Wildlife Hazard Management Plan

AFCO AvPORTS Management LLC
(As Agent of Planetary Ventures, LLC)
Moffett Field, California 94035-1000

WILDLIFE HAZARD MANAGEMENT PLAN

Rev 2014

MOFFETT FEDERAL AIRFIELD
NASA AMES RESEARCH CENTER, CA

Submitted_____ Date: _____

Airport Director, AvPORTS

Acronyms and Abbreviations

AC	Advisory Circular
AFB	Air Force Base
AFSC/SEFW	Air Force Safety Center/Safety Flight Wildlife
AO	AvPORTS Airport Operator
AOA	Airport Operations Area
APD	Ames Policy Directive
APR	Ames Procedural Requirements
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
BASH	CA ANG Bird/Wildlife Aircraft Strike Hazard
BRAC	Base Realignment and Closure
BWHC	Bird/Wildlife Hazard Conditions
CA ANG	California Air National Guard
CDFW	California Department of Fish and Wildlife
CDC	Centers for Disease Control and Protection
CFR	Code of Federal Regulations
DOD	Department of Defense
DOI	Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMD	NASA Environmental Management Division
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FPEIS	Final Programmatic EIS
FOD	Foreign Object Debris
HHS	Department of Health and Human Services
IAP	International American Products
IPM	Integrated Pest Management
KNUQ	ICAO Identifier for Moffett Federal Airfield

KNUQ/MFA	Moffett Federal Airfield at NASA Ames Research Center
KSJC	Mineta San Jose International Airport
KSFO	San Francisco International Airport
MFA	Moffett Federal Airfield at NASA Ames Research Center
MIMP	Mitigation Implementation and Monitoring Plan
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NADP	NASA Ames Development Plan
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOTAM	Notice to Airmen
NWHC	National Wildlife Health Center
ROD	Record of Decision
RWOCB	Regional Water Quality Control Board
USAF	United States Air Force
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WHMP	Wildlife Hazard Management Plan for PV Property at MFA
WS	Wildlife Services

Historical Record of Revisions to Precedent Plan

Change Number	Entered By	Date Entered
10/05	RW, Code Q, & TJ	10/26/2005
7/07	USDA, Code JO	7/6/2007
7/07-1	Code JO	7/12/2007
8/07	Code JO	8/21/2007
8/07-1	Code JO	8/28/2007
3/08	Code QE &JO	3/25/2008
4/08	Code JO	4/1/2008
4/08-1	Code JO	4/7/2008
10/08	Code JO & QE	10/9/2008
07/09	Beegle	7/2/2009
09/2012	Beegle	9/27/2012
09/12	Williams	09/12/2013
11/13	Hoffman	11/15/2013
10/14	AvPORTS Airport Director	10/01/2014

This plan, the new "Wildlife Hazard Management Plan" is being established by AFCO AvPORTS Management LLC (As Agent of Planetary Ventures, LLC) for Moffett Field, California 94035-1000 by the ground lessee of Moffet Field and shall be effective upon the date of such transfer. The plan adopts and incorporates elements of the wildlife hazard management plan in place at the time of the leasehold interest transfer of the property to the ground lessee, including revisions listed above.

Table of Contents

PREFACE

The purpose of this Wildlife Hazard Management Plan (WHMP) is to establish guidelines to minimize aircraft exposure to potentially hazardous wildlife while assuring compliance with wildlife conservation laws, regulations, Federal Executive Orders (EO), and Planetary Ventures, LLC (PV) policies and procedural requirements, and any applicable National Aeronautics and Space Administration (NASA) Ames Research Center policies and procedural requirements. This plan is not intended to cover every contingency that may arise or every rule of safety and good operating practice. The rules, procedures, and guidelines in this plan are to be considered as minimum standards. This plan should be used in conjunction with other governing directives, regulations, and procedures. This plan supersedes prior editions.

This plan is prepared in accordance with the guidelines established by the Federal Aviation Administration (FAA) for commercial air carrier airports under the provisions of Title 14 Code of Federal Regulations (CFR) Part 139.337.

When the need arises, special instructions or waivers will be issued by the AO and any other affected directorate or agency concerned. Special instructions will be supplemental to this plan and will be considered as standard operating procedures. In due course, special instructions will either be incorporated into this WHMP or canceled. Deviations or waivers from this WHMP are authorized in emergencies or in situations where flight or ground safety might otherwise be compromised. Written documentation of deviations is required and must be transmitted to the AO no later than 10 calendar days following any deviation from these guidelines.

This WHMP may be revised by new editions or updated by page changes or pen-and-ink corrections. When corrections or page changes are entered, the changes shall be annotated on the Record of Revisions page.

Comments and recommendations concerning this WHMP are encouraged and should be submitted to the AO. Extra copies of this WHMP can are obtained from the AO.

INTRODUCTION

Moffett Federal Airfield at NASA Ames (KNUQ/MFA)is a restricted use Federal airfield owned by the National Aeronautics and Space Administration (NASA) that is leased to PV as of [October 1, 2014] (PV Property) (Map 2), and operated by AFCO AvPORTS Management LLC (AvPORTS) as PV's agent its Airport Director, Airport Operator (AO) to meet the needs of PV, NASA, the California Air National Guard (CA ANG), other Resident Agencies, and other NASA Ames Research Center (NASA Ames) authorized users. The Navy, and at various times other military services, managed the airfield as a military airfield from the 1930s when Congress established the Naval Air Station (NAS) at Moffett Field in 1933 until 1994 when the Navy transferred ownership to NASA following a 1992 Base Realignment and Closure Act (BRAC) decision.

The FAA and the United States Air Force (USAF) have documented wildlife aircraft strike data nationally in the FAA National Wildlife Strike Database and the USAF wildlife strike database. The airfield and the California Air National Guard (CA ANG) have compiled data for wildlife strikes at KNUQ/MFA. Prior to the 1994 BRAC transfer, the Navy had compiled bird-strike data for KNUQ/MFA at NASA Ames.

Because the CA ANG is one of the primary tenants on the airfield and has developed a Bird/Wildlife Aircraft Strike Hazard (BASH) Plan similar to the NASA Ames Wildlife Hazard Management Plan, the AO reviewed both FAA guidance and USAF and Department of Defense (DOD) guidance. The USAF and DOD, of which the Air National Guard Bureau and CA ANG are entities therein, have signed several agreement documents with the U.S. Fish and Wildlife Service (USFWS) and other agencies regarding wildlife and wetlands conservation and hazard management. These include: the 2003 "Memorandum of Agreement (MOA) Between the Federal Aviation Administration, the U.S. Air Force, the U.S. Army, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture to Address Aircraft-Wildlife Strikes" and the 2006 "Memorandum of Understanding (MOU) Between the U.S. Department of Defense and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds." The 2003 MOA incorporates the FAA Advisory Circular (AC) 150/5200-33, Hazardous Wildlife Attractants on or Near Airports, which was updated August 28, 2007. The USAF has since revised its guidance as USAF Pamphlet 91-212, Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques (Feb. 1, 2004).

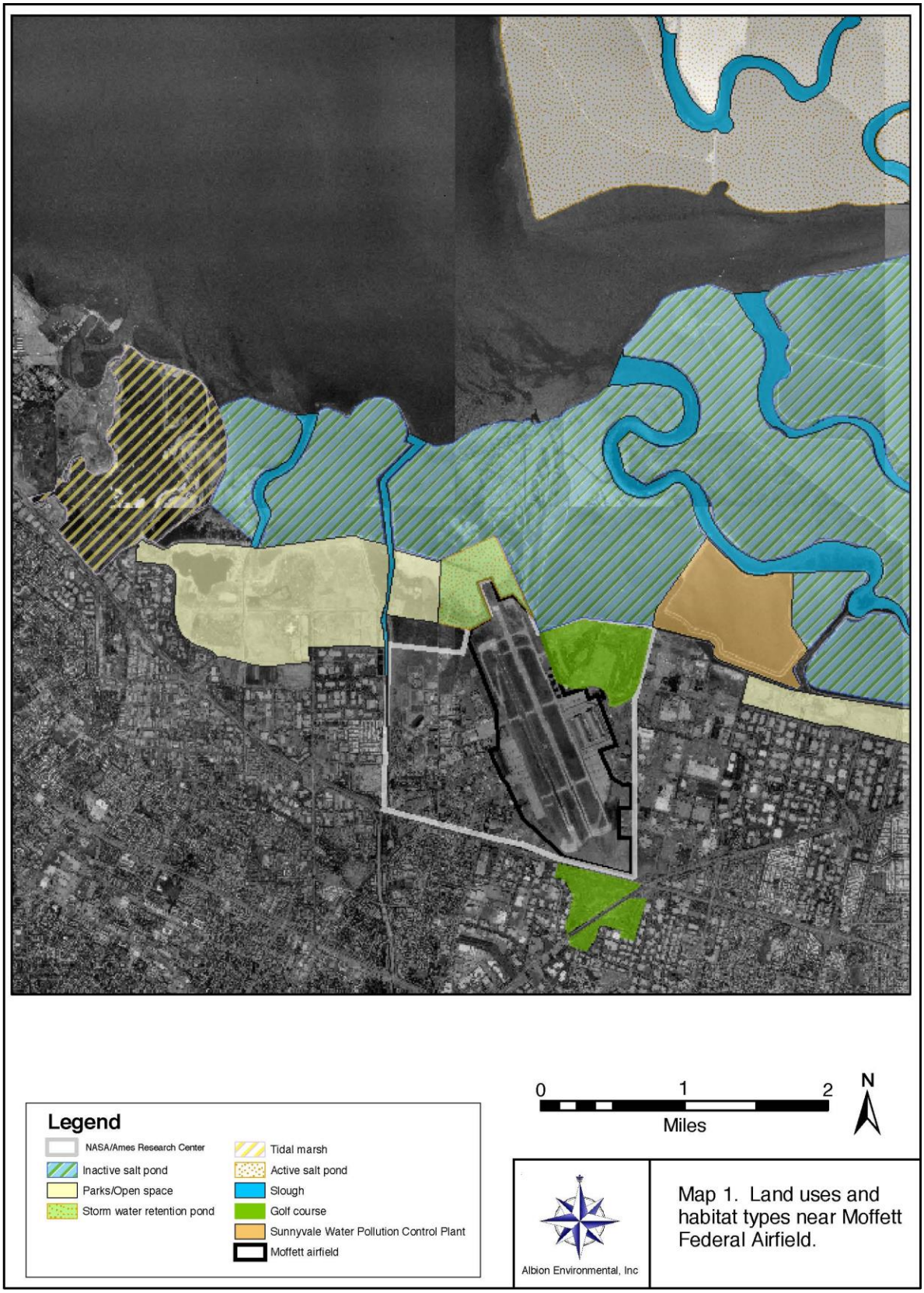
Historically, the NASA Ames Airport Management Office, in consultation with the NASA Ames Environmental Management Division (EMD), and upon review of wildlife strike data for airfields nationwide and at KNUQ/MFA and FAA and USAF guidance documents for managing wildlife risk to aircraft, have established that a potential for moderate to severe wildlife hazard exists at KNUQ/MFA.

The primary risks at KNUQ/MFA are associated with the airfields historic location in a grassy upland ecosystem adjacent to wetlands in the Pacific Flyway and with human activity at and in the vicinity of the airfield which attracts mammals, large bodied birds, and flocking birds posing severe to moderate risk of damage to aircraft and adverse effects on flight (Map 1).

In light of these risks, the NASA Ames Airport Management Office and EMD implemented a variety of measures to reduce wildlife risk to aircraft at the airfield since the Navy transferred the airfield to NASA in 1994. Examples include habitat management and an active harassment program. Prior to the Navy's transfer, the Navy leased the unpaved areas of the airfield to a

farmer who cultivated the land planting a variety of crops including, for example, oats, following the list of approved crops for use at airfields by the FAA to reduce wildlife hazards to aviation (AC 150/5300-13, *Airport Design*). Prior to establishment of the airfield by the Navy in the 1930's, the land was managed as part of a 500,000 acre ranch.

PV and AvPORTS have adopted and, through the United States Department of Agriculture (USDA) Wildlife Services, are actively implementing appropriate measures in the PV Property and related areas to the PV Property. The PV Property includes the Golf Course at Moffett Field and portions of the Sunnyvale Municipal Golf Course that are managed by OB Sports (the "PV Golf Courses"). The purpose of this WHMP, therefore, is to establish recommended measures as guidelines to minimize aircraft exposure to potentially hazardous wildlife while assuring compliance with wildlife and wetland conservation laws, regulations, Federal Executive Orders (EO), PV policies and procedures, and any applicable NASA Ames policy directives (APD) and procedural requirements (APR).



Map 1. Moffett Federal Airfield at NASA Ames

Map 2. PV Property

1. WILDLIFE HAZARD ASSESSMENT

The FAA National Wildlife Strike Database provides information on the 119,917 reported wildlife strikes at airfields in the United States during the period 1990 through 2011 (FAA 2012). Data for strikes that caused damage to one or more aircraft or had an adverse effect on an aircraft's flight can be seen in Table 1. Using these data, FAA created a hazard ranking for different types of wildlife based on degree of damage to aircraft and effect on flight (see Table 2)

(FAA AC 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports, dated Aug. 28, 2007).

On a scale of 1 (lowest risk) to 100 (greatest risk), large mammals, such as deer (100), and large bodied birds, such as vultures (64), geese (55), eagles (41) and ducks (39) present the most severe risk to aircraft. Owls, which vary greatly by species from pygmy to great horned owls, were rated at 23 as a group. Flocking birds, such as gulls (24), pigeons (23), and doves (14) and grassy passerines, such as horned larks (17), meadowlarks (7), and swallows (4), present a moderate to severe risk. Crows and ravens were rated (16), kestrels rated a (9) and shorebirds rated a (10). In 2003, the FAA, USAF, U.S. Army, U.S. Environmental Protection Agency (USEPA), USDA, and USFWS signed the Memorandum of Agreement (MOA) referenced earlier to address aircraft-wildlife strikes based on these data.[1]

Table 1compiled from the FAA publication: Wildlife Strikes to Civil Aircraft in the United States 1990-2011, where identified wildlife groups or species that were involved in two or more strikes, which caused damage to one or more aircraft components. The data is for 1990-2011 and involves only civilian, U.S. aircraft.

Table 1.Nationwide civilian bird strikes

Birds	No. reported strikes
Loons	18
Grebes	12
Albatrosses/shearwaters	8
Tropicbirds	8
Pelicans	36
Cormorants	33
Anhinga	10
Frigatebirds	5
Herons/bitterns	80
Egrets	69
Storks	5
Ibises/spoonbills	6
Total waterfowl	1,679
Mallards	(151)
Canada geese	(677)
Total hawks, eagles, vultures	1,056

[1]The MOA between the FAA, USAF, U.S. Army, USEPA, USFWS, and USDA to Address Aircraft-Wildlife Strikes (2003) adopted the following definition of an aircraft-wildlife strike as when 1) a pilot reports than an aircraft struck 1 or more birds or other wildlife; 2) aircraft maintenance personnel identify aircraft damage as having been caused by an aircraft-wildlife strike; 3) personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife; 4) bird or other wildlife remains, whether in whole or in part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified; or 5) the animal's presence on the airport had a significant, negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal) (Wildlife Control Procedures Manual, Technical Publication 11500E, 1994).

Red-tailed	(230)
Turkey Vultures	(224)
Bald eagle	(61)
Falcons/caracaras	44
Gallinaceous birds (pheasants)	58
Cranes	44
Rails/gallinules	30
Shorebirds	101
Gulls/jaegers	1,282
Tern/kittiwakes	5
Pigeons/doves	422
Cuckoos	3
Owls	104
Nightjars	2
Swifts	6
Woodpeckers	5
Flycatchers	1
Larks	16
Swallows	25
Starlings/mynas	108
Crows/ravens	56
Jays/magpies	2
Wrens	1
Mimics	1
Thrushes	50
Waxwings	1
Vireos	2
Meadowlarks	20
Blackbirds/orioles	102
Tanagers	10
Finches	8
Sparrows	52
Towhees	1
House sparrow	3

Total known birds 5,566

Mammals

Flying mammals (bats)	
Microbats	6
Megabats	1
Terrestrial mammals	
Marsupials (Vir. Opossum)	1
Xenarthyras	1
Lagomorphs	7
Rodents	2

Carnivores	55
Artiodactyls	890
Perissodactyls	4
Total known mammals	**967**

Table 2. Ranking of 25 species groups as to relative hazard to aircraft (1=most hazardous) based on three criteria (damage, major damage, and effect-on-flight), a composite ranking based on all three rankings, and a relative hazard score. Data were derived from the FAA National Wildlife Strike Database, January 1990–April 2003.[2]

Ranking by criteria

Species group	Damage[4]	Major damage[5]	Effect on flight[6]	Composite ranking[2]	Relative hazard score[3]
Deer	1	1	1	1	100
Vultures	2	2	2	2	64
Geese	3	3	6	3	55
Cormorants/pelicans	4	5	3	4	54
Cranes	7	6	4	5	47
Eagles	6	9	7	6	41
Ducks	5	8	10	7	39
Osprey	8	4	8	8	39
Turkey/pheasants	9	7	11	9	33
Herons	11	14	9	10	27
Hawks (buteos)	10	12	12	11	25
Gulls	12	11	13	12	24
Rock pigeon	13	10	14	13	23
Owls	14	13	20	14	23
H. lark/s. bunting	18	15	15	15	17
Crows/ravens	15	16	16	16	16
Coyote	16	19	5	17	14
Mourning dove	17	17	17	18	14
Shorebirds	19	21	18	19	10
Blackbirds/starling	20	22	19	20	10
American kestrel	21	18	21	21	9
Meadowlarks	22	20	22	22	7
Swallows	24	23	24	23	4
Sparrows	25	24	23	24	4
Nighthawks	23	25	25	25	1

[2] Excerpted from the *Special Report for the FAA, "Ranking the Hazard Level of Wildlife Species to Civil Aviation in the USA: Update #1, July 2, 2003".* Refer to this report for additional explanations of criteria and method of ranking.

Many of the types of wildlife identified in the 2003 MOA and the FAA AC occur at KNUQ/MFA. USDA Wildlife Service has conducted yearlong assessments of wildlife hazards at and near KNUQ/MFA. The results of that survey are on file at the AO. Figure 1 displays data on observed wildlife at the airfield by calendar year. Species were broken into guilds of related behavior and threats to aviation. Waterfowl numbers were at their greatest in 2010 followed by starlings/blackbirds and songbirds. Waterfowl populations tended to increase during November to December and spike from January through February (Figure 2). European starling/blackbirds populations increase in midsummer as juvenile population arrives and in fall as more birds migrate into the area (Figure 3). Shorebird populations increased in the late summer and fall (Figure 4). Other species were present in relatively small numbers throughout the year, as one species declines another increases to take its place (Figure 5).

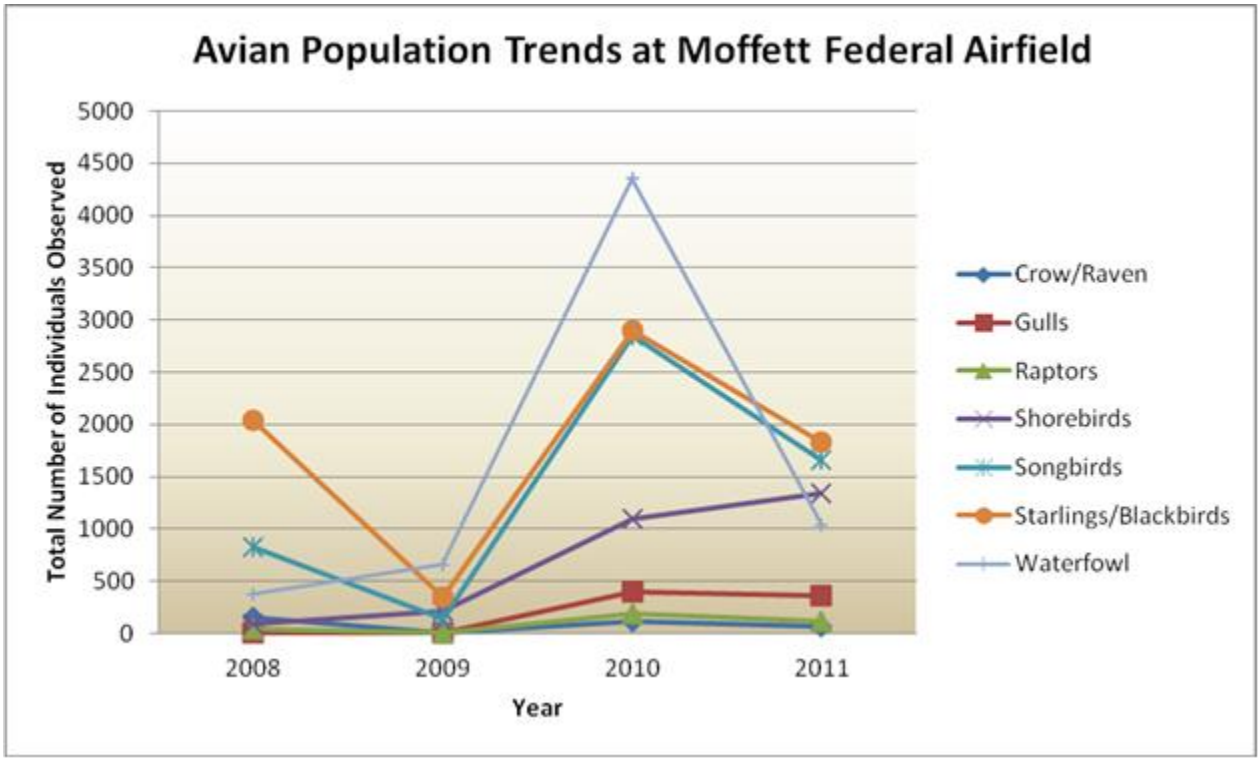


Figure 1. Avian Population Trends of guilds observed by calendar year, 2008-2011 (USDA 2011)

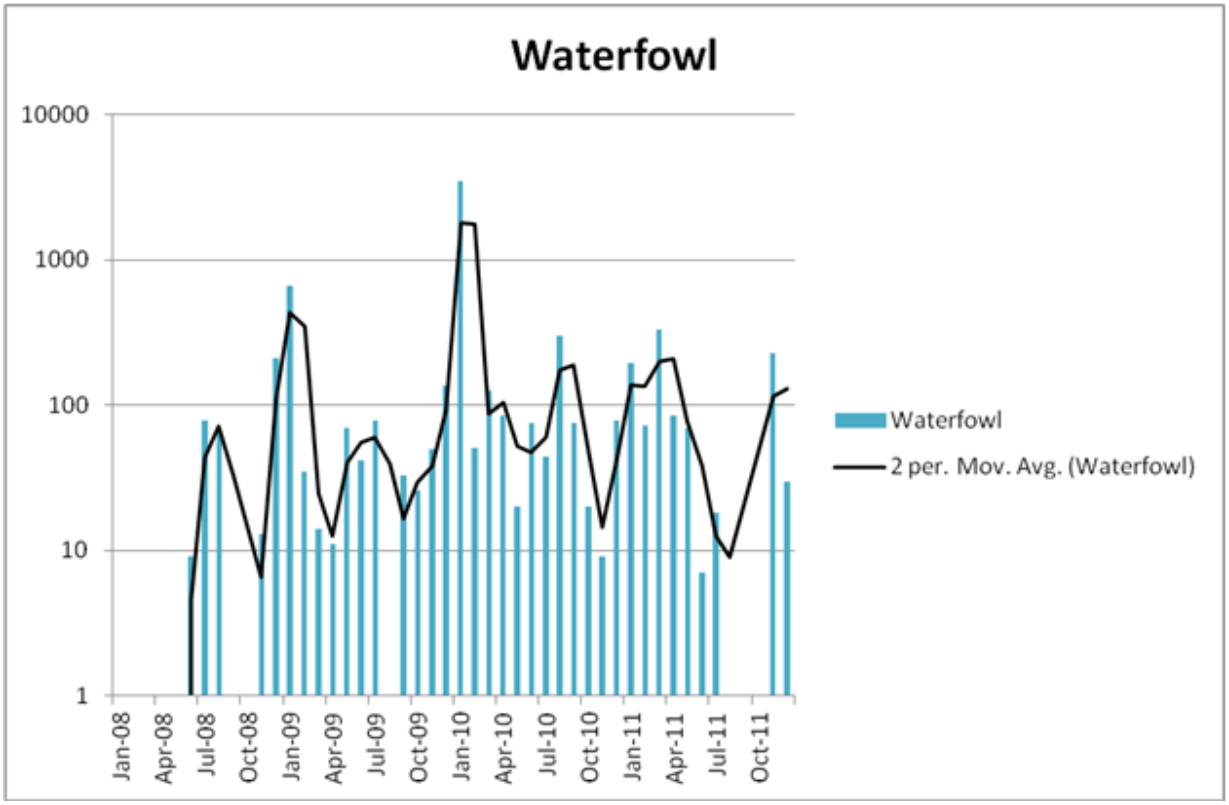


Figure 2. Waterfowl Population Trends observed by monthly calendar year, 2008-2011 (USDA 2011)

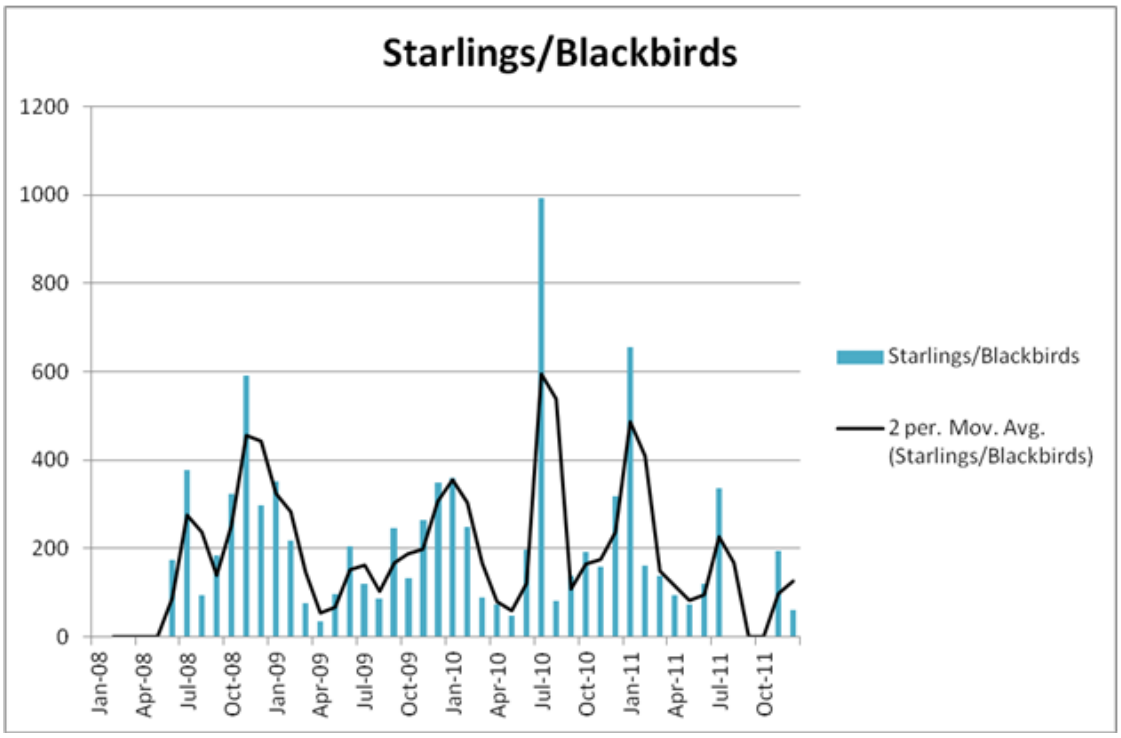


Figure 3. Starlings/Blackbirds Population Trends observed by monthly calendar year, 2008-2011 (USDA 2011)

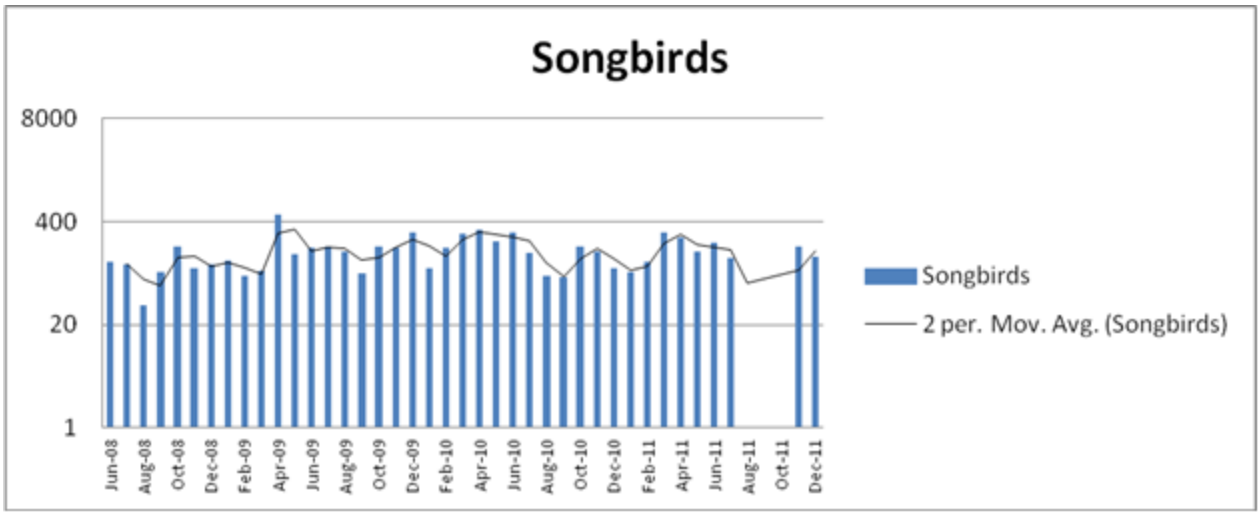


Figure 4. Songbirds Population Trends observed by monthly calendar year, 2008-2011 (USDA 2011)

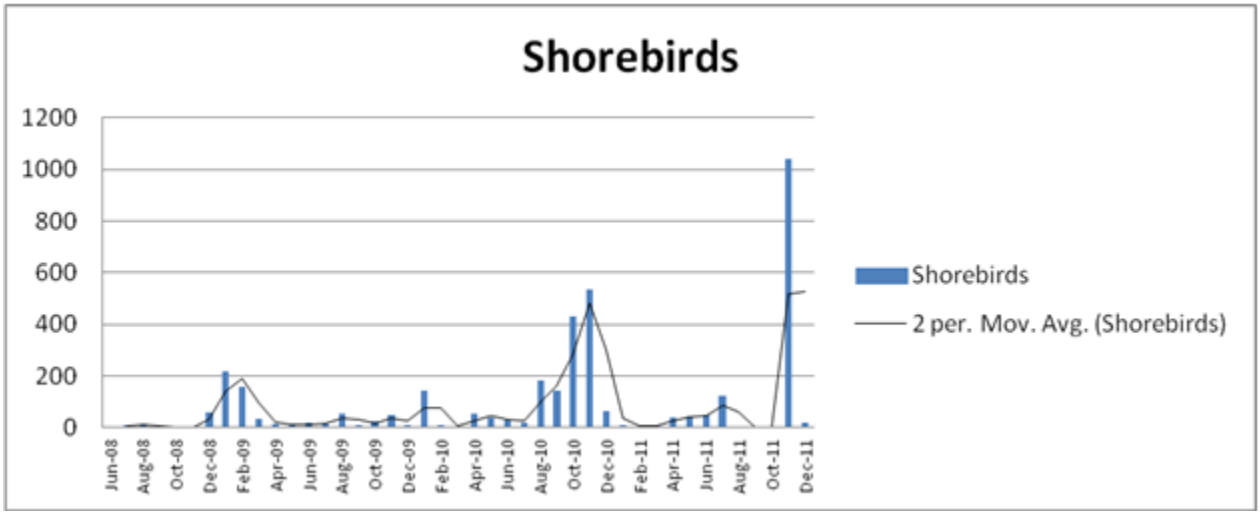


Figure 5. Shorebirds Population Trends observed by monthly calendar year, 2008-2011 (USDA 2011)

Table 3 depicts bird strikes at KNUQ/MFA as reported to the FAA and the USAF, Bird Aircraft Strike Hazard (BASH) Team, AFSC/SEFW, Kirtland AFB for the period from June 2000 through September 2012. Additional data from 1986 to 2004 are available in the Albion report (2004). Changing missions from Navy operations to NASA and resident agency operations at the airfield in 1994 have impacted reporting procedures. From 1986 to 1994, when the Navy operated the airfield, most bird aircraft strikes involved P-3's. Since 1994, when the Navy transferred the airfield to NASA, strikes have involved mostly C-130's. In most reports since 1994, the wildlife species is identified.

Table 3. Bird Aircraft Strike Data

Date	Aircraft	Time	Airspeed KIAS	Altitude AGL	Phase of Operation	Common Name	Notes
07-Jun-00	MC130P	1615	115	0	TAKEOFF	California Gull	FUSELAGE / ANTENNA / SKIN, PROPELLER, WING / ROTOR
07-Jun-00	MC130P	1345	110	0	GO-AROUND	Cliff Swallow	
13-Jun-00	MC130P	2041	210	1000	CRUISE LOW LEVEL	UNKNOWN	RADOME/NOSE, WINDSHIELD/CANOPY, WING/ROTOR
13-Jun-00	MC130P				UNKNOWN	Barn Swallow	
17-Jul-00	FXWG	1600			UNKNOWN	American Kestrel	AIRCRAFT INVOLVED IS NOT KNOWN. VMGR 352 HAD TWO C-130S DEPART JUST PRIOR TO THE BIRD BEING FOUND ON THE RUNWAY.
26-Jul-00	T-38A	0955	155	0	TAKEOFF	UNKNOWN	WILDLIFE FOUND ON RUNWAY
14-Oct-00	MC130P	1055	115	30	INITIAL CLIMB	Horned Lark	FUSELAGE / ANTENNA / SKIN
17-Oct-00	MC130P	750	115	0	TAKEOFF	Yellow-rumped Warbler	RADOME / NOSE
04-Jun-01	HC130N	1025	115	25	INITIAL CLIMB	California Gull	
14-Jun-01	FXWG	900			UNKNOWN	California Gull	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
19-Jun-01	C-5C	1930			UNKNOWN	UNKNOWN	FEATHERS AND BLOOD RETRIEVED FOR NOSE
25-Jun-01	FXWG				UNKNOWN	Cliff Swallow	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
11-Jul-01	FXWG	800			UNKNOWN	Cliff Swallow	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
15-Jul-01	MC130P	1110	100	5	LANDING	American Kestrel	
23-Oct-01	MC130P	1400	105	0	GO-AROUND	UNKNOWN	ECM PODS / PYLONS, RADOME / NOSE

Date	Aircraft	Time	Airspeed KIAS	Altitude AGL	Phase of Operation	Common Name	Notes
06-Nov-01	MC130P	1500			LANDING	Western Meadowlark	
20-Dec-01	MC130P	1515	105	0	GO-AROUND	UNKNOWN	PROPELLER
30-May-02	P-3C	1700	0	0	UNKNOWN	California Gull	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
11-Sep-02	UNKW				UNKNOWN	American Kestrel	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
11-Sep-02	UNKW				UNKNOWN	Mourning Dove	
01-Apr-03	MC130P	1630	180	UNKW	ENROUTE	Barn Swallow/ Swallow	RADOME / NOSE
28-May-03	MC130P	1815	100	0	GO-AROUND	California Gull	TAIL / STABILIZER / RUDDER
12-Nov-03	MC130P	2050	125	100	APPROACH-FINAL	Ring-billed Gull	FUSELAGE / ANTENNA / SKIN, OTHER (SPECIFY IN REMARKS)
08-Jan-04	MC130P	2215	109	300	APPROACH-FINAL	Perching Birds	FUEL TANKS, WING / ROTOR
10-Mar-04	C130T	1330	UNKW	UNKW	GO-AROUND	Red-tailed Hawk	PROPELLER - AIRCRAFT FROM VR-55
01-May-04	C130H	1015	100	0	TAKEOFF	UNKNOWN	RADOME / NOSE, OTHER (SPECIFY IN REMARKS)
22-Jun-04	HC130P	1500	130	0	LANDING	Rock Dove/Pigeon	OUTSIDE ENGINE NO. 4
10-Jul-04	FXWG	1200	UNKW	UNKW	TAKEOFF	Rock Dove/Pigeon	B-737 AIRCRAFT FROM VR-59 -- 20 INDIVIDUAL BIRD STRIKES INSIDE ENGINE NO. 1 AND ON LEFT WING.
11-Jul-04	MC130P	835	100	0	LANDING	Rock Dove/Pigeon	FUEL TANKS, FUSELAGE / ANTENNA / SKIN, INSIDE ENGINE NO. 2, INSIDE ENGINE NO. 3, LANDING GEAR, LIGHTS, OUTSIDE ENGINE NO. 2, OUTSIDE ENGINE NO. 3, PROPELLER, RADOME / NOSE, TAIL / STABILIZER / RUDDER, WINDSHIELD / CANOPY, and WING / ROTOR

Date	Aircraft	Time	Airspeed KIAS	Altitude AGL	Phase of Operation	Common Name	Notes
07-Oct-04	UNKW				UNKNOWN	Striped Skunk	FOUND DEAD ON 32R
15-Oct-04	UNKW				UNKNOWN	Barn Owl	TOWER REPORTED AN INJURED BIRD ON RUNWAY
21-Oct-04	MC130P	2200	120	100	TAKEOFF	California Gull	FUEL TANKS
08-Dec-04	MC130P	1900	140	300	APPROACH-FINAL	Western Meadowlark	FUEL TANKS, OUTSIDE ENGINE NO. 2
7-Nov-05	C130	1052	UNKW	UNKW	TAKEOFF	Western Meadowlark	CARCASS RECOVERED FROM 32R
14-Nov-05	UNKW				UNKNOWN	Burrowing Owl	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
29-Nov-05	C-130				UNKNOWN	Plovers	
27-Jun-06	C130H	1345	UNKW	UNKW	LANDING	Red-tailed Hawk	STRIKE SEVERED WING OF HAWK. RECOVERED FROM RUNWAY BY CODE Q.
27-Sept-06	C-130				UNKNOWN	Bat	
18-Oct-06	UNKW				UNKNOWN	Western Meadowlark	WILDLIFE FOUND ON RUNWAY (AIRCRAFT STRUCK UNKNOWN)
23-Oct-06	C130	1801	120	50	INITIAL CLIMB	Western Meadowlark	BIRD FLUIDS FOUND ON NO. 4 PROPELLER NASA PERSONAL FOUND CARCASS ON RUNWAY
03-Jan-07	UNKW				UNKNOWN	Mallard	WILDLIFE FOUND ON 32R OVERRUN (AIRCRAFT STRUCK UNKNOWN)
26-Feb-07	UNKW				UNKNOWN	Barn owl	MANGLED BIRD RECOVERED FROM 32R
03-Apr-07	C-130				UNKNOWN	Western Gull	
03-Apr-07	UNKW				UNKNOWN	Short-eared owl	TWO WINGS FOUND ON32R AT CHARLIE
21-May-07	UNKW				UNKNOWN	California Gull	WILDLIFE FOUND ON 32R JUST NORTH OF ALPHA (AIRCRAFT STRUCK UNKNOWN)
22-MAY-07	UNKW				UNKNOWN	California Gull	RECOVERED FROM 32L NEAR BRAVO (AIRCRAFT STRUCK UNKNOWN)

Date	Aircraft	Time	Airspeed KIAS	Altitude AGL	Phase of Operation	Common Name	Notes
01-JUN-07	UNKW				UNKNOWN	Barn owl	WILDLIFE FOUND ON 32R JUST NORTH OF ALPHA (AIRCRAFT STRUCK UNKNOWN)
12-JUN-07	MC-130P	1650	115	0	TOUCH & GO	UNKNOWN	
09-Jul-07	T-38C	1632	170	50	TAKEOFF INITIAL CLIMB	Barn Swallow	#2 ENGINE LOST ALL THRUST, MISSION TERMINATED, HEAVYWEIGHT SINGLE-ENGINE LANDING.
27-JUL-07	C-130	1430	130	30	LANDING FLARE/ROLL-OUT	UNKNOWN	SMALL BIRD IMPACT RIGHT SIDE OF FUSELAGE, BELOW COPILOTS SEAT.
02-AUG-07	UNKW				UNKNOWN	American Kestrel	WILDLIFE FOUND ON 32R ON SOUTH END (AIRCRAFT STRUCK UNKNOWN)
07-SEP-07	UNKW				UNKNOWN	Opossum	WILDLIFE FOUND ON 32R SOUTH OF CHARLIE (AIRCRAFT STRUCK UNKNOWN)
12-OCT-07	C-130				UNKNOWN	Hermit Thrush	WILDLIFE FOUND ON 32R AT 3,500 FT REMAINING SNARG TAKEN POST FLIGHT
03-NOV-07	B-767	1609			LANDING	UNKNOWN	SMALL FLOCK OBSERVED BY PILOT. NO DAMAGE AND NO REMAINS RECOVERED.
06-MAR-08	C-130				UNKNOWN	Western Gull	
24-APR-08	C-130				UNKNOWN	White-throated Swift	
29-APR-08	C-130				UNKNOWN	Cliff Swallow	
28-MAY-08	UNKW				UNKNOWN	Gadwall	
12-AUG-08	UNKW				UNKNOWN	Mexican Free-tailed Bat	
25-AUG-08	C-130				UNKNOWN	Black-tailed Jack Rabbit	

Date	Aircraft	Time	Airspeed KIAS	Altitude AGL	Phase of Operation	Common Name	Notes
21-SEPT-09	C-130				UNKNOWN	Mexican Free-tailed Bat	
18-NOV-09	C-130	1530			APPROACH-FINAL	Unknown Passerine	
13-APR-10	C-130	2000 - 2300			UNKNOWN	Mexican Free-tailed Bat	Low level and pattern work at Moffett
23-APR-10	Learjet	1805			UNKNOWN		32L
23-APR-10	C-130	1300			APPROACH-FINAL	White-throated Swift	Over Sunnyvale Golf Course
04-MAY-10	UNKW				UNKNOWN	Cliff Swallow	Found dead on 32R between markers 5/3
05-MAY-10	C-130	2200			UNKNOWN	Vesper Bat	Found blood on random
18-MAY-10	C-130				APPROACH-FINAL	Unknown Passerine	100 Foot Final Moffett
22-MAY-10	UNKW	1525			UNKNOWN	California Gull	Found dead 32R found dead after departure of C-5
17-AUG-10	C-130	1315			LANDING/ROLL	White-throated Swift	Found dead after report of strike 32R at 5 DRM
14-SEPT-10	C-130				UNKNOWN	Fox Sparrow	Found remains post flight local maneuvers
24-SEPT-10	C-130				UNKNOWN	Unknown Passerine	Found remains post flight local maneuvers in engines 2 & 3
30-NOV-10	UNKW				UNKNOWN	Mourning Dove	Found dead 32R at 1 DRM
09-JAN-11	UNKW				UNKNOWN	American Coot	Found dead on 32R
13-JAN-11	UNKW				UNKNOWN	Striped Skunk	Found dead 32R at 3 DRM
04-FEB-11	F-18	1555			LANDING/ROLL	Western Meadowlark	32L AC Reg. 110
14-APR-11	C-130				UNKNOWN	Cliff Swallow	Night maneuvers cracked leading edge of wing

Date	Aircraft	Time	Airspeed KIAS	Altitude AGL	Phase of Operation	Common Name	Notes
22-APR-11	C-130				UNKNOWN	Fox Sparrow	Found during post flight inspection
04-MAY-11	H-60G				UNKNOWN	Unknown	Found during post flight inspection; Lost sample
12-JUN-11	P-3C	1840			TAKEOFF	California Gull	32L at 3 to 4 DRM
13-JUL-11	C-130	1600			APPROACH-FINAL	Cliff Swallow	
26-JUL-11	UNKW				UNKNOWN	White-throated Swift	Found dead 32L CA ANG landing box
01-SEPT-11	UNKW				UNKNOWN	American Crow	Found dead on 32L
28-SEPT-11	C-130	1920			APPROACH-FINAL	Canada Geese	Struck over Sunnyvale Golf Course 200' 32R
24-JAN-12	C-130				UNKNOWN	Wilson's Snipe	Night maneuvers
24-JAN-12	UNKW				UNKNOWN	Barn Owl	Found dead on 32L
02-MAY-12	C-130				TAKEOFF	Red-tailed Hawk	
03-MAY-12	C-130				UNKNOWN	UNKNOWN	Night maneuvers
16-JUL-12	C-130	2225			LANDING/ROLL	Barn Owl	14R 4 DRM
15-AUG-12	Raytheon 390	1958			APPROACH-FINAL	Canada Geese	32R Carcass picked up off runway

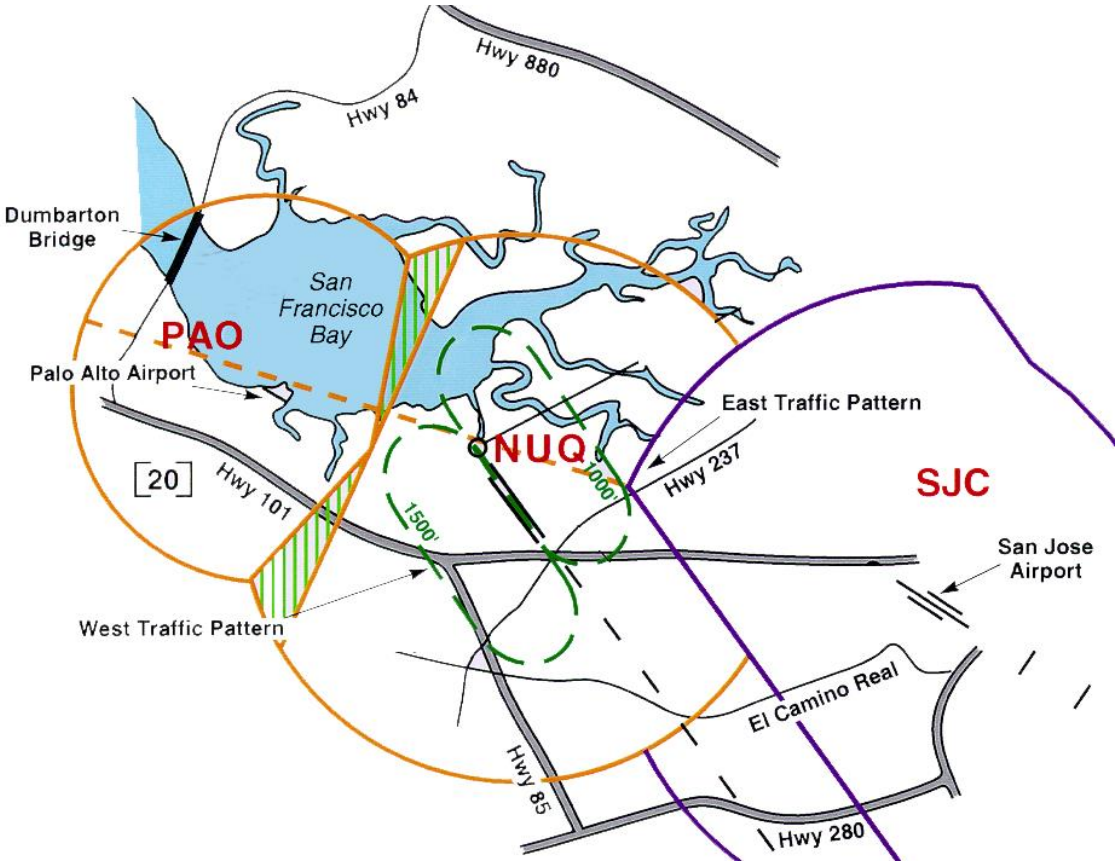


Figure 6. Regional Area

Although the data in Table 3 for July 2000 to September 2012do not indicate where each strike occurred, the data does in some cases indicate the phase when each strike occurred, e.g., landing, take-off, approach. Aircraft typically land at KNUQ/MFA at NASA Ames from the south heading north on the 32 heading and depart the airfield heading north, consistent with air traffic patterns around San Jose International Airport (KSJC), Palo Alto Airport (KPAO), and San Francisco International Airport(KSFO)(Figure 6).

Generally, more strikes are reported during landing phases of flight due to the shallow angle of landing profiles and the longer exposure of the aircraft to birds at lower altitudes (Table 4). However, using the flight phase information and not taking into account the strikes at unknown phases, the data indicate that strikes during takeoff and landing at KNUQ/MFA at NASA Ames were nearly equal. Given that strikes nationwide are typically lower during landing, this pattern suggests that there may be a relatively higher number of birds at that north end of the runways at the airfield. The north end of the runway is a much closer to the Bay, one of the PV Golf Courses at KNUQ/MFA, and wetland habitats on the airfield.

Table 4. Reported phase of flight at time of occurrence of wildlife strikes with civil aircraft, USA, 1990–2011 compared with KNUQ/MFA strikes 2000-2012.

	Nationally				KNUQ/MFA			
	Birds		Terrestrial mammals		Birds		Terrestrial mammals	
Phase of flight	22 year total	% of total known	22 year total	% of total known	12 year total	% of total known	12 year total	% of total known
Parked	55	<4	2	<1	0	0	0	0
Taxi	289	<1	38	2	0	0	0	0
Take-off Run	15,473	19	559	32	10	14	0	0
Climb	14,545	18	35	2	3	4	0	0
En Route	2,084	3	0	0	34	47	0	0
Descent	2,838	3	0	0	5	7	0	0
Approach	32,887	40	121	7	9	13	0	0
Landing Roll	13,940	17	933	57	11	15	0	0
Total known	**82,111**	**100**	**1,748**	**100**	**72**	**100**	**0**	**100**
Unknown	**34,297**		**1,006**		**41**		**8***	
Total	**116,408**		**2,754**		**113**		**8***	

*** Unknown mammal strikes included 2 striped skunks and 1 opossum found dead on runways**

The data during the period of June 2000 through September 2012 indicate that bird strikes tend to occur most often in April (10), May (13), June (13), July (11) and October (9). The most commonly struck identified birds during these months included: gulls (13), swallows (10), western meadowlarks (6), kestrels (4), and barn owls (4).

The FAA and USAF guidance documents further identify habitat conditions and human activities that tend to attract wildlife with known risks to aircraft. The major factor is associated with the airfield's geographic location in the South San Francisco Bay area and proximity to land uses attractive to hazardous wildlife (Map 1).

The airfield is located in a wetland to grassy upland ecosystem adjacent to the San Francisco Bay and within the Pacific Flyway. Flight patterns subject the airfield to seasonal hazards associated with migratory bird activity. The San Francisco Bay, associated wetlands, the Don Edwards San Francisco Bay National Wildlife Refuge, drainage channels, local storm water retention and water treatment ponds, and ponds at golf courses and parks located near the airfield attract

waterfowl, shorebirds and other wildlife. During winter months, rainwater pools on the airfield, attracting waterfowl and shorebirds. During periods of inclement weather, coastal birds may seek refuge inland at the airfield. The grassy areas provide habitat for a variety of wildlife, including small rodents such as mice and insects, which in turn provide prey for wildlife that are hazardous to aircraft. Trees and other types of structures provide perches for flocking birds and larger birds such as raptors.

Several golf courses and many parks are also located near the airfield and attract Canada geese and other wildlife. For example, one of the PV Golf Courses is located on a former landfill adjacent to the airfield, and Shoreline Golf Course is located nearby in the City of Mountain View. Across US 101 to the south of the airfield, at another of the PV Golf Courses, the City is paid to top trees to maintain the clear zone and support approach lighting systems to the south of the runway.

Artificial food sources, such as dumpsters, landfills, and artificial feeding stations also attract multiple wildlife species, which are hazardous to aircraft at their associated levels. Small mammals, such as rodents, feed on these food sources and in turn attract larger birds of prey and carnivores which present a significant hazard to aircraft. Dumpsters at KNUQ/MFA, if not kept covered, attract wildlife that is hazardous to aircraft. Two municipal solid waste landfills are located east near Milpitas and a smaller landfill is located north of the airfield, all of which are within the five-mile radius exclusion zone, prescribed by the FAA for land uses that have the potential to attract hazardous wildlife on or near airports (AC: 150\5200-33B).The city of Palo Alto operates the land fill to the north of the airfield while the City of Sunnyvale operates a trash recycling facility northeast of the airfield. These facilities attract thousands of gulls each year. Similarly, employee feeding of feral cats and pigeons, which has been prohibited at KNUQ/MFA, attracts wildlife that is hazardous to aircraft.

Current Wildlife Hazard Management

A variety of techniques to reduce wildlife hazards to aircraft are currently practiced at KNUQ/MFA and the wider PV Property at NASA Ames. These and FAA and USAF recommendations are described below by type of wildlife.

The AO, through the USDA Wildlife Services, is implementing an active harassment program. Active harassment is conducted for most species. A U.S. Fish and Wildlife Service depredation permit was obtained that allows the lethal take, as necessary, of numerous migratory bird species.

<u>Large Mammals</u>

Deer, Cougar, Coyotes, Fox: Among animals known to pose the greatest risk to aircraft due to size are deer. Nationally, deer are the most commonly reported wildlife struck (FAA 2012). In 2007, a deer was spotted at the north end of the airfield. An unverified mountain lion sighting as well as numerous coyotes has been reported. Grey and red foxes populations are regularly observed on the airfield. USAF guidelines recommend controlling vegetation (e.g., broad-leaf weeds, shrubs, and trees), installing fencing, conducting active harassment, and controlling rodents, rabbits, and other food sources. The number of large mammals at

the airfield is low to moderate, and no strikes have been reported at the airfield. Therefore, the AO is continuing to monitor the sightings.

Black-tailed jackrabbit: Black-tailed jackrabbits are common at the airfield. These large bodied hares present a hazard to aircraft and attract raptors that also present a high risk to aircraft. Black-tailed jackrabbits are the number one struck mammalian species in California (FAA 2012). For rabbits and hares in general, the USAF recommends proper grass management, trapping, poisoning, and lethal removal. The AO has contracted with USDA Wildlife Services who lethally remove jackrabbits when observed on the airfield. Black tailed jackrabbits are protected as a game species under California law; however, no permit is needed under California Department of Fish and Wildlife (CDFW) Code Section 4152.

Heavy-bodied Birds

Vultures: Heavy-bodied birds, such as vultures, are regularly observed at the airfield. Vultures are scavengers and often soar on mid-day thermals in search of food. The USAF recommends removing dead animals from the airfield to avoid attracting vultures.

Canada Geese: Geese, being large bodied, also pose a significant hazard to aircraft. Canada geese frequently occur on the airfield and at the PV Golf Courses. Geese are also utilizing nearby golf courses, wetlands, and parks and move among these sites. Aside from removing these land uses, the USAF recommends steepening banks and removing vegetation along water bodies, avoiding grain crops and implementing active harassment. There are two population classifications of Canada geese resident and migratory. A resident Canada goose is defined by USFWS as a Canada goose that nest and reside predominantly in the U.S. and do not have the characteristically long north/south migration patterns so common in the rest of the populations and species of Canada geese (USFWS FEIS 2005). The USFWS has issued regulations, guidance, and an Environmental Impact Statement on managing resident Canada geese. The CDFW has adopted the USFWS FEIS stance of controlling resident Canada geese (Section 503, Title 14, California Code of Regulations).

The AO, in conjunction with O.B. Sports, which manages the PV Golf Courses, uses pyrotechnics to disperse geese from the airfield and PV Golf Courses.

Eagles: Eagles, being large bodied, pose a risk to aircraft. Three individual golden eagles have been observed on the airfield. Eagles are active during the day and prefer feral cats and jackrabbits, but will prey on ground squirrels. An additional depredation permit is required from the USFWS to harass eagles. No lethal take is authorized under this permit. The USAF recommends managing perching sites and using pyrotechnics and radio-controlled airplanes. The AO has reduced perching sites and has employed an active harassment program. The AO has developed and is implementing a Non-Native Predator Trapping Program, focusing on feral cats, and the Burrowing Owl Habitat Management Plan, which covers the management of squirrel species as well.

Raptors: Other raptors in addition to eagles have been observed on the airfield and prey primarily on California ground squirrels, black-tailed jack rabbits, mice, insects, and snakes common to grassland environments. Red-tailed hawks and American kestrels are the most

common species seen. Red-tailed hawks are opportunistic feeders whose prey centers on rodents including mice and ground squirrels, but will prey on black-tailed jack rabbits, lizards, and burrowing owls (Preston et al. 1993, and Odell, pers. comm.). Kestrels, our smallest raptor, prey on insects, small rodents and birds (Preston et al. 1993). The USAF recommends managing rodent populations, removing perches and active harassment. The AO uses a variety of techniques to control ground squirrels and jackrabbits occurring on the airfield. The AO has developed and is implementing a plan to control squirrel species (contained in 2002 NASA Ames Development Plan Programmatic Final Environmental Impact Statement and Record of Decision). The AO has reduced perching sites, and the USDA is employing pyrotechnics. Problem raptors can be captured and relocated in accordance with the USFWS depredation permit and the CDFW code.

Gulls: According to the USAF Pamphlet 91-212, gulls pose the most significant bird strike hazard to aircraft worldwide. Gulls prefer flat, open ground and are omnivorous. Gulls are most active just after sunrise and before sunset. The USAF recommends managing food waste, maintaining grass height between 7 and 14 inches, harassment with pyrotechnics and grasshopper control. The USAF notes that establishing and maintaining a uniform cover of this type will be difficult without irrigation in drier climates. The AO is using a combination of tools (discing, herbicides, seeding, and mowing) to establish the recommended grass cover within the climate and resource constraints at the airfield. The AO, through the USDA Wildlife Services, is implementing an active harassment program using pyrotechnics to disperse gulls, and several MFA organizational units are implementing food waste management controls.

Owls: Most owls are nocturnal and prey upon rodents. Short eared owls and barn owls that occur at the airfield are nocturnal, feeding upon mice, voles, bats, insects, lizards, pigeons, and cats. The USAF recommends removing perch sites and controlling rodents. The USAF notes that owls, such as barn owls, hunting in hangars can drastically reduce pigeon populations. An FAA triggering bird strike, which requires completion of a new wildlife hazard assessment, occurred at the airfield with a flock of pigeons caused substantial damage to the aircraft. The AO has developed and is implementing a policy against feeding of feral cats and pigeons, a tree and ground squirrel management plan, a feral cat management plan, and a policy against leaving dumpsters open.

Western burrowing owls (*Athene cunicularia hypugaea*) are very small owls with long legs and a short tail (Preston et al. 1993).These owls are common residents in the western United States, occupying small mammal burrows, and hunting insects, reptiles, and small rodents, particularly in the early morning and late evening. Burrowing owls are considered a sedentary species (Thomsen 1971) and show strong fidelity to nest sites (Gervais et al. 2008). Burrowing owls prefer short, sparse vegetation with few shrubs (Haug et al. 1993). Individual owls generally forage within 600 meters of a nesting burrow (Gervais et al. 2008).

Western burrowing owls are a California Species of Special Concern because the CDFW has identified the species as being at risk of becoming listed under the California Endangered Species Act (California ESA). Therefore, the CDFW has issued guidance for giving greater consideration to its conservation, especially on public lands (see Memorandum on Staff Report on Burrowing Owl Mitigation, issued by the CDFW, October 17, 1995 superseded on

March 7, 2012, for use in reviewing projects). The western burrowing owl is also identified by the USFWS as a bird of conservation concern (USFWS 2008).

The USAF, in its guidance documents, recommends discouraging burrowing owls from taking up residency on airfields. Therefore, the AO in coordination with the USDA Wildlife Services, conducts surveys, bands individual birds, passively relocates individuals from the Airfield outside of nesting season with a priority on the safety zone and approaches, and constructs at least three artificial burrows in designated owl preserves and/or other available non-airfield habitat at MFA for each burrowing owl relocated in accordance with the Burrowing Owl Habitat Management Plan and all other relevant considerations including airfield safety. In addition, the airfield mowing is accomplished in a sequence to discourage burrowing owls from moving onto the airfield. Because owls prefer short grass, the owl habitat areas are mowed first, then mowing begins at the perimeter of the airfield working inward.

Burrowing owls will be generally managed according to the Burrowing Owl Management Plan in the NASA Ames Development Plan Programmatic Environmental Impact Statement and Record of Decision (2002).

Ducks and Other Waterfowl: Ducks and other waterfowl, which tend to be heavy bodied, pose a significant risk to aircraft. Risk reduction measures include vegetation, water depth, and channel slope management. Active harassment is conducted with additional efforts focused to the storm water retention ponds. NASA Ames, through the EMD, and in coordination with the AO, had been actively participating in the USFWS, Bay Conservation and Development Commission, and California Coastal Conservancy led South San Francisco Bay Salt Pond Restoration Project and in the Army Corps of Engineers led Shoreline Study for management of wetlands and water bodies to the north of the airfield. PV and AvPORTS will continue these efforts.

Flocking Birds

Shorebirds: Shorebirds pose a significant risk when occurring in large numbers or flocking in tight groups, particularly during migration and along coastlines. The USAF recommends avoiding operations in the vicinity of large flocks, managing grass height, eliminating puddles, and steepening ditch banks. At the airfield, pools of rainwater occur during the winter, particularly at the north end of the runways. This end of the runway has subsided in recent years. Further, several Federally designated seasonal wetlands occur toward the north end of the airfield. Toward the mid-field, the drain tiles may be broken. The AO has taken steps to improve drainage of the runways by halting the subsidence. The offices are also engaged with Federal, State and local agencies in assuring levees are adequate to protect the airfield from sea level (and associated ground water) rise. The AO has increased active harassment after heavy rainstorms. Further, NASA Ames through the Environmental Services Division, in coordination with the NASA Airport Management Office, actively participated in the USFWS, Bay Conservation and Development Commission, and California Coastal Conservancy led South San Francisco Bay Salt Pond Restoration Project and in the Army Corps of Engineers led Shoreline Study for wetlands and water bodies to the north of the airfield. PV and AvPORTS have continued these efforts.

Pigeons and Doves: Structures, such as fences, power lines, towers, and lights, at the airfield provide perches that attract birds, such as doves and pigeons. The USAF recommends reducing perches or installing deterrents. The AO has initiated efforts to control employee feeding of pigeons. The AO is reducing perches, largely by installing deterrents where feasible.

Crows and Ravens: Crows and ravens are medium bodied birds that can occur in large flocks. Crows and ravens are attracted to garbage and open, grassy areas for foraging. The USAF recommends managing grass height, removing known roosting sites, managing food waste, and employing bioacoustics and pyrotechnics. The AO is actively implementing controls to minimize waste food availability. The AO has an active harassment program.

Grassy Passerines: Among animals known to pose moderate risk to aircraft, grassland passerines, such as larks, are attracted to the grassy upland areas. The USAF recommendations include maintaining a dense, uniform grass cover, with grass height between 7 and 14 inches, eliminating broad leaf weeds and perching sites to discourage meadowlarks, and seeding bare spots or coating with an oil base cover to discourage horned lark use. The USAF notes that maintaining this type of grass cover, especially a uniform cover, will be very difficult in the Southwest without irrigation, and therefore also recommends persistent use of pyrotechnics. The AO has been implementing vegetation management and is experimenting with different seed and mowing regimes. The AO, through the USDA Wildlife Services, is also implementing an active harassment program.

Swallows: Although the USAF considers swallows generally good at avoiding aircraft, the USAF recommends employing active harassment and washing mud nests with the support of the airfield fire department when swallows begin to build them near the airfield. The AO is implementing an active harassment program.

Blackbirds, cowbirds, and starlings: These species occur at KNUQ/MFA and are considered particularly hazardous because they tend to flock in large numbers. The USAF recommends maintaining grass height between 7 and 14 inches, controlling for seed-producing weeds and grain crops, eliminating roosting sites, and employing bioacoustics and pyrotechnics. The AO is experimenting with different types of seed and mowing regimes. The AO is reducing roosting sites, and through USDA Wildlife Services, is also implementing an active harassment program.

Rodents

Rodents, such as mice, rats, and squirrels, provide a prey base for a variety of wildlife species, including raptors, coyotes, and fox that are hazards to aircraft. The USAF recommends using rodenticides and controlling food waste. The AO has been implementing an integrated pest management plan and controlling food waste disposal.

The AO is controlling California ground squirrels at the airfield using firearms, fumigants, rodenticides, cage traps and conibear traps. Carcasses on the airfield are removed as soon as possible to avoid attracting scavengers such as vultures.

The salt marsh harvest mouse (*Reithrodontomys raviventris*), which occurs in the northern part of the Center where pickleweed (*Salicornia spp*.) occurs, is protected as an endangered species under the Federal Endangered Species Act. NASA, in the 2002 NADP FPEIS and ROD, adopted mitigation measures for these species. The AO is continuing these mitigation measures for these species. Although no salt harsh harvest mice have ever been found on the airfield, fumigating, rodenticide application and discing are not performed within or near known habitat.

Vegetation

The Airfield slopes from low, often wet ground near the Bay to a grassy upland toward the south (U.S. Highway 101). Portions of the Airfield between the runways were at times covered in asphalt and concrete. In the past, the Navy engaged a farmer to maintain some of the areas outside the taxiways in oat and tomato production. More recently, the AO has mowed the established non-native grasses periodically during the growing season. Local practice would recommend increasing active harassment during and immediately after mowing, and spot seeding bare patches.

The USAF generally recommends maintaining grass height at 7 to 14 inches and limiting operations at sunrise and sunset when insect-eating birds are foraging. (Tall, large bodied birds, such as cranes, and fringillids (e.g., sparrows, finches, grosbeaks, and buntings) may be attracted to grass >14 in.) The USAF notes that such an effort without irrigation may be difficult. Further, grass management may create other hazards. Disturbance may increase the risk of invasive, broad-leafed weeds that may attract grasshoppers and thus also insect-eating birds, such as gulls, that pose a moderate to severe hazard to aviation. Without irrigation, bare patches may occur where seeds collect that have not germinated. These seeds are then exposed as a food source that may attract wildlife hazardous to aircraft.

At KNUQ/MFA, mowing and other vegetation management techniques must avoid impacting the salt marsh harvest mouse (*Reithrodontomys raviventris*), protected under the Endangered Species Act, and the associated pickleweed (*Salicornia spp*.), which occur to the north and northwest of the airfield. Mowing and other vegetation management techniques in burrowing owl nesting habitat preserves must likewise be consistent with the 2002 NADP FPEIS and ROD.

Discing and rolling, chaining or tamping is used to level the airfield and provide a suitable seedbed for revegetation. Tamping or rolling is recommended by the USFWS to reduce ground squirrel intrusion. Compliance with storm water management, archeological resource, plant conservation, and wetland laws, regulations, EO's, and APDs and APRs is required during these activities. Federal and California Clean Air Act requirements for air permits and conformity determinations (with the State Air Quality Implementation Plan) may be also required.

The storm water management system at MFA is regulated by a Regional Water Quality Control Board (RWQCB) permit. The AO will prepare and submit a Notice of Intent with

the requisite per acre fees to the RWQCB in coordination with EMD. The RWQCB requires seeding within a specified number of days.

To avoid adversely impacting archeological sites, the AO must coordinate with NASA in advance. If artifacts, including for example human bones, are discovered, the AO must immediately cease disturbance and notify NASA.

Federally designated seasonal wetlands occur in northern areas of KNUQ/MFA and are regulated by the USEPA and U.S. Army Corps of Engineers under the Federal Clean Water Act, EO 11990, Protection of Wetlands (May 24, l977, 42 FR 26961), EO 11988, Floodplain Management (May 24, 1977, 42 FR 26951), and NASA regulations at 14 CFR subpart 1216.2. Wetlands are defined in terms of soil and vegetation. NASA, in the 2002 NADP ROD, committed to maintaining these wetlands. PV and AvPORTS continue this commitment. Maps and other information can be obtained from the AO.

EO 13112, Invasive Species, and the Federal Noxious Weed Act of 1974 require agencies to avoid introducing or spreading invasive species, such as black mustard (*Brassica spp.*), and especially noxious weeds, such as yellow star thistle, (*Centaurea solstitalis L.)*, Black mustard and yellow star thistle; all of which are known to occur in disturbed areas at or in the vicinity of MFA. The AO, in coordination with the USDA, is avoiding the spread of these invasive species. Native species are encouraged but non-natives that are non-invasive and not noxious may also be maintained.

Summary

Risk		**Action**
General		AO maintains USFWS depredation permits.
		Provide MSDS for approval prior to chemical use.
		Follow Health and Safety procedures.
Mammals		
	Deer	Sightings are rare. Continue to monitor.
	Coyote	Sightings are rare. Continue to monitor.
	Mountain lion	Sightings are rare. Continue to monitor.
	Fox (grey and red)	Sightings are sporadic; lethal removal on airfield as necessary.
	Black-tailed jackrabbit	Continue lethal removal on airfield as necessary.
	Ground squirrels	Continue lethal removal using firearms, fumigants, rodenticides, cage traps and body griptraps.
Large bodied birds		
	Canada geese	Continue active harassment and lethal removal as necessary.
		Continue to coordinate with O.B. Sports, local golf courses, parks, and airfields.
	Vultures	Remove carcasses on the airfield as they are

		discovered.
		Continue active harassment and lethal removal as necessary.
	Golden eagle	Continue active harassment under USFWS Eagle Depredation Permit (which does not permit lethal removal).
		Implement lethal removal of squirrels and jackrabbits on the airfield.
	Hawks, large owls (e.g., Barn Owls)	Continue active harassment.
		Manage small mammal populations, including assisting Integrated Pest Management Plan, Feral Cat Management Plan and food waste and solid waste management regulations.
		Trap and relocate as necessary.
		Lethal removal will be considered if the relocated raptor returns to the airfield or if relocation efforts are unsuccessful.
	Cranes	Continue to maintain grass between 7" to 14".
		Continue active harassment and lethal removal as necessary.
	Gulls	Continue to implement active harassment and lethal removal as necessary.
		Implement grasshopper control.
	Ducks and other waterfowl	Continue to coordinate with U.S. Fish and Wildlife Service to manage vegetation and water depth.
		Continue to implement active harassment and lethal removal as necessary.
Flocking birds (not large bodied)		
	Shorebirds	Continue to repair drains.
		Continue to participate in the implementation of the South Bay Salt Pond Restoration Project and Army Corps of Engineers Shoreline Study EIS.
		Continue to implement active harassment and lethal removal as necessary.
	Pigeons	Continue to enforce no feeding requirement.
		Continue to further reduce availability of perches.
		Continue to implement active harassment and lethal removal as necessary.
	Doves	
		Implement mowing two to three times per growing season.
		Conduct additional harassment during and immediately following mowing.
		Continue to reduce availability of perches.

		Continue to implement active harassment and if active harassment is ineffective, lethal removal as necessary.
	Grassy passerines	Same as for doves.
	Crows and ravens	Manage trees near airfield.
		Continue to implement food waste and solid waste regulations.
		Continue to implement active harassment and lethal removal as necessary.
	Blackbirds and Starlings	Continue to implement active harassment and lethal removal as necessary.
		Use humane traps to control as necessary.
		Continue to reduce availability of perches.
Burrowing owls		General: Continue to assure consistency with 2002 NADP FPEIS and ROD Mitigation Implementation and Monitoring Plan (MIMP).
		Participate in protocols for avoiding the taking of burrowing owls during implementation of baiting, fumigation, etc.
		Remove dead squirrels at least once daily during rodenticide use.
		Install at minimum 3 artificial burrows in owl preserves or in non-airfield owl habitat for every burrow closed if it is determined that this would improve habitat conditions.
Vegetation		
		Continue to assure application of pesticides, herbicides and other agricultural practices is consistent with 2002 NADP FPEIS and ROD, including the Biological Assessment for endangered species under the ESA.
		Check for known archeological sites and during disturbance if artifacts are discovered, cease mowing and discing and notify the NASA Cultural Resources Manager immediately.
		Place weed free bales of straw, waddles or covers around storm drains and protect light fixtures.
		Submit Notice of Intent to disturb the soil (e.g., by discing) and associated per acre fees to Regional Water Quality Control Board (RWQCB) in coordination with EMD.
		Continue to coordinate with EMD to determine if air permits or conformity analyses will be required.

		Coordinate mowing schedule with NASA so that the mowing is done in sequence; first the owl habitats, then landscaped areas, with the airfield mowed last and mowed starting at the perimeter working inwards. Mow as required during growing season to maintain vegetation height.
		Increase active harassment during and immediately after mowing.
		Avoid use of heavy equipment on wet ground.
		Do not fill federally designated seasonal wetlands.
		Consider using geotechnical fabric.
		Consider using biodiesel in grounds maintenance equipment.

2. FAA APPROVAL

FAA approval for this plan is not required. This management plan will become effective upon approval by AvPORTS Airport Director.

3. AUTHORITY

The following shall be designated as having responsibilities in bird and wildlife control at the PV Property at Moffett Federal Airfield:

Program Authority

Airport Operator

Program authority for assuring aviation safety and implementing the Wildlife Hazard Management Plan at KNUQ/MFA at NASA Ames is the responsibility of the AO.

The AO will consult mission support organizations for their expertise in wildlife and related issues and to assure compliance with Federal, State, and local laws, regulations, and EOs, and PV, NASA and NASA Ames policies and procedural requirements. The AO in consultation with PV must then complete any required National Environmental Policy Act (NEPA) documentation.

The AO will obtain any necessary regulatory approvals and permits and assure compliance, e.g., with the storm water system permit, air permits, hazardous materials and hazardous waste permits in coordination with EMD. (Permits to apply herbicides, rodenticides, fungicides, and other pesticides must be obtained by the applicator and approved by the AO before use.)

In addition, the AO will conduct wildlife, vegetation, soil, and ecological surveys, studies, and investigations, at the airfield and throughout the Center to further the Agency's strategic goal of carrying out its mission in a safe and environmentally sound manner. The EMD will provide advice and technical oversight in preparing any necessary NEPA or Endangered Species Act documentation and interagency communication, coordination, and consultation.

The AO, except where noted otherwise, is responsible for the following actions.

Health and Safety

The AO will provide guidance and oversight to assure health and safety. The AO provides certain health and safety training, such as in personal protective equipment, respiratory protection, and hearing conservation, and guidance on other training.

Grounds Maintenance

Turf: The USAF recommends maintaining a dense, uniform grass cover, with grass height between 7 and 14 inches, eliminating broad leaf weeds and seeding bare spots. See section of vegetation.

Drainage: Take additional active bird control efforts during periods when the airfield has standing water especially during and after unusually high rainfall.

Prior to disturbance, e.g., by discing, notify the AO and request the AO submit a Notice of Intent and the associated per acre fees to the RWQCB in coordination with EMD. Follow all permit terms and conditions. Protect storm drains and infrastructure such as lighting, using weed free straw bales. Seed within specified time period.

Do not fill federally designated seasonal wetland areas.

Active Harassment

Authorize USDA Wildlife Services to implement an active harassment program. Approved AO personnel will conduct harassment activities in the absence of Wildlife Services personnel. The AO will have on file a current list of approved personnel.

Request Federal and State permits through the AO Safety Office, in coordination with the USDA Wildlife Services, as needed, for harassment, e.g., under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act.

Implement active harassment in accordance with the AO Wildlife Control Safety Plan (Appendix 6) and permit conditions. Coordinate with Dispatch and Air Traffic Control (ATC) to ensure the safety of airfield operations.

Active harassment will be used before using firearms to control migratory birds. All required personal protective equipment will be worn.

Depredation Control

Request Federal and State depredation permits through the AO Safety Office, in coordination with USDA Wildlife Services, for depredation involving lethal removal of species and non-lethal methods to control migratory birds and other protected species.

All permittees and sub-permittees must maintain a copy of the USFWS depredation permit and be able to readily produce the document when asked by USFWS or CDFW officials.

Maintain depredation permits at the AO.

Authorize USDA Wildlife Services to implement depredation control measures. Implement depredation control measures in accordance with the AO Wildlife Control Safety Plan (Appendix 6) and permit conditions.

All individuals who are involved in bird and wildlife control at the airfield must be identified and designated in writing to the AO. Airfield personnel will comply with all CDFW and USFWS regulations relevant to the control of wildlife.

Reporting

USDA Wildlife Services will document wildlife control efforts daily. USDA Wildlife Services will compile data at the end of each month and distributed to personnel designated by the AO. Use these data to determine trends in bird/wildlife activity and assist in development of habitat management priorities.

Report all dead, injured and sick birds and mammals on the airfield to USDA Wildlife Services biologist upon discovery. Coordinate all investigations of suspected bird or other wildlife strikes with USDA Wildlife Services biologist, who will report bird kills to regulatory agencies if required by regulation. If evidence a bird strike is present send the carcass to the Smithsonian Institute for identification (see protocol below) if identification of species cannot be made, otherwise, transfer the remains to USDA Wildlife Services biologist for further investigation

4. INSPECTION OF MOVEMENT AREAS

This section provides for the routine inspection of aircraft movement areas and perimeter fences for evidence of bird and other wildlife activity.

Sweeps of Runways

Conduct sweeps of runways for birds, other wildlife, and debris at a minimum under the following circumstances:

4.1.1 Early Morning

1. Conduct runway sweeps for each runway during this period.

4.1.2 Opening a Runway

1. Conduct a sweep if any runway has been closed or inactive for a lengthy period of time (more than 3 hours).
2. Conduct sweeps following events such as air shows and other vehicular activities using runways for demos, training, etc.

4.1.3 Upon Demand

1. Conduct a sweep at the request of the tower, air carrier or any other source.

4.1.4 Dead, Sick and Injured Wildlife

1. FollowPV,NASA and NASA Ames policy and procedures and U.S. Department of Health and Human Services (HHS) Centers for Disease Control and Protection (CDC) "Interim Guidance for States Conducting Avian Mortality Surveillance for West Nile Virus (WNV) and/or Highly Pathogenic H5N1 Avian Influenza Virus" for personal protective equipment for handling dead, sick, and injured wildlife. See:

http://www.cdc.gov/flu/avian/doh/aviansurveillance.htm . See also U.S. Department of the Interior (DOI) Geological Survey (USGS) National Wildlife Health Center (NWHS) "Wildlife Health Bulletin #05-03" (August 29, 2005):http://www.nwhc.usgs.gov/publications/wildlife_health_bulletins/WHB_05_03.jsp

2. Use personal protective equipment for handling wildlife.
3. Remove all dead wildlife upon discovery.
3. Remove all dead wildlife following depredation activities.
4. Report all dead, sick and injured wildlife to USDA Wildlife Services Wildlife Biologist.
5. Report all wildlife strikes in accordance with the Bird Strike Reports paragraph below and the Reporting paragraph above.

Bird/Wildlife Hazard Condition (BWHC) Determinations

USDA Wildlife Services will inform ATC of the BWHC. Airfield personnel can determine the BWHC during sweeps of runways. In addition, other airfield users can make determinations as conditions warrant. Report BWHC to ATC and the AO. ATC will advise departing and arriving aircraft of the BWHC.

The only authorized entities to determine the BWHC are:

1. United States Department of Agriculture (USDA)
2. AvPORTS
3. Air National Guard 129/OG, Supervisor ofFlying (SOF)
4. PV

4.1.5 Bird/Wildlife Hazard Conditions:

SEVERE: Heavy concentration of birds on or immediately above the active runway or other specific locations that represent an immediate hazard to safe flying operations. Aircrews must thoroughly evaluate mission need before operating in areas under condition SEVERE.

MODERATE: Concentrations of bird's observable in locations that represent a probable hazard to safe flying operations. This condition requires increased vigilance by all agencies and extreme caution by aircrews.

LOW: Normal bird activity on and above the airfield with a low probability of hazard. Continue with operations as normal.

WARNING: When the BWHC is MODERATE or SEVERE; it will remain as such until wildlife is no longer a threat to aircraft.

Bird Strike Reports

Contract with USDA Wildlife Services and require AO personnel on duty to complete bird strike reports for bird remains found within 250 feet of any runway or taxiway. Provide assistance by the AO's staff to tenants and other airfield users in reporting strike events in accordance with the AO's policy. Follow up will be conducted by the Operations staff on duty on any strike reported by a pilot or the tower. Notify the 129th CA Air National Guard of all strikes involving, or possibly involving CA ANG aircraft.

4.1.6 Report Form

1. Record all bird/wildlife strikes on the Air Force Wildlife Strike Report form (Appendix 2).
2. If known, add location and altitude of the strike and if known what phase of flight such as short final, touchdown, landing roll, departure roll, and initial climb-out the aircraft was in when the strike occurred.
3. Archive completed forms in the AO and forward to the 129th Rescue Wing, California Air National Guard.

4.1.7 Species Identification

1. If a dead bird shows evidence of a strike, follow Center for Disease Control protocols for personal protective equipment and transfer all unidentifiable remains from strikes to USDA Wildlife Services for shipment to the Smithsonian Institution in Washington, D.C. for identification by forensic ornithologists. See Appendix 3 for additional information.
2. If the remains do not show evidence of a bird-aircraft strike, follow Center for Disease Control protocols for personal protective equipment and transfer remains to USDA Wildlife Services Biologist who will arrange for a forensic analysis if needed and provide results to the AO and the EMD.

5. WILDLIFE CONTROL MEASURES

The AO is using active harassment, trapping, habitat management and firearms to minimize wildlife hazards on the airfield. Active harassment will include the use of pyrotechnics, bioacoustics, and propane cannons. Contact the AO before accessing the airfield for wildlife control. The AO will notify Moffett Dispatch, ATC, and the 129thSOF that the AO will be conducting wildlife control on the airfield. No one will shoot firearms or pyrotechnics towards the 129th aircraft parking ramp, any hangar, road, or the airfield fence. Firearms and pyrotechnics will not be used in the direction of personnel within 500 feet. Clean up all debris (wildlife, shell casings, etc.) and dispose of in accordance with FOD, health and safety, and environmental requirements.

Contact Moffett ground control on 121.85 or a designated radio assigned by the AO, as appropriate, at completion of the operation and announce that the operation is complete. After exiting the area, contact the AO and let them know that your operation is complete. For after hours operation, before accessing the airfield for wildlife control, notify Moffett Dispatch, and the 129th that wildlife control on the airfield will be resuming. (See paragraph 5.1.2. for operational procedures).

Vegetation

Vegetation management was implemented at the airfield by NASA and prior to the transfer to NASA by the Navy to deter hazardous wildlife or prey that would attract hazardous wildlife. PV and AvPORTS continue to implement vegetation management.

The USAF recommends airfield vegetation to be maintained at a height of 7 to14 inches in a thick, uniform stand of sod-forming vegetation that will fill bare spots and out-compete weeds, thus discouraging many flocking species, limiting the ability of birds to locate invertebrate food sources and detect predators, and increasing the difficulty of movement. The USAF acknowledges that in the Southwest achieving this type of cover will be difficult without irrigation.

Use a series of mowing, discing and herbicide application to achieve the desired vegetation cover. Continue in developing techniques through experimentation and follow up surveys that will identify the best species of grasses and schedule of mowing to provide the recommended uniform vegetation cover. One possible experiment involves allowing the grass to go to seed once prior to mowing (coupled with increased active harassment) to encourage a more uniform cover; however, where star thistle is present, mow before thistle forms a seed head.

Except in the owl preserve, avoid mowing the vegetation shorter than 6 or 7 inches, or allowing it to reach heights where it becomes uneven to prevent growth of broad-leaved weedy vegetation that provides food and cover for wildlife and increases bird hazards at the airfield.

Pyrotechnics

Pyrotechnics launched from a pyrotechnic launcher or shotgun will be the most commonly used control devices on the facility. Use a combination of screamers, bangers and shellcrackers to be most effective. Use care to not over use a device or become complacent about safety. Wear safety glasses and hearing protection when using this method.

Fire the pyrotechnic launcher with arms fully extended away from the body. 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.

Store unused pyrotechnics in a secure, cool dry place and rotate stock frequently.

Coordinate with AvPORTS, the NASA Ames Health and Safety Division Explosives Safety Officer, Protective Services, and Fire Department.

Do not shoot pyrotechnics towards the 129th CA ANG aircraft parking ramp, any hangar, road, or in the direction of personnel within 500 feet.

Clean up all debris (e.g., wildlife, shell casings, etc.) and dispose of in accordance with FOD, health and safety, and environmental requirements.

Contact Moffett ground control on frequency 121.85, or tower on a designated radio assigned by the AO prior to and at completion of the operation.

After exiting the area, contact the AO and let them know that your operation is complete.

5.1.1 Pyrotechnics Safety (also see AO Wildlife Control Safety Plan-Appendix 6)

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 safely at all times.
6. Use only devices designed for the pyrotechnic device.

5.1.2 Operation

1. During official hours of operation, 0700 to 2300 local, contact Moffett ground control on frequency 121.85 or tower on a designated radio assigned by the AO before going active for wildlife abatement. The tower will let you know if there is airborne or ground traffic.
2. Outside of official operating hours broadcast your location on any controlled movement area (CMA) using the common traffic advisory frequency (CTAF) 119.55. Continually scan the CMA for aircraft in flight or taxiing to the runway. Frequently announce your position on the CTAF.
3. At 0700 local, promptly broadcast your position to Moffett ground control on frequency 121.85 or the radio assigned by the AO.
4. Move as close to bird/flock as possible.
5. Load 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.
6. Point the pistol over the bird/flock at a 45 degree angle, with arm fully extended and fire.
7. If bird/flock move to land nearby, immediately approach the flock and repeat the procedure.
8. Use combinations of screamers and bangers.

5.1.3 Potential Problems

1. Habituation - if used too often, birds will get used to the noise.
2. Fire hazards - if rounds explode near the ground during dry conditions.
3. Hazardous materials or hazardous waste disposal violations.
4. Health and safety violations.

Bioacoustics

Bioacoustics are currently in use at KNUQ/MFA.Bioacoustics are a valuable tool that may be utilized when conditions warrant.

5.1.4 Operation

1. Identify species of bird to be dispersed.
2. Select the appropriate distress call tape for the particular species and load into the cassette deck.
3. Drive vehicle as close to the bird flock as possible.
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 not more frequently than 3 times in one hour.

5.1.5 Potential Problems

1. Habituation - if used too often, birds will get used to the noise.
2. Mobbing - birds may attack the speakers.

Propane Cannons

Propane cannons are mechanical devices that produce loud report that are louder than a shotgun blast. Propane cannons have been very effective in deterring a variety of bird species, but are most effective on waterfowl, gulls, and blackbirds.

5.1.6 Operation

1. Set up in appropriate area.
2. Use remote transmitters or a timer to fire cannons.
3. Move the cannons to any area as needed. Appropriate locations include the north end of the airfield during waterfowl migration and locations where birds congregate regularly.
4. Do not operate the cannon continuously.
5. Use in combination with other control methods.

5.1.7 Safety (Also see AO Wildlife Control Safety Plan-Appendix 6)

1. Always wear ear and eye protection.

5.1.8 Potential Problems

1. Habituation - if cannon stays in one place too long or fires on a schedule, birds will habituate.
2. Fire hazards - do not set up in dry grassy areas or the cannons must be mounted 3 to 4 feet above any vegetation.

Traps

Implement humane trapping of wildlife as needed for target species.

5.1.9 Operation

1. Use traps that are specifically designed for the species of wildlife that is targeted.
2. Check mammal traps daily and immediately remove any trapped wildlife. Follow regulations for disposal of carcasses.
3. If traps are not checked on a daily basis, provide water and food.

Food Source Elimination

Food source management is a critical element of controlling for hazardous wildlife at the airfield and can reduce the need to use other tools that may be controversial or present health and safety or environmental risks.

1. When there is an influx of wildlife on the airfield; identify and minimize or eliminate their food source.
2. Install wildlife resistant dumpsters as necessary.
3. Keep dumpster lids closed.
4. Encourage use of proper food waste disposal measures.
5. Develop or update an integrated pest management plan before applying pesticides.
6. Obtain approval for use of pesticides, fungicides, rodenticides and herbicides from the AO.
7. Assure that applicators have necessary permits, training, and protective gear.
8. Follow vegetation management protocols.
9. Store hazardous materials and waste following NASA Ames procedural requirements. Inventory in Hazardous Materials Inventory System.
10. Complete Form A to request pick up and disposal of hazardous waste.
11. Cooperate with the AO in prohibiting artificial feeding.

Rodenticides

The AO uses rodenticides as one of several tools to control rodentsat the airfield and adjacent CA ANG facility. The primary purpose of this control action is to reduce the population of ground squirrels so as to:

1. Limit the attractiveness of the airfield as foraging habitat for raptors and other wildlife that prey on ground squirrels.
2. Limit the damage caused by squirrels that undermine structural foundations and ammunition depot mounds.
3. Reduce the number of squirrel burrows on the airfield to decrease the damage incurred to aircraft should an aircraft leave the runway during an emergency.
4. Keep the squirrel numbers down to a manageable level.

To apply rodenticides:

1. Obtain requisite training and maintain training records. Wear required personal protective equipment.
2. Use zinc phosphide or chlorophacinone treated grain between the taxiways and runways and to a lesser area, approximately 300 acres, leased by the California National Guard.
3. Obtain approval of the AO to use other rodenticides.
4. Do not apply within 250 feet of any known burrowing owl locations.
5. Do not place rodenticides within 100 yards of salt marsh harvest mouse (*Reithrodontomys raviventris*) habitat. This habitat is identified by the presence of pickleweed (*Salicornia spp.*).
6. Do not apply rodenticide without supervision by a California Certified Pesticide Applicator with prior permission from the Santa Clara Department of Agriculture, when required.
7. Follow NASA Ames hazardous materials and hazardous waste disposal procedures.

Fumigants

To control ground squirrels, the AO uses fumigants, typically gas cartridges that produce carbon monoxide gas when ignited, filling ground squirrel burrow systems. These can only be used when a ground squirrel is seen to enter a hole and no evidence of burrowing owls occurring in the near vicinity. They will not be used in salt marsh harvest mouse habitat.

5.1.10 Operation

1. Observe squirrel enter hole and survey area for evidence of burrowing owls.
2. Puncture holes in one end of gas cartridge and insert fuse.
3. Light and insert cartridge in burrow.

4. Fill burrow with dirt and watch for seeping gas.
5. Fill any other holes or cracks where gas is escaping.

5.1.11 Potential Problems

1. Fire hazards - Do not use near dry grass or in burrows near buildings due to fire hazard and potential to inject smoke into buildings.

Firearms

Lethal control using firearms may be necessary to reduce the long-term and persistent hazards posed by such birds as rock doves, gulls, European starlings, blackbirds, Canada geese, and other bird and wildlife species.

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 (eye protection, hearing protection, etc.).
3. A depredation permit from the USFWS will be on file in the AO for migratory birds and in possession while exercising its authority.
4. Contact the Moffett Ground ATC tower on a designated radio before wildlife abatement activities are initiated. The tower will advise if there is airborne or ground traffic.

Other Wildlife Control Methods

Other wildlife control methods may be useful in specific situations and upon availability.

1. Use trained falcons, trained dogs, remote controlled planes and other wildlife control methods only if approved by the AO.

6. COMMUNICATIONS

Assure careful coordination and communication with ATC personnel to avoid moving birds and wildlife into the path of aircraft.

Harassment Operations

1. Prior to dispersal activity, ATC personnel, Protective Services and 129th Security must be advised of planned activity.

ATC

2. In accordance with all applicable Air Force Instructions (AFI) and FAA directives, Air Traffic Control personnel must advise all air traffic when birds or wildlife are observed in the immediate path of aircraft. Additionally, Air Traffic Control personnel must communicate bird/wildlife activities reported by aircraft and grounds personnel to all aircraft operating in the area.

ATIS

3. Indicate significant (moderate or severe) bird/wildlife activity, as reported by an approved agency, that presents temporary hazards on the Automated Terminal Information Service (ATIS) broadcast.

NOTAM

4. Communicate persistent bird and wildlife hazards through NOTAMs.

7. REVIEW OF THE WILDLIFE HAZARD MANAGEMENT PLAN

The AO, in conjunction with USDA Wildlife Services and the Aviation Safety Committee, will conduct a review of the Wildlife Hazard Management Plan whenever requested.

Aviation Safety Committee

The Aviation Safety Committee consists of representatives from AvPORTS, PV, USDA Wildlife Services, CA ANG, NASA, and the U.S. Army. The AvPORTS Airport Director or his designee serves as the Chair of the Committee of the Aviation Safety Committee.

The Aviation Safety Committee will conduct the annual review of the Wildlife Hazard Management Program. The following as a minimum will be reviewed:

1. Review of USDA's monthly reports and strike reports.
2. Assessment of on airfield wildlife habitat.
3. A review of wildlife hazards to aviation.
4. Review wildlife habitat management priorities and target date.
5. Assessment of new construction or habitat changes.
6. Assessment of off-airfield wildlife habitat/land uses.
7. Identify any new off-site attractions (landfills, parks, agriculture, wetlands, etc.).
8. Review personnel and equipment requirements.
9. A review of AO bird control techniques and methods.
10. Permit requirements.
11. Safety.
12. Review of the current Wildlife Hazard Management Plan.

Summary Report

Following the program review, the Aviation Safety Committee must prepare a summary report and the Chair of the Committee must file the report in the AO with a copy to EMD.

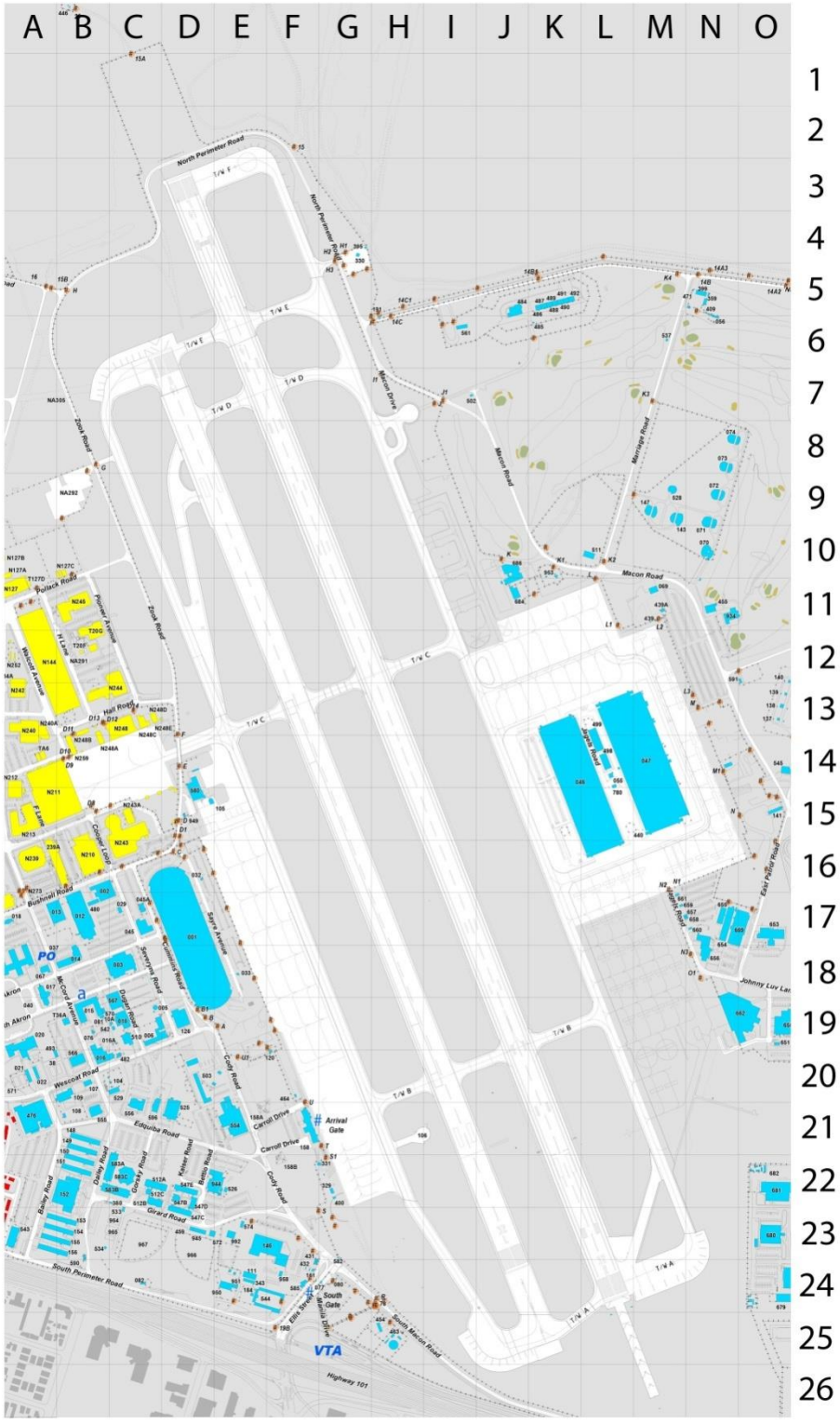
Bird Hazard Working Group (BHWG)

The BHWG consists of representatives from AvPORTS, PV, USDA Wildlife Services, CA ANG, NASA, and the U.S. Army.

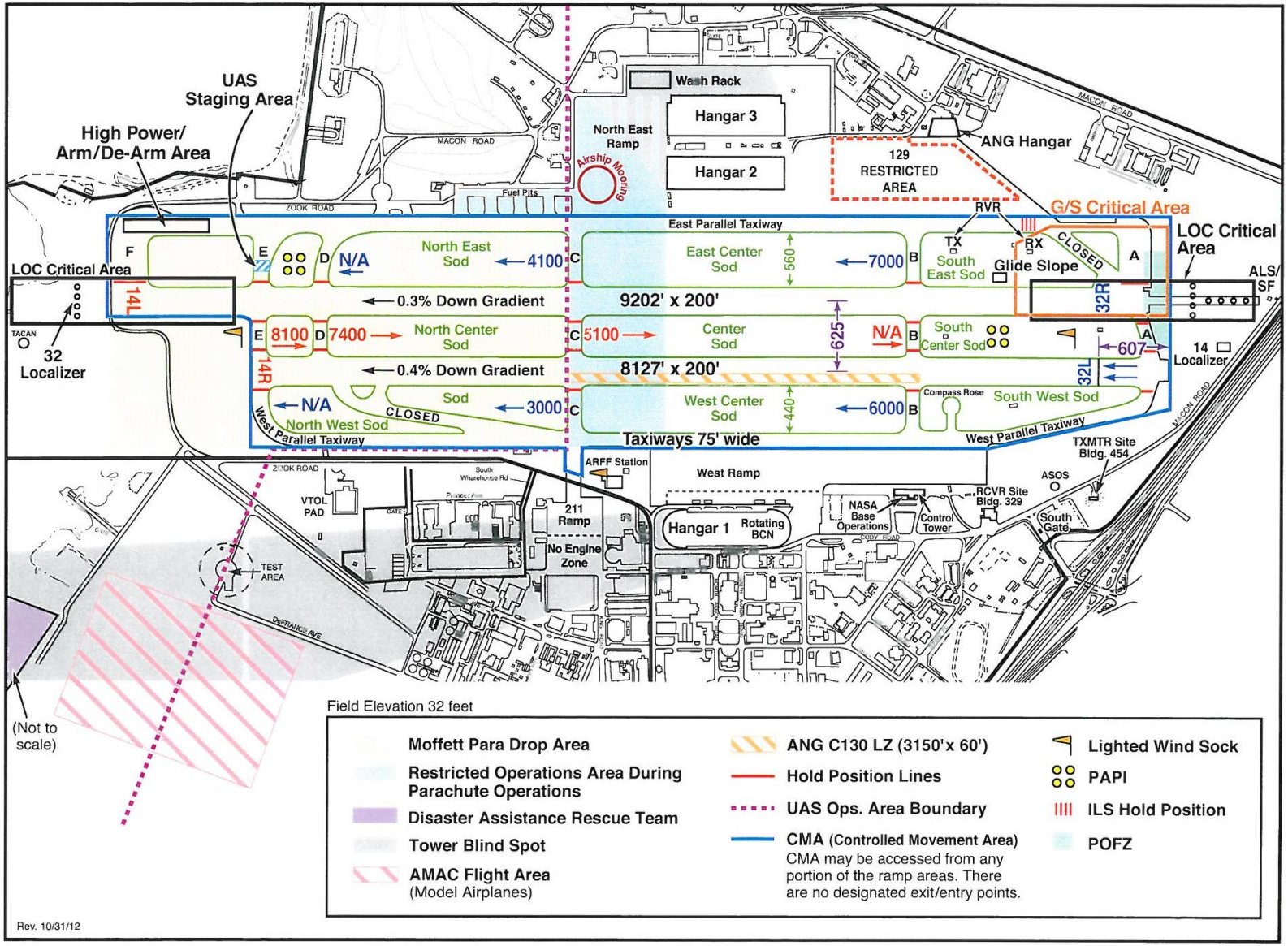
BHWG meetings will be held twice a year to meet CA ANG requirements.

Appendix 1

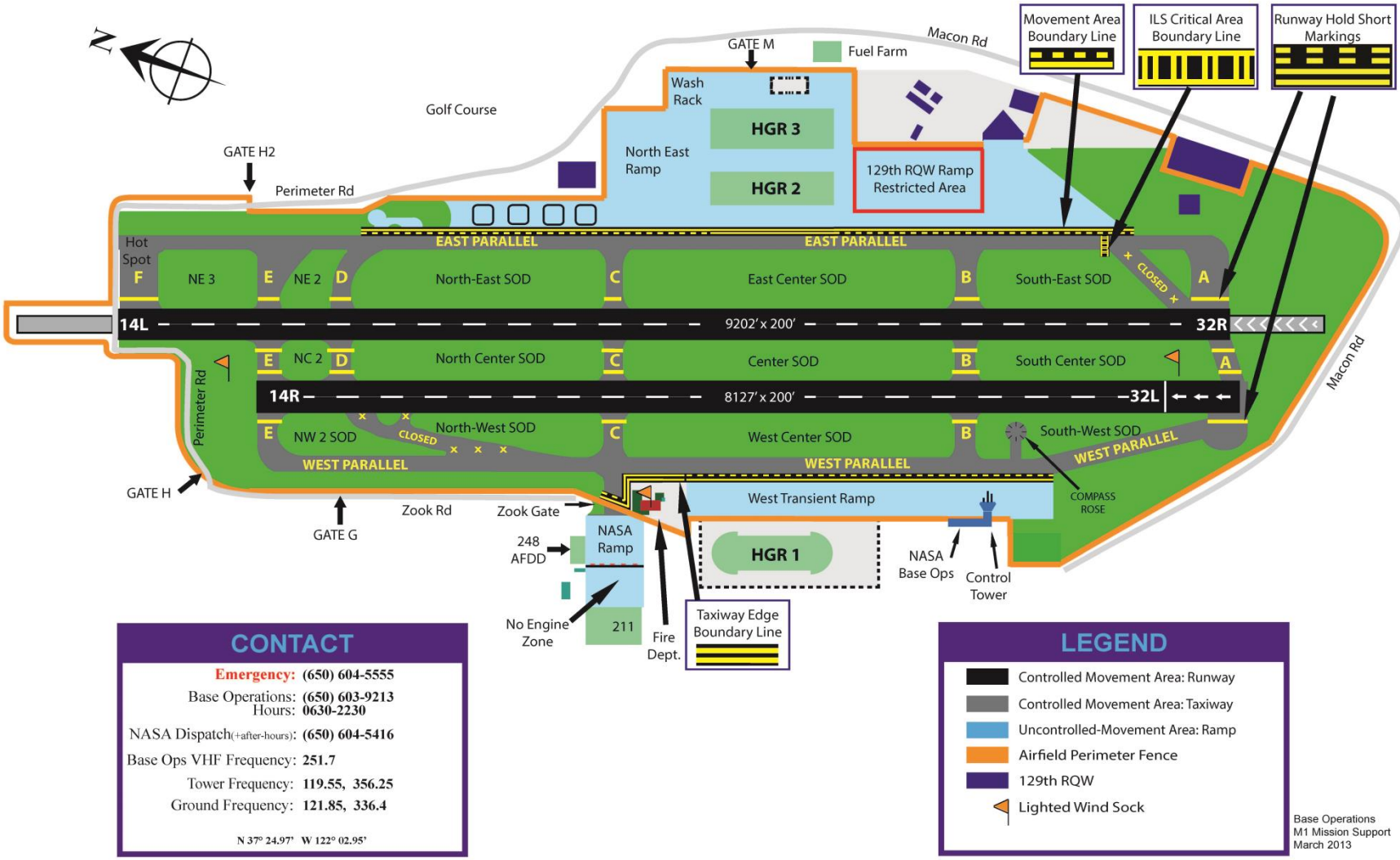
Moffett Federal Airfield Inspection and Wildlife Grid



Moffett Airfield Diagram



Moffett Airfield Layout



CONTACT

Emergency:	**(650) 604-5555**
Base Operations:	**(650) 603-9213**
Hours:	**0630-2230**
NASA Dispatch(+after-hours):	**(650) 604-5416**
Base Ops VHF Frequency:	**251.7**
Tower Frequency:	**119.55, 356.25**
Ground Frequency:	**121.85, 336.4**

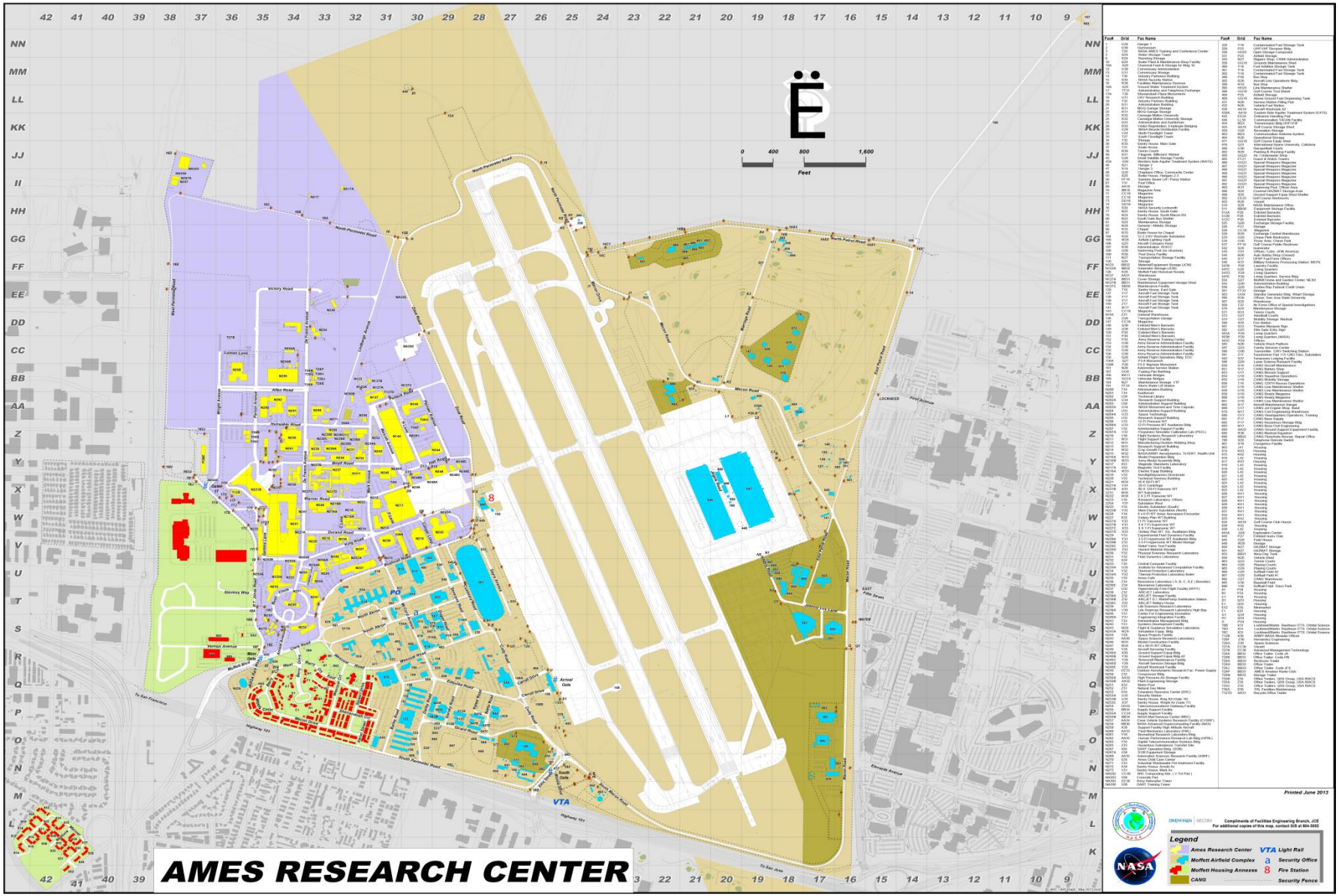
N 37° 24.97' W 122° 02.95'

LEGEND

- Controlled Movement Area: Runway
- Controlled Movement Area: Taxiway
- Uncontrolled-Movement Area: Ramp
- Airfield Perimeter Fence
- 129th RQW
- Lighted Wind Sock

Base Operations
M1 Mission Support
March 2013

Moffett Airfield Facility Map



Appendix 2

Air Force Wildlife Strike Report

AIR FORCE WILDLIFE STRIKE REPORT

1. UNIT–WING/SQUADRON

2. AIRCRAFT (alphanumeric designation)

3. TAIL NUMBER/REGISTRATION

4. DATE (dd mmm yyyy)

5. TIME (local hh:mm)

6. DAILY PERIOD
- O UNKNOWN
- O DAWN
- O DAY
- O DUSK
- O NIGHT

7.a. AIRPORT
NAME:
ICAO:
HOST ID (FAA IDENT):
RUNWAY:
OTHER:

7.b. SPECIAL USE AIRSPACE
- O ALERT
- O DANGER
- O MILITARY OPERATIONS AREA
- O PROHIBITED
- O RESTRICTED
- O TEMPORARY RESERVED
- O AIRSPACE
- O WARNING

NAME:

7.c. LOW-LEVEL ROUTE
INSTRUMENT ROUTE IR_____
SLOW ROUTE SR_____
VISUAL ROUTE VR_____
OTHER:

8. AWARENESS OF STRIKE IN FLIGHT
- O YES (time and location known)
- O NO
- O UNKNOWN

9. LATITUDE
N- Degree Minutes: Second
S

10. LONGITUDE
E- Degree Minutes: Second
W

11. EFFECT ON FLIGHT
- O UNKNOWN
- O ABORTED TAKE-OFF
- O ENGINES SHUTDOWN
- O NONE
- O OTHER
- O PRECAUTIONARY LANDING

12. SPEED (Kias)

13. ALTITUDE (ft AGL)

14. LANDING LIGHTS
- O YES (on) O UNKNOWN
- O NO (off) O NOT APPLICABLE

15. STROBE LIGHTS
- O YES (on) O UNKNOWN
- O NO (off) O NOT APPLICABLE

16. PHASE OF FLIGHT
- O UNKNOWN
- O PARKED
- O TAXIING
- O TAKEOFF ROLL
- O TAKEOFF INITIAL CLIMB
- O CRUISE CLIMB
- O CRUISE
- O CRUISE LOW LEVEL
- O RANGE OPS
- O CRUISE DESCENT
- O HOVER
- O LANDING FINAL APPROACH
- O LANDING TRAFFIC PATTERN
- O LANDING FLARE/ROLLOUT
- O MISSED APPROACH/ TOUCH & GO

17. FLIGHT PATH (relation to clouds)
- O UNKNOWN
- O ABOVE CLOUDS
- O BELOW CLOUDS
- O BETWEEN LAYERS
- O CLEAR
- O IN CLOUDS

18. CLOUD TYPE
- O UNKNOWN
- O BROKEN
- O CLEAR
- O OVERCAST

19. PRECIPITATION
- O UNKNOWN
- O FOG
- O RAIN
- O SNOW
- O NONE

20. PILOT WARNING
- O SAW BIRD BEFORE IMPACT
- O BIRDS REPORTED TO PILOT
- O (A) AND (B)
- O NONE OF THE ABOVE

21. BIRD AVOIDANCE MODEL
- O UNKNOWN
- O NO REPORT
- O LOW
- O MODERATE
- O SEVERE

22. BIRD WATCH CONDITION
- O UNKNOWN
- O NO REPORT
- O LOW
- O MODERATE
- O SEVERE

23. WILDLIFE SEEN
- O UNKNOWN
- O NONE
- O ONE
- O 2-10
- O 11-100
- O MORE THAN 100

24. WILDLIFE STRUCK
- O UNKNOWN
- O NONE
- O ONE
- O 2-10
- O 11-100
- O MORE THAN 100

25. WILDLIFE SIZE
- O UNKNOWN
- O SMALL (sparrow size)
- O MEDIUM (pigeon size)
- O LARGE (duck size)

26. REMARKS ON LOCATION

27. BIRD STRIKE REPORTED BY
(name, rank, DSN phone, E-mail)

AF FORM 853, 20010501 ***(EF-V1)*** PREVIOUS EDITION IS OBSOLETE.

AIR FORCE WILDLIFE STRIKE REPORT

28. COST ESTIMATE
- ○ NOT APPLICABLE
- ○ ESTIMATED COST (not yet known)
- ○ ACTUAL COST

$_____

29. CLASS
- ○ CLASS A
- ○ CLASS B
- ○ CLASS C
- ○ LESS THAN C

30. TIME OUT OF SERVICE (days)

31. IMPACT POINTS
(description of impact points, and struck or damaged; if the list is not representative of the strike, please explain in the remarks section)

	S	D
UNKNOWN	☐	☐
INSIDE ENGINE 1	☐	☐
INSIDE ENGINE 2	☐	☐
INSIDE ENGINE 3	☐	☐
INSIDE ENGINE 4	☐	☐
INSIDE ENGINE 5	☐	☐
INSIDE ENGINE 6	☐	☐
INSIDE ENGINE 7	☐	☐
INSIDE ENGINE 8	☐	☐
OUTSIDE ENGINE 1	☐	☐
OUTSIDE ENGINE 2	☐	☐
OUTSIDE ENGINE 3	☐	☐
OUTSIDE ENGINE 4	☐	☐
OUTSIDE ENGINE 5	☐	☐
OUTSIDE ENGINE 6	☐	☐
OUTSIDE ENGINE 7	☐	☐
OUTSIDE ENGINE 8	☐	☐
FUSELAGE/ANTENNA/SKIN	☐	☐
RADOME/NOSE	☐	☐
WINDSHIELD/CANOPY	☐	☐
WINDSHIELD PENETRATION	☐	☐
TAIL/STABILIZER/RUDDER	☐	☐
WEAPONS/MISSILE POD	☐	☐
LANDING GEAR	☐	☐
LIGHTS	☐	☐
WING/ROTOR	☐	☐
FUEL TANKS	☐	☐
PROPELLER	☐	☐
ECM PODS/PYLONS	☐	☐
OTHER (specify in remarks)	☐	☐

32. REMAINS FOUND ON RUNWAY
- ○ NO
- ○ YES, REMAINS FOUND ON RUNWAY (aircraft struck unknown)
- ○ YES, REMAINS FOUND ON RUNWAY (aircraft struck known)

33. REMAINS FOUND ON AIRCRAFT
- ○ YES
- ○ NO
- ○ UNKNOWN

34. DATE REMAINS SENT TO SMITHSONIAN INSTITUTION
(dd mmm yyyy)

35. ADDITIONAL REMARKS

WILDLIFE REMAINS

IAW AFI 91-204, 7.4.7, feather remains from **every** bird strike, if available, must be sent to the Smithsonian National Museum of Natural History for identification. Send feathers or feather fragments and a copy of the corresponding BASH SAS report to:

Smithsonian Institution
Natural History Building
Division of Birds
ATTN: Dr. Carla Dove
NHBE 610 MRC 116
10th and Constitution Ave. NW
Washington, DC 20560

Send as much material as possible to include feet, beak, wing, tail, breast, and back feathers. For wildlife strikes other than birds, send samples of skin, fur, teeth, other non-fleshy remains, or a picture if possible, along with the corresponding BASH SAS report to the Smithsonian for identification.

In the event that remains are found on the runway as the result of a suspected strike, they should also be sent to the Smithsonian.

For overnight shipping of specimen, wrapping the remains in newspaper and freezing it entirely should be adequate. If you collect a whole bird carcass, freeze it per the above instructions and contact the Smithsonian at (202) 357-2334 to see if they could use the specimen in their collection.

Please forward copies of any photographs of the strike to the BASH Team via E-mail or regular mail:

HQ AFSC/SEFW
9700 G Ave Se, Bldg 24499
Kirtland AFB, NM 87117-5671

These resources are extremely helpful in educating about mishap prevention and the hazard that wildlife poses to flight.

AF FORM 853, 20010501 ***(EF-V1)(Reverse)***

Appendix 3

FEATHER IDENTIFICATION LAB - General Information

SHIPPING

U.S. Postal Service	**Overnight Shipping**
(routine / non-damaging cases)	(priority / damaging cases)
~~	~~~
Feather Identification Lab	Feather Identification Lab
Smithsonian Institution	Smithsonian Institution
NHB, E600, MRC 116	NHB, E600, MRC 116
P.O. Box 37012	10th & Constitution Ave., NW
Washington, DC 20013-7012	Washington, DC 20560-0116

- Include report number or copy of report (AFSAS for military, 5200-7 for civil)
- Include contact information if not on report

Feather Lab contact information: 202-633-0801
dovec@si.edu or heackerm@si.edu

COLLECTING REMAINS

Follow Center for Disease Control protocols for using personal protective equipment when handling dead wildlife.

Whole Feather

- Whole bird: Pluck a variety of feathers (breast, back, wing, tail)
- Partial bird: Collect a variety of feathers with obvious color or pattern
- Feathers only: Send all material found
- Do not cut feathers from bird (we need the down at the base); Do not use any Sticky substance (ex. tape)
- Place remains in reclosable bag; If remains are fleshy/moist can fold material in paper (ex. paper towel, coffee filter) and use more than one reclosable bag.

Small Amount of Material

- Wipe area with paper towel; Send all material / entire towel in reclosable bag
- If needed, spray area with alcohol or water to loosen material for collection

WEBSITES

Air Force: http://safety.kirtland.af.mil
Civil Aviation: http://wildlife-mitigation.tc.faa.gov
Birdstrike Committee: www.birdstrike.org

* Basic safety measures and good hygiene when collecting material is encouraged. Use latex gloves, face mask and eye protection; always thoroughly wash hands after handling remains.

Rev 1/22/07 MHS

Appendix 4

Timeline of Activities at Moffett Federal Airfield at NASA Ames

Annually	Continue discing and revegetating airfield as funding and airfield activities allow.
April 15 – July 15 Annually	Nesting season burrowing owl surveys.
May - September	Use zinc phosphide rodenticide to control California ground squirrel when needed.
September 1 – January 31 Annually	Conduct burrowing owl passive relocation during this time.
Continuously	Lethal control of California ground squirrel using firearms, cage traps, body grip traps, fumigants and others.

Appendix 5

Deviations from the CA ANG BASH Plan

There are recommendations in the California Air National Guard BASH Plan (November 2006) that deviate from the procedures the AO currently practices. One such recommendation is regarding the management of burrowing owls and their habitat. Another recommendation concerns wetland vegetation and the salt marsh harvest mouse. This appendix addresses these issues and explains the differences.

Burrowing Owls

Burrowing owls occur on NASA Ames Moffett Federal Airfield and are a California Species of Special Concern. Species of Special Concern status applies to animals not listed under the Federal Endangered Species Act or the California Endangered Species Act, but which nonetheless are (1) declining at a rate that could result in listing, or (2) historically occurring in low numbers with known threats to their persistence. California Department of Fish and Game devised the 'species of special concern' status in order to give some official recognition to species that are vulnerable or have low populations but which have not been listed under the ESA. The USFWS Sacramento Office has identified the western burrowing owl as a Federal Species of Concern (formerly a List 2 Candidate Species under the Federal ESA). Designation of a species as a Federal Species of Concern does not necessarily mean that the species will be listed as threatened or endangered under the Federal ESA. The burrowing owl is protected under the Migratory Bird Treaty Act and several agencies concerned with bird conservation and aviation safety, including the USDA, USFWS, DOD, USAF, and FAA have signed agreements to cooperate in furthering Federal goals for conservation in the context of assuring aviation safety.

NASA established Burrowing Owl Nesting Habitat Preserves as required by the NASA EIS (July 2002), one of which is on the airfield. In these areas owls are not relocated and ground squirrels are not controlled. The CA ANG BASH plan recognizes the EIS, but it is their position, "that the pursuit of any such habitat within the aircraft movement areas of the AOA runs contrary to aviation and public safety." The current Burrowing Owl Nesting Habitat Preserve on the airfield represents a low strike risk to aircraft for a number of reasons. It is located on the side of the airfield, not on the approach or the departure ends and not in the aircraft movement area. Also, burrowing owls are not a flocking species and typically fly at low altitudes. Burrowing owls are also small in mass and present a low hazard for aircraft damage. Further, the AO is removing perches or adding raptor deterrents to perches and implementing active harassment to reduce the risk posed by larger bodied birds, such as kestrels, hawks, and larger owls that may be attracted to small rodents, small birds, and insects.

Wetland vegetation and salt marsh harvest mouse

Section 9 of the Federal ESA of 1973, as amended, prohibits the take or harm of any species listed as threatened or endangered. Harm is defined by the ESA as, "any act that kills or injures the species, including significant habitat modification." The endangered salt marsh harvest mouse is known to exist at NASA Ames. This species is entirely dependent upon salt marshes and associated vegetation. The BASH plan recommends "wetland vegetation should be

routinely removed from all area within the Airport Operating Area and flow of drainage maintained to prevent standing water and recurrence of aquatic vegetation." AvPORTS and PV would be in violation of the ESA if endangered species habitat was destroyed at the airfield. Currently, designated wetlands constitute a very small portion of the airfield at the north end. The existence of these wetland areas does not significantly increase bird activity; therefore no redesignation of wetlands is being actively pursued. NASA coordinated with other Federal, State, and local agencies to halt activities contributing to subsidence and took steps to improve storm water management on the Eastside of NASA Ames. AvPORTS and PV are continuing these efforts.

Appendix 6

Wildlife Control Safety Plan

August 30, 2005
Revised 3/08

Airfield Wildlife Control Safety Plan

In accordance with Ames Procedural Requirement (APR) 1700.1, Ames Health and Safety Manual, Chapter 12 Explosive Safety, all requirements and procedures to safely handle and use ammunition and pyrotechnic devices applies. The NASA Ames Explosive Safety Officer (ESO) shall review, audit, and approve the hazardous operations involved with use of firearms and pyrotechnic devices. This includes training, certification, procuring, transporting, shipping, receiving, storing, using, disposing and other management of these materials. The AO and USDA Wildlife Services will conduct wildlife management in accordance with the Wildlife Hazard Management Plan. Wildlife depredation control and harassment will be implemented in accordance with this safety plan.

Safety, health, and environmental training required:

Consult with the Safety and Health Division and the Environmental Services Division.

Maintain training records.

Location of the airfield requested area to be utilized:

All of the active airfield

List special equipment required:

Personal Protection Equipment (PPE) (i.e., safety glasses, gloves, hearing protection mask).

Hazardous Operation or Chemicals Involved:

Use of 12 gauge shotguns, various pyrotechnic devices, and other wildlife harassment equipment. The Bird Abatement Protocol document further explains the use of pyrotechnics. Pesticides and fumigants are also used.

List and purpose of personnel to participate:

The AO and USDA Wildlife Services personnel

1. Contact the AO before accessing the airfield for wildlife control at 650-603-9213/14. The AO will notify Moffett Dispatch, ATC, and the 129th that the Airport Operator (AO) will be conducting wildlife control on the airfield. For after hours operation, before accessing the airfield for wildlife control, notify Moffett Dispatch, and the 129th that wildlife control on the airfield will be resuming.

2. All personnel will have appropriate personal protective equipment for the activity being conducted as required by protocol and the material data safety sheet (eye protection, hearing protection, etc.).
3. All personnel will be trained and certified prior to using firearms, pyrotechnic devices, discing and mowing machinery, pesticides, herbicides, or fumigants that they are operating or applying. Pesticide application will be conducted by a Qualified Applicator as designated by the California Department of Pesticide Regulation to efficiently apply the pesticides in a safe manner while preventing personnel over exposure.
4. A depredation permit from the US Fish and Wildlife Service will be on file in the AO for migratory birds and in possession while exercising its authority.
5. MSDS for all hazardous material will be on file in the AO. If there are multiple personnel involved in the wildlife control operation there will be a safety briefing prior to the operation.
6. Types and quantities of chemicals stored or used are reported to the AO to assure necessary permits are in place and followed, and reports to regulatory agencies are complete.
7. If there are multiple personnel involved in the wildlife control operation there will be a safety briefing prior to the operation.
8. Stay clear of all runways and taxiways unless you have permission for access from the ATC tower.
9. Maintain communication with and monitor Moffett Ground ATC by designated radio at all times.
10. Contact the Moffett Ground ATC on designated radio before wildlife abatement activities begin. The tower will let you know if there is airborne or ground traffic.
11. If ATC advises of airborne or ground traffic in the vicinity of wildlife control operations advise ATC that you are in cease fire mode and wait for ATC to inform you the traffic is clear.
12. No one will shoot shotguns or pyrotechnics towards the 129th aircraft parking ramp, any hangar, road, or the airfield fence closer than 500 feet.
13. Firearms and pyrotechnics will not be used in the direction of personnel within 500 feet.
14. Clean up all debris (wildlife, chemicals, cleaning materials, shell casings, etc.) and dispose of in accordance with FOD, health and safety, and environmental requirements.
15. All unused or unexploded ammunition or pyrotechnics devices will be removed and properly disposed of consistent with NASA Ames procedural requirements. Contact the ESO to arrange for removal, transportation and proper disposal.
16. Contact the Moffett Ground ATC on designated radio at completion of the operation and announce that operation is complete.
17. After exiting the area, contact the AO and let them know that your operation is complete.

Propane Cannon Operating Procedures

There are four propane cannons available for use at the airfield. They are controlled by remote control. One remote control will be kept in ATC Tower and the other will be kept in the AO.

1. All personnel within 20 feet must wear hearing protection.
2. Never stand in front of the cannon unless the cannon is turned off.
3. The cannons are to be used to augment shotguns and other pyrotechnic devises.
4. Check for personnel near cannon before firing cannon.
5. Only fire the cannons when there is wildlife nearby or testing as needed.
6. ATC will be notified when the cannons are to be fired.
7. Never fire cannon without ATC permission or when there is an aircraft within 5,000 feet.

Propane Cannon Operating Procedures for ATC Personnel

1. The cannons are portable, so they can be moved over time to wherever they will be most effective.
2. The cannons are activated by the remote control. The top (X10) arrow should be left pointing to zero. The bottom (X1) arrow is used the select the cannon you wish to fire. Press and release the Fire button. There is a five –second delay during which the cannon will charge and ignite propane from the attached cylinder.
3. The cannons should only be fired to displace birds/wildlife which could be a hazard to aircraft operations. Verify that the area around the cannon is clear of personnel/vehicles. Avoid firing with aircraft on base or final legs, or on the runway. Advise the AO prior to firing.
4. The AO has an identical remote control. They will request permission from the Tower before firing.
5. The AO should be notified (1) if a cannon is malfunctioning, or (2) if the cannons need to be moved for maximum effectiveness.

Appendix 7

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Appendix 8 NASA/CANG Agreement on Airfield Management

National Aeronautics and
Space Administration
Ames Research Center
Moffett Field, California 94035

S. Zornetzer/200-3
P. Fluegemann/200-9
C. Duff/200-9
M. Dudley/218-6
S. Olliges/218-1
K. Kilpatrick/218-1
G. Tiffany/158-1
R. Williams/158-1
M. Sumich/237-2
J. Beegle/244-30
Maj J. Waldman
Col A. Bagdasarian

September 14, 2006

To: Marvin Christensen, Deputy Center Director
From: Lewis Braxton, Director of Center Operations
Re: NASA/CANG agreement on airfield management issues for Moffett Federal Airfield

As a result of several meetings regarding airfield management issues pertaining to the Bird Aircraft Strike Hazard plan, NASA and the CANG have reached agreement on the disposition of current issues and on a plan of approach for longer term issues. The parties have resolved all open items such that a revised BASH plan and a revised JO-7 can be generated.

The parties have agreed that Moffett Federal Airfield is an operating airport, not a wildlife refuge. Areas that are designated as wildlife habitat will be managed as required by applicable law. All other areas will be managed in the interest of aircraft safety using all approved methods. These methods include using one way doors to move burrowing owls out of non-habitat areas during non-mating season and depredation of non-protected bird species.

Further, we agree that the most significant pending issues for safe aircraft operations are the re-planting of the infield areas of the airfield to reduce wildlife attractants and reduce the presence of flocking birds (presently Canada Geese) on the airfield. Re-planting of three infield areas south of taxiway alpha is in the planning stages (estimated start- Nov 2006) with other infield areas to follow. A permanent full-time USDA Wildlife representative will start work on Sept 25, 2006 to actively manage the bird hazard and control the squirrel population.

Issues that do not have significant impact on aviation safety and which require the coordination of multiple agencies will be worked as long term issues. The long term issues that we will pursue as a team include, but are not limited to: cooperation with CANG to improve and maintain the airfield utilizing joint funding if possible, pursuing the possibility of re-designation of infield wetland areas, and pursuing the possibility of movement of designated burrowing owl habitats to areas outside the aircraft movement areas.

Going forward, NASA and the CANG will hold weekly and quarterly meetings to continue this coordinated effort. The weekly meeting will be a status meeting to communicate new issues and status ongoing work. Each quarter, the Airfield Operations Board meeting will include a meeting of the Bird Hazard Working Group.

Maj. Jeff Waldman (CA ANG)

Janet Beegle (Code JO)

Kran Kilpatrick (Code QE)

Mark Sumich (Code JO)

Concurrence

Mike Dudley (Director Code Q)

Col. Amos Bagdasarian (Cmdr 129th)

Approval

Lewis Braxton III (Director Code J)

Appendix 9