve to control bird/wildlife hazards during and after the completion of RA activities at Hangar 1. Detailed procedures for implementing these measures in the field are included in Appendix B. Ongoing bird/wildlife monitoring activities, incidents, and control and mitigation procedures will be communicated to ATC, CANG Safety and Operations, NASA Safety and Operations, Airfield Management, CDFG, and USDA, as appropriate, to keep these entities informed.

7.1 Control and Mitigation During RA Activities

7.1.1 Biological Monitoring and Nest Removal

Routine inspections will be conducted by a qualified biologist during RA field activities. The purpose of the inspections will be to identify potential nesting or roosting activities so that the appropriate measures can be taken to prevent active nesting in the hangar. Whenever practical, inactive nests and nest-building materials identified in the hangar will be removed..

7.1.2 Rodent Control

Bait stations, such as those currently used by airfield operations staff for burrowing rodents, can also be used to draw rodents in Hangar 1 to central locations for control. Zinc phosphide is a restricted material in California and its use in bait stations is limited. The contractor or agency responsible for BHAP implementation will acquire and renew any necessary permits for rodenticide use.

7.1.3 Large Mammal Control

The potential presence of large mammals in Hangar 1, such as foxes and coyotes, is best controlled by removing the attractive prey base (e.g., rodents) that can draw them to the site. NASA will be contacted if additional control measures are required, such as trapping

and relocation. NASA maintains contracts with USDA biologists who are qualified to perform relocation.

7.2 Control and Mitigation After Completion of RA

7.2.1 Biological Monitoring and Nest Removal

Routine inspections will be conducted by a qualified biologist after the completion of RA field activities. The purpose of the inspections will be to identify potential nesting or roosting activities so that the appropriate measures can be taken to prevent active nesting on the superstructure if this presents a BASH hazard. The frequency of inspections will be determined by the biologist to take into account nesting seasons and monitoring experience gained at the site. Due to the size of the Hangar 1 structure, inspections will be carried out using binoculars. Nest removal, if necessary, may require use of high pressure water jets attached to a boom, as is commonly used in cleaning and nest removals for large stadiums and statues.

7.2.2 Bird Control – Installed Deterrents

Effigies of dead birds in "distress" positions have been proven effective as deterrents for some species (e.g., vultures [Ball 2009] and crows [Avery *et al.* 2008]). Based on their commonalities with crows, effigies may be effective in deterrence of common ravens, which were observed perching on Hangar 1. However, effigies were not effective for other tested species (e.g., Seamons *et al.* 2007) and their use would have to be considered experimental. Therefore, effigies should only be used in combination with other forms of bird control, such as active harassment and depredation.

7.2.3 Bird Control – Active Harassment

Active harassment measures, if necessary, will be performed by the contractor or agency responsible for implementation of this BHAP. Pyrotechnic devices can be extremely effective in dispersing waterfowl, gulls, crows, shorebirds, starlings, and flocks of blackbirds. Gulls, starlings, crows, and blackbirds may also be dispersed using a combination of pyrotechnics and bio-acoustics.

A combination of frightening devices should be available for use whenever birds are present on the Hangar 1 structure. Primary among those are pyrotechnic devices that can be fired from 15-millimeter "starter" pistols, standard 12-gauge shotguns, or modified flare pistols. These devices project pyrotechnics many meters over flocks of birds. Skillful use of the devices can disperse birds from the field in desired directions. They produce a variety of loud sounds and explosions, bright flashes of light, and/or trailing smoke. Training for safely using the devices and coordination with the ATC tower is imperative.

Bio-acoustics are the recorded distress and alarm calls of species to be dispersed and successful application of these devices must ensure that species-specific calls are used. Birds will sometimes disperse upon hearing species-specific calls, but may come to investigate the source of the sound and can then be encouraged to leave using pyrotechnic devices.

Additional harassment techniques can be used to reinforce other measures. Radio-controlled model aircraft, falconry, dogs, remotely triggered gas cannons, water spray from high-pressure hoses, or other methods can also be effective supplements to other dispersal techniques. The use of these techniques with those listed above will make the overall effort much more successful and delay habituation to the combination of techniques. Ingenuity is encouraged in the active harassment program.

If necessary, the contractor or agency responsible for BHAP implementation will provide active harassment during off-duty and night hours. Occasional blasts of high-pressure air or water can be used to make hangars an undesirable roosting site. Such activity may be beneficial, in some cases, to prevent habituation problems that complicate efforts during regular operations.

7.2.4 Bird Control – Depredation

Trapping, poisoning, and shooting individuals or flocks of birds may be required to ensure airfield safety. Removal of nuisance birds will be conducted only by NASA, or NASA-contracted USDA personnel, who have the required training and maintain the appropriate depredation permit. Rock pigeons (domestic pigeons), European starlings, and house sparrows can be taken without a permit. Most other species require federal and state permits. Although no protected species are expected to be encountered nesting or roosting on Hangar 1, if such animals must be removed they may be trapped and relocated to another location, at the direction of USDA.

Depredation is a last-resort measure that may reinforce habitat management or active control efforts and is recommended when a severe hazard persists for several days. Trapping and relocation will be considered as a possible alternative to depredation when practical. However, lethal control may be necessary to reduce the long-term and persistent hazards posed by such birds as rock doves, European starlings, red-winged blackbirds, Canada geese, common ravens, American crows, or others. Leaving a dead bird or two exposed for a day or two following such efforts may also reinforce these techniques, though these must be placed well away from the operating surfaces and off the ground. Suspending a dead bird by the foot at sufficient height to discourage scavenging may be effective.

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APPENDIX A

WILDLIFE SPECIES OBSERVED DURING 2010 BIOLOGICAL SURVEYS HANGAR 1, MOFFETT FIELD, MOFFETT FIELD, CA

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APPENDIX A
Wildlife Species Observed During 2010 Biological Surveys
Hangar 1, Moffett Field, Moffett Field, CA

AVES	BIRDS
Cathartidae	**New World Vultures**
Cathartes aura	Turkey Vulture
Accipitridae	**Hawks, Kites, Eagles, Allies**
Buteo jamaicensis	Red-tailed Hawk
Falconidae	**Caracaras, Falcons**
Falco sparverius	American Kestrel
Charadriidae	**Lapwings, Plovers**
Charadrius vociferus	Killdeer
Columbidae	**Pigeons, Doves**
Columba livia	Rock Pigeon
Zenaida macroura	Mourning Dove
Tytonidae	**Barn Owls**
Tyto alba	Barn Owl
Strigidae	**Typical Owls**
Athene cunicularia	Burrowing Owl
Apodidae	**Swifts**
Aeronautes saxatalis	White-throated Swift
Tyrannidae	**Tyrant Flycatchers**
Sayornis nigricans	Black Phoebe
Sayornis saya	Say's Phoebe
Corvidae	**Crows, Jays**
Corvus brachyrhynchos	American Crow
Corvus corax	Common Raven
Alaudidae	**Larks**
Eremophila alpestris	Horned Lark
Hirundinidae	**Swallows**
Petrochelidon pyrrhonota	Cliff Swallow

APPENDIX A
Wildlife Species Observed During 2010 Biological Surveys
Hangar 1, Moffett Field, Moffett Field, CA

Paridae	**Chickadees, Titmice**
Poecile sp.	Chickadee
Troglodytidae	**Wrens**
Thryomanes bewickii	Bewick's Wren
Turdidae	**Thrushes**
Turdus migratorius	American Robin
Sturnidae	**Starlings**
Sturnus vulgaris	European Starling
Parulidae	**Wood-Warblers**
Dendroica coronata	Yellow-rumped Warbler
Icteridae	**Blackbirds**
Sturnella neglecta	Western Meadowlark
Fringillidae	**Fringilline and Cardueline Finches, Allies**
Carpodacus mexicanus	House Finch
MAMMALIA	**MAMMALS**
Leporidae	**Rabbits, Hares**
Lepus californicus	Black-tailed Jackrabbit
Sciuridae	**Squirrels**
S*permophilus beecheyi*	California Ground Squirrel
Geomyidae	**Pocket Gophers**
Thomomys bottae	Botta's Pocket Gopher
Canidae	**Wolves, Foxes, Coyote**
Canis familiaris	Feral/Domestic Dog
Canis latrans	Coyote
Vulpes vulpes	Red Fox
Urocyon cinereoargenteus	Common Gray Fox
Felidae	**Cats**
Felis catus	Feral Cat

APPENDIX B

PROCEDURES FOR IMPLEMENTING CONTROL AND MITIGATION MEASURES (ADAPTED FROM NASA 2009)

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APPENDIX B

PROCEDURES FOR IMPLEMENTING CONTROL AND MITIGATION MEASURES (ADAPTED FROM NASA 2009)

Detailed procedures for implementing the control and mitigation measures discussed in Section 7.0 are provided below. An Activity Hazard Analysis (AHA) will need to be prepared for each of these activities before they are initiated. Preparation and approval of AHAs is discussed in the project Accident Prevention Plan (AMEC 2010c). Approved AHAs will be maintained on-site with the APP.

B.1 Pyrotechnics

B.1.1 Operation

1. Contact the Moffett Ground ATC tower on trunking radio before using shotguns or launching any pyrotechnics. The tower will let you know if there is airborne or ground traffic.
2. Move as close to bird/flock as possible.
3. Load the pistol once you are as close as possible by first loading the primer, then the screamer or banger (pyrotechnic round) taking care to put the fuse end toward the barrel.
4. Point the pistol over the bird/flock at a 45-degree angle, with arm fully extended, and fire.
5. If the pyrotechnics fail to fire, hold the barrel down range away from other people and equipment for 30 seconds before attempting to remove the pyrotechnic round.
6. If bird/flock moves to land nearby, immediately approach the flock and repeat the procedure.
7. Use combinations of screamers and bangers.
8. Store unused pyrotechnics in a secure, cool dry place and rotate stock frequently.
9. Do not shoot pyrotechnics towards the CANG aircraft parking ramp, any active hangar, road, or the airfield fence, if within 1,000 feet of these features. If it is necessary for safety reasons to shoot pyrotechnics toward these areas, contact Moffett Ground ATC tower to coordinate. Do not use pyrotechnics in the direction of personnel within 1,000 feet. (Note: Due to the location of Hangar 1, these criteria will be difficult to meet effectively, so coordination with ATC will be required).
10. Clean up all debris (e.g., wildlife, shell casings, etc.) and dispose of in accordance with health and safety, and environmental requirements.

11. Contact the Moffett Ground ATC tower on trunking radio at completion of the operation and announce that operation is complete.
12. After exiting the area, contact Base Operations and let them know that your operation is complete.

B.1.2 Pyrotechnics Safety

1. Always use ear and eye protection.
2. Do not shoot at the ground.
3. Be aware of dry grass and brush.
4. Have a fire extinguisher nearby.
5. Use firearm safety at all times.
6. Use only devices designed for the pyrotechnic device.

B.1.3 Potential Problems

1. Habituation – If these controls are used too often, the birds will become used to the noise.
2. Fire hazards – Rounds exploding near the ground during dry conditions may present a fire hazard.
3. Personnel safety hazards – These hazards must be addressed in an approved AHA.

B.2 Bioacoustics

B.2.1 Operation

1. Distress calls may be broadcasted from a vehicle equipped with a mounted speaker that can produce 30 to 50 watts of distortion-free sound in 90 to 100 decibel (db) with a frequency response between 12,000 and 14,000 Hertz (Hz).
2. Try to identify the bird species you wish to disperse and use that species' distress call. However, a variety of calls may be tried to determine the most effective selection for a particular pest. Some bird species do not respond to distress calls.
3. Drive your vehicle as close to the bird flock as possible and stop the vehicle before playing the distress call. Birds need to identify the source of the disturbance before they can react. The vehicle should be no more than 200 meters away from the flock when playing the distress call.
4. Play the distress call for 10 to 15 seconds.
5. If birds respond with mobbing behavior (coming towards the speaker), disperse with pyrotechnics. Repeat distress call.

6. Do not continue to play the tape for more than 15 seconds and do not play more frequently than three times in one hour.

B.2.2 Potential Problems

1. Habituation - If these controls are used too often, the birds will become used to the noise.
2. Mobbing - Birds may attack the speakers. However, this mobbing behavior presents an opportunity to supplement deterrence with pyrotechnics, which increases effectiveness.

B.3 Propane Cannons

B.3.1 Operation

1. Set up in appropriate area.
2. Use remote transmitters or a timer to fire cannons. It is typically best to fire the cannons at dawn or dusk when birds begin to congregate.
3. Move the cannons to locations where birds congregate regularly.
4. Do not operate the cannon continuously.
5. Use in combination with other control methods.
6. Always wear ear and eye protection.

B.3.2 Potential Problems

1. Habituation - If the cannon remains in one place too long or fires on a schedule, birds will become habituated to it.
2. Fire hazards - Do not set up the cannons in dry, grassy areas; the cannons must be mounted 3 to 4 feet above any vegetation.

B.4 Traps

B.4.1 Operation

1. Use traps designed for the targeted species of wildlife.
2. Check mammal traps daily and immediately remove any trapped wildlife. Follow regulations for disposal of carcasses.

B.5 Firearms

1. Use firearms only when wildlife is not responsive to harassment techniques, to reinforce harassment techniques and when a severe hazard exists.
2. All personnel will have appropriate training and appropriate personal protective equipment (e.g., eye protection, hearing protection).
3. A depredation permit from the United States Fish and Wildlife Service for migratory birds must be on file and in possession while conducting depredation activities.
4. Contact the Moffett Ground ATC tower on trunking radio before using firearms to control birds. The tower will advise if there is airborne or ground traffic.