ENVIRONMENTAL ASSESSMENT

WILDLIFE HAZARD MANAGEMENT AT [redacted] AIRPORT

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL DAMAGE CONTROL

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1. Introduction

The U.S. Department of Agriculture (USDA) is authorized by law to protect American agriculture and other resources from damages attributed to wildlife. The primary authority for the USDA Animal and Plant Health Inspection Service, Animal Damage Control (APHIS-ADC) program is the Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1468; 7 U.S.C. 426-426b and 426c) and the Rural Development, Agriculture and Related Agencies Appropriations Act of 1988 (P.L. 100-102). APHIS-ADC activities are conducted in cooperation with other federal, state, and local agencies, and private organizations and individuals.

This environmental assessment is tiered to the 1994 USDA Animal Damage Control Program Final Environmental Impact Statement which analyzed the national ADC program impacts on the environment.

Wildlife damage management or control, is the alleviation of damage or other problems attributed to wildlife. It is an integral component of wildlife management (Leopold 1933, The Wildlife Society 1990, Berryman 1991). The APHIS-ADC program uses an Integrated Wildlife Damage Management (IWDM) approach in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the ADC EIS (USDA 1994). These methods may include modifying cultural practices or altering wildlife habitat to reduce the attraction to wildlife. The reduction or elimination of wildlife damage may also require that the offending animal(s) be removed or that populations of the offending species occasionally be reduced through lethal and non-lethal methods. Potential environmental impacts resulting from the application of various wildlife damage reduction methods are evaluated in this environmental assessment.

Animal Damage Control activities are conducted at airports throughout the country under cooperative agreements. APHIS-ADC program efforts are aimed at preventing bird and mammal strikes and other damage to aircraft and airport facilities. Bird aircraft strikes at or near airport facilities during takeoff or landing are a serious airport safety problem. Mammal aircraft strikes are a concern during taxiing, landing, and takeoff. Aircraft collisions with birds or mammals can result in human injury or loss of lives and serious damage to aircraft.

The APHIS-ADC program provides an IWDM program at [redacted] Airport ([redacted]) and surrounding areas to reduce the bird hazards to aircraft. Lethal methods include shooting and trapping introduced birds on the airfield and at locations around key cattle egret roost and rookery sites. Nonlethal control includes technical assistance, trapping and relocation, hazing using pyrotechnics, driving, walking and flushing wildlife (for all species but especially endangered species as permitted).

The objective of the APHIS-ADC operation at [redacted] is to protect human safety and property by reducing bird strikes through an appropriate combination of management methods.

2. Purpose and Need

A. Aviation Wildlife Conflicts - General

Wildlife/aircraft strike hazards are a major aviation concern in the United States. Collisions with wildlife cost the airline industry and the military about $250 million annually and threaten the lives of passengers and crews. To control wildlife hazards, many airports and military airfields have made wildlife management an integral part of airport operations.

The Federal Aviation Administration (FAA) reported 2,285 bird and mammal strikes in the United States in 1994. A total of 524 of these incidences, or 24 percent, resulted in damage. Waterfowl, birds of prey and crows cause the highest ratio of damage per strike. In 1994, the FAA reported a total of 488 aircraft components damaged by wildlife strikes. Engines are most readily damaged followed by wings, nose, windshield, and landing gear (Dolbeer, 1995)

[redacted]

In Hawaii, APHIS-ADC has provided on-going technical and operational assistance to reduce wildlife hazards at civilian and military airfields since 1987.

B. [redacted] Airport

There have been 116 bird-strikes at [redacted] from August 1992 to November 1996 (Appendix 1). The records are obtained from various sources such as the airlines, FAA, the airport manager, and APHIS-ADC. Three species were most frequently involved in strikes. The endangered black-necked stilt was involved in seven percent of these strikes. Introduced barn owls were involved in 19 percent and Pacific golden plovers were involved in 33 percent of all strikes. The most serious single incident involved a barn owl that was ingested in the engine of a DC-9. The repairs were estimated at $106,750.

[redacted] Airport is located on the island of [redacted] along the northern shoreline of the isthmus between the [redacted] and [redacted]. The airport is east of the town of [redacted]. [redacted] Airport runs second in the State in passenger volume after [redacted] Airport. Aircraft operations at [redacted] totaled [redacted] movements (take-offs or landings) in 1995.

The airport comprises approximately [redacted] acres of developed and undeveloped lands. Except for a [redacted] acre site which is owned by the [redacted], all the land is owned by the [redacted]. The dominant grass on the airfield is the buffel grass (*Cenchrus ciliaris*) which is not a favored species for seed eating birds. Approximately [redacted] acres of the land within the airport boundary have been designated as the [redacted]

[redacted]. This wetland is managed by the [redacted] ([redacted]) under the Memorandum of Agreement with the [redacted] ([redacted]) and the Federal Aviation Administration (FAA) as modified by a Memorandum of Understanding with the [redacted]. [redacted] supports a population of federally listed endangered water birds: the black-necked stilts (*Himantopus mexicanus knudseni*), the Hawaiian coot (*Fulica alai*), and koloa (*Anas wyvilliana*).

[redacted] Airport is classified as a Commercial Service-Primary Airport serving long-haul air carrier routes of over 1,500 miles. It is certified to operate as a scheduled air carrier facility by the FAA. The airport is required to take immediate measures to alleviate wildlife hazards to aircraft whenever they are detected under Federal Aviation Regulations (FAR) 139.337 (FAA, 1988). The FAA recognizes that APHIS-ADC has the expertise to provide technical and operational assistance needed to reduce wildlife hazards to aviation on and near airports (USDA, 1989). The [redacted] requested the assistance of APHIS-ADC to reduce the bird strike hazards at [redacted]. APHIS-ADC and [redacted] have entered into a cooperative reimbursable agreement that allows APHIS-ADC to manage the bird-strike hazards at the airport.
The APHIS-ADC bird hazard management operations for [redacted] began in July 1987. A population of about 1,300 cattle egrets (*Bulbulcus ibis*) flew across the airport twice a day on their morning and evening migration between their upland feeding sites and their rookery within the kiawe (*Prosopis pallida*) at nearby [redacted]. The main objective of the APHIS-ADC operation was to move the egret population out of [redacted] to put an end to the overflight hazard. Shooting at [redacted] and shooting of egrets during their morning and evening flights, forced the egret population to relocate. By July 1988, the egrets were out of [redacted] and had moved to red mangrove (*Rhizophora mangle*) stands within [redacted], six miles south of [redacted]. Occasionally, egrets would be seen in kiawe trees at [redacted], but were not allowed to roost. Shooting egrets keeps the population at a reduced level which ensures that the egrets on [redacted] do not expand beyond the capacity of [redacted] to provide suitable rookery habitat.

On January 13, 1989, the [redacted] manager reported large numbers of Pacific golden plovers using the taxiway of Runway [redacted] as an evening roost site. APHIS-ADC responded with nonlethal techniques, using pyrotechnics, harassing plovers off runway areas to force them to roost elsewhere.

In 1993, APHIS-ADC began to receive reports of endangered black-necked stilts being found dead on the runways at [redacted], apparently as a result of collisions with aircraft at night. Heavy rains created ponds along the main runway attracting the black-necked stilts. On September 9, 1996, APHIS-ADC was again designated a FWS agent to chase the stilts away from the runways at [redacted].

C. The Current Program

The objectives of the APHIS-ADC operations at [redacted] are to protect human safety and property by reducing bird strikes through an appropriate combination of management methods. An APHIS-ADC biological technician is present at the airport each day to assist the airport manager

in implementing the wildlife hazard management plan. Egrets are monitored at [redacted] and any that are found to be roosting are chased out of the sanctuary. The plover flocks and stilts are chased off the runways at the airport. Egrets are periodically shot along flight routes to reduce the population at [redacted] which is now the primary egret roost on the island of [redacted]. Feral cats and other mammals such as feral dogs and mongoose have been trapped infrequently and could potentially be removed from airport property. All actions are conducted primarily during daylight hours with occasional night-time operations being performed as necessary to address nocturnal bird activities. Appendix 2 lists the birds found on [redacted].

3. Public Involvement and Issues Identification

APHIS-ADC used the information gathered from its interdisciplinary team of specialists within the agency, the FWS, HDLNR and from airport personnel to identify potential issues. The following issues have been determined to be important to this environmental analysis: impacts on federally listed threatened and endangered species; impacts on target and nontarget species, animal welfare, impacts on migratory birds; and effectiveness (effects on aviation safety and avoiding economic losses from animal damage incidents).

Input received from the public on this environmental assessment (EA) was used to modify the analysis.

The [redacted] and FAA are preparing a draft EIS on [redacted] Airport improvements. This EA is not tiered to the [redacted]/FAA EIS. The scope of this EA is limited to the environmental analysis of ADC activities aimed at reducing birdstrike hazards. The EIS is using information gained from this EA.

The March 1996 [redacted] Airport Improvements, Draft Environmental Impact Statement ([redacted] 1996) mentions the hazing of stilts from the airport by APHIS-ADC to minimize the interaction between the aircraft and stilts. It also mentions that [redacted] is undertaking operational and maintenance measures to lessen the attraction of the ponding areas on the airfield that include but are not limited to drainage improvements and plantings. While these actions are not part of the proposed [redacted] Airport Improvements, they are mentioned in the EIS analysis because they may affect an endangered species, the black-necked stilt.

All habitat alterations from filling to draining wetland sites may be recommended by APHIS-ADC as part of its technical assistance responsibility to identify wildlife attractants and recommend ways eliminate or reduce the attraction. APHIS-ADC does not have the authority to enforce its recommendations. APHIS-ADC does not implement recommendations to alter habitat. Environmental compliance requirements for altering wetlands must be coordinated with the U.S. Army Corps of Engineers and/or the U.S. Fish and Wildlife Service. APHIS-ADC makes general recommendations to the airport for compliance with regulations regarding habitat modification. [redacted] compliance responsibilities for habitat alterations are beyond the scope of this environmental assessment.

A letter from the Office of Environmental Quality Control recommends to the [redacted]/FAA the incorporation of new information from this EA in the [redacted] Airport Improvement EIS.

4. Alternatives

The following alternatives (options) that could be implemented by APHIS-ADC at [redacted] are discussed below. Table 1 summarizes the wildlife hazard management methods that would be conducted by APHIS-ADC under each alternative.

A. Current Program (No Action Alternative)

The "No Action" alternative is the current program described under a mutually accepted annual cooperative service agreement. It incorporates the [redacted] Wildlife Hazard Management Plan which includes the implementation of primarily daytime operational bird control measures and occasional mammal trapping, with occasional night operations, and technical assistance recommendations for habitat modifications in an integrated manner. The current program is being conducted to safeguard immediate and long term threats to human health and safety, and to assist [redacted] in complying with FAA regulations.

B. Technical Assistance

Alternatives B would allow APHIS-ADC to provide only technical assistance to the airport. Under this alternative, APHIS-ADC would make recommendations to [redacted] personnel on effective lethal and non-lethal control methods. This may include recommendations regarding physical modifications to airport property including drainage patterns, vegetation, buildings and other structures. Lethal control methods such as shooting would be demonstrated to airport personnel for their use.

Technical Assistance provided by APHIS-ADC would result in the airport conducting the activities either directly or through a contracted agent such as DLNR, or a private pest control operator, licensed to work on the airport operations area. APHIS-ADC has no authority to ensure that management recommendations are carried out by the airport or its contracted agent.

C. Off-Site Control Only

Control measures and the locations where they are conducted are dependent on the species of wildlife that are a problem to flight safety. Since the current APHIS-ADC objective for egret control is to keep egrets from overflying the airport runways, APHIS-ADC could continue effective control off-site for this species. However, APHIS-ADC could not conduct control activities on Pacific golden plovers, common barn owls and stilts, since on-site control is necessary to manage these species. These activities would have to be done by the airport manager or a contracted party.

D. On-site Control Only

On-site control would address hazards associated with the Pacific golden plovers, common barn owls and the endangered stilts. The egret population would not be managed from within the boundaries of the airport.

E. Increase Control Operations

Current APHIS-ADC operations are conducted primarily during daylight periods with occasional night operations being performed as necessary. Under this alternative, APHIS-ADC would expand its operations to regular seasonal night operations during fall migration and periods of heavy rainfall. Regular seasonal control operations would take place during night hours when common barn owls, Pacific golden plovers and stilts are more active.

5. Environmental Consequences

The APHIS-ADC program evaluated the environmental consequences of the management alternatives in the programmatic EIS (USDA 1994). In the development of this EIS, issues concerning biological, economic, sociocultural, and physical impacts were identified for evaluation. Each alternative is examined against the issues identified in the environmental assessment process.

A. No Action Alternative

The impact of the current program on target species is the removal of 2,527 cattle egrets from 1992 through 1995, or an average of 632 egrets per year. A January 11, 1996 census of the egret population in central [redacted] revealed a population of 2,023 birds. The removal of cattle egrets from the population to control bird strike hazards has no significant impacts. This action simply maintains population control. The cattle egret is classified as an introduced migratory bird. It was introduced to [redacted] in 1959 by the Board of Agriculture to control flies on cattle. It has been suspected of preying on chicks of the endangered stilt and could prey on chicks of other native and endangered water birds.

The impact on mammals is not significant. In 1995, APHIS-ADC took 17 feral cats *(Felis catus*), seven mongooses (*Herpestes auropunctatus*), and one black rat (*Rattus rattus*) at [redacted].

The cost to implement the current program is about $75,000 per year. Most bird-strike incidents result in no damage to the aircraft but a single incident of a bird being ingested in an engine, such as one that occurred on February 2, 1995 at [redacted], cost the airlines $106,750 to repair the aircraft. A catastrophic incident such as the one caused by Canada geese at Elmendorf Air Force Base in Anchorage, Alaska, claimed the lives of all 24 crew members and totally destroyed an $189 million aircraft. The cost of the current APHIS-ADC program is insignificant when compared to what it can potentially cost the American public if there was no APHIS-ADC program to control wildlife hazards to aviation.

The 1992 Programmatic Biological Opinion on the APHIS-ADC program by the U.S. Fish and Wildlife Service (USDI, 1992) and the recent consultation with the FWS (1996) and DLNR

(1996) on the [redacted] proposal have determined that program activities would not likely affect the federally listed endangered black-necked stilt, however both agencies and the Hawaii Audubon Society expressed the need to monitor the long term cumulative effects of a continued or enhanced hazing program on the endangered waterbird species. Hazing black-necked stilts occurred only 20 times by APHIS-ADC from 1992 to November 1996 and therefore, represent a very minor activity in APHIS-ADC operations at [redacted]. APHIS-ADC will continue to monitor and survey bird occurrences at [redacted] but it is not likely that there are any harmful affects from the very rare, low intensity hazing that may take place when stilts are along the runways.

No significant impacts on any other endangered waterbird species, or indigenous migratory birds would occur from implementing the current program. No non-target species are taken or harassed since the methods used, shooting and hazing are highly selective. Hazing activities at [redacted] to remove cattle egrets are of extremely short duration, usually lasting less than one hour and would have little or no affect on endangered waterbird species. APHIS-ADC consults with DLNR during waterbird nesting season and defers to the state wildlife biologist unless there is an extraordinary build up of egrets at [redacted] that causes a resumption of twice daily egret overflight patterns across the main runway at [redacted] that puts aircraft at extremely high risk. Yet successful hazing of such numbers during the nesting season has involved less than a few hours of work and has been necessary only once since 1988.

Increases in aircraft flights as a result of the FAA/[redacted] proposed airport expansion may or may not increase the bird strike incidents. Increased flight activities will not change the APHIS-ADC program at [redacted] and its effect on endangered water birds, migratory birds or nontarget species. APHIS-ADC will continue to haze and shoot in a preventative control manner regardless of the number of flights.

Animal welfare will be described in terms of humaneness for this EA. The issue of humaneness, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. Some individuals and groups are opposed to some of the management actions of APHIS-ADC, especially lethal methods. Because serious safety hazards can occur from wildlife at the airport, it is concluded that the most effective methods must be used to handle wildlife conflicts. APHIS-ADC personnel are experienced and professional in their use of lethal methods being as humane as possible.

The current program allows APHIS-ADC to assist [redacted] in satisfying most of the needs for resolving bird-strike hazards. It satisfies the immediate wildlife management and control necessary to protect human safety, and reduce economic losses from wildlife conflicts primarily during the daylight period.

Table 1. Comparison of the alternatives

Management Method	Alt. A Current Program	Alt. B Technical Assist.Only[1]	Alt. C Off Site Only	Alt. D On Site Only	Alt. E Increased Control
Hazing	yes	no	yes	yes	yes
Shooting (lethal)	yes	no	yes	yes	yes
Live Trapping	yes	no	no	yes	yes
Survey and Monitor	yes	yes	yes	yes	yes
Habitat/Structure Management	yes	no	no	yes	yes
Regular Seasonal Night Operations	no	no	no	no	yes

B. Technical Assistance Alternative

Alternative B would allow APHIS-ADC to provide technical assistance to the airport. Some examples of this would be to provide recommendations to airport operations management on habitat modifications to deter wildlife; or instruction in shooting and hazing animals. [redacted] personnel or others contracted by [redacted] to conduct wildlife hazard management would implement recommendations proposed by APHIS-ADC at their discretion. Although many techniques are applicable, the [redacted] would determine which recommendations to carry out or contract. APHIS-ADC would most likely be involved in providing training on hazing methods to non-wildlife personnel. It is likely that this alternative would have a greater negative impact on all species (threatened and endangered, migratory birds, target and non-target), and may be less humane than the current program if personnel implementing the control operations were not well trained and experienced in wildlife management techniques.

In many situations, technical assistance is effective in reducing wildlife hazards at airports. For example, changing the drainage patterns to reduce ponding after rains can be effective. However, they are most effective when combined with the full array of management methods. This alternative could make it more difficult for the [redacted] to provide air travelers and flight personnel with an adequate level of protection. Wildlife damage prevention efforts at the airport would not

[1]Technical assistance from APHIS-ADC would allow [redacted] or its contracting agents to implement any of the management methods listed in the table.

cease under this alternative, but APHIS-ADC program expertise and techniques would not be available to respond to urgent wildlife damage situations arising at [redacted]. The American public expects a high level of health and safety protection. Under this alternative, increased possibilities of aircraft strikes, along with possible threats to human safety and loss of human life, represent serious threats and would not meet the expectations of the American public. Therefore, this is not the preferred alternative.

C. Off Airport Control Only

This alternative would allow APHIS-ADC to use its IWDM approach only off the airport. This would limit APHIS-ADC involvement in any wildlife hazard management activity and reduce the necessary expertise to successfully alleviate problem situations at the airport. Alternative C, would not provide sufficient protection for airport safety if a situation warranted on-site control. On-site control would be done by the airport manager. APHIS-ADC would technically assist the airport personnel on how to control wildlife. Wildlife damage prevention efforts at the airport would not cease under this alternative, but APHIS-ADC program expertise would be restricted in the event an urgent wildlife hazard situation should arise. Under this alternative, increased possibilities of aircraft strikes, along with possible threats to human safety and loss of human life, represent serious threats. Impacts on all bird species, except egrets, and the level of humaneness would likely be similar to the technical assistance alternative for the portion of the control work on the airport for the same reasons as described above, therefore, this is not the preferred alternative.

D. On Airport Control Only

No off-site control would be conducted. This would not allow adequate preventive control measures on the egret population at off-site locations. If egrets are not controlled at off-site locations, they would very likely move back to [redacted] and resume their daily flights over the approach end of the main runway. On-site control of the egret overflight can be implemented but would not be as effective as preventive control measures off-site.

Alternative D could affect APHIS-ADC's ability to quickly address wildlife threats and damage to problems by limiting control actions to airport property only. Continued or increase wildlife hazards at the airport would be likely to occur due to the restrictions placed on this management program.

This alternative would make it more difficult for [redacted] to provide adequate aircraft safety. Wildlife hazard management efforts at the airport would not cease under this alternative, but APHIS-ADC's program expertise and techniques would not be fully available to manage potential and actual off site threats. It is not reasonable to expect the airport manager to use APHIS-ADC at the airport and not use the program to control egrets off-site. It is also not reasonable to assume that DLNR or FWS would assume the responsibility of controlling egret numbers on their own. Under this alternative, increased possibilities of aircraft strikes and potential threats to human safety could continue. Therefore, this is not the preferred alternative.

E. Increase Control Operations

The discussion on the impacts for Alternative E is essentially the same as Alternative A, the "No Action" alternative, with the addition of regular seasonal night control operations when they are deemed necessary by APHIS-ADC and [redacted]. Increased control operations at night would allow hazing activities to take place when birds such as black-necked stilts, Pacific golden plovers, and barn owls become a problem. Night operations are not necessary throughout the year, but during the fall migration, or during periods of frequent rainfall that create flooded conditions on the airfield that attracts birds, extra personnel may be needed to monitor and alleviate the bird hazards that may occur at night. This alternative would have no significant impacts on the target species affected since they are merely hazed from the runways. There will be an increase in the hazing of the endangered black-necked stilt, since these birds frequent [redacted] at night. The effect of infrequent low intensity hazing will not have any long term cumulative effect on the black-necked stilt population. There would be no affect on nontarget species. The ability of APHIS-ADC to institute regular seasonal night operations is dependent on [redacted] providing the necessary funds for this expanded service, therefore this alternative was not selected.

6. Cumulative Impacts

Cumulative impacts are impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. The scope of this proposal and the number of mammals and birds that might be removed in an integrated wildlife management program from a long term perspective would not result in significant cumulative impacts. Because of ongoing contact with state and federal wildlife management agencies, national and local knowledge of wildlife population trends, and mitigation measures used, APHIS-ADC does not have a significant cumulative impact on target species, non-target species, or sensitive and endangered species. This finding is also made on a national level in the APHIS-ADC programmatic EIS (USDA 1994).

7. Conclusions

Limitations on the types of methods, locations, and timing of work allowed decreases the effectiveness of actions taken to reduce wildlife hazards. Because each wildlife hazard situation is unique, many favor the availability of a combination of options to be applied, depending on the factors involved with each individual situation. Such consideration of the full array of techniques, locations and timing to respond wildlife problems is fundamental to the concept of IWDM.

Because birds and mammals can create serious safety hazards and cause damage to aircraft and injury or death to people, this integrated approach is necessary to provide expedient, professional, and biologically sound assistance to airport operations. Alternative A provides this with no significant impacts on the human environment. A Finding of No Significant Impact will be issued.

This environmental assessment will be reviewed periodically to assure conformance with current environmental regulations and [redacted] requests and airport wildlife status. Changes in the project scope or

changes in environmental regulations may trigger the requirement for a new or revised environmental assessment.

8. Consultations

[redacted]	Biological Technician, Supervisory Animal Damage Control Specialist, USDA-APHIS-ADC, [redacted], Hawaii
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Kathy Smith	Wildlife Biologist, [redacted], U.S. Fish and Wildlife Service, Maui, Hawaii.
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Roger Woodruff	Wildlife Biologist, Reviewer, Assistant State Director, USDA-APHIS-ADC, Olympia, Washington.

9. References

Berryman, J.H. 1991. "Biodiversity:...a word of caution". Proc. 45th SE Assoc. Fish and Wildlife Agencies Conference.

Dolbeer, R.A. 1995. Preliminary Analysis of 1994 Data for the United States. (in press) USDA-APHIS-ADC Denver Wildlife Research Center, Sandusky, OH.

Federal Aviation Administration. 1988. Federal Aviation Regulations. Part 139 Certification and Operations: Land Airports Serving Certain Air Carriers. Revised January 1, 1988. U.S. Department of Transportation.

[redacted] Honolulu, HI.

Hawaii Audubon Society. 1996. Letter of comments on Draft EA for an Integrated Wildlife Hazard Management Program at [redacted]. Honolulu, Hawaii.

Hawaii State Historic Preservation Division. 1996. Compliance with Section 106 National Historic Preservation Act.

Hawaii Department of Land and Natural Resources (DLNR). 1996. Letter of concurrence. July 15, 1996. State of Hawaii, Division of Forestry and Wildlife, Maui, Hawaii.

Leopold, A.S., 1933. Game Management. Charles Scribner & Sons, New York, New York.

U.S. Department of Agriculture (USDA). 1989. Memorandum of Understanding between the United States Department of Transportation, Federal Aviation Administration and USDA, Animal and Plant Health Inspection Service, Animal Damage Control.

U.S. Department of Agriculture. 1994. Animal and Plant Health Inspection Service, Animal Damage Control. Final Environmental Impact Statement.

U.S. Department of Agriculture. 1995. November Monthly Narrative Report, Western Region. Animal and Plant Health Inspection Service, Animal Damage Control, Western Regional Office, 12345 West Alameda Parkway, Lakewood, CO.

U.S. Department of Interior (USDI). 1992. U.S. Fish and Wildlife Service. Biological Opinion on the USDA-APHIS-ADC Program.

U.S. Department of Interior. 1996. Informal Section 7 Consultation July 5, 1996. U.S. Fish and Wildlife Service. Honolulu, Hawaii.

Wildlife Society, The, 1990. Conservation Policies of the Wildlife Society. The Wildlife Society, Washington, DC. p. 20.

Appendix 1. Bird Strike Records at [redacted] Airport

DATE	TIME	SPP	RWY	LOC	COM	MOD	POF	R/U	WSP	WDI	CLC	ASP	ALT	COST	NOTE
[redacted]	530	Common Barn Owl	[redacted]	[redacted]				U	20	NE	5				
[redacted]	1500	Pac. Golden Plover	[redacted]	[redacted]				U	18	SE	5				
[redacted]	630	Unidentified	[redacted]	[redacted]	[redacted]	B737	LR	R	22	NE	5	120	0		
[redacted]	719	Unidentified	[redacted]	[redacted]	[redacted]	B737	TO	R	23	NE	5	180	15	$1,000	LT. SIDE - POSS. INGESTION
[redacted]	800	Pac. Golden Plover	[redacted]	[redacted]	[redacted]			U	23	SN	5				
[redacted]	1900	Common Barn Owl	[redacted]	[redacted]				U	12	SE	9				
[redacted]	500	Common Barn Owl	[redacted]	[redacted]	[redacted]	P-3	TP	R	15	SE	5	110	0	$1,000	PILOT (LFT) WINDSHIELD
[redacted]	1108	Pac. Golden Plover	[redacted]	[redacted]	[redacted]	B737	LR	R	18	NE	5	130	0	$1,000	CO-PILOT(RT) WINDSHIELD
[redacted]	2048	Unidentified	[redacted]	[redacted]	[redacted]	B737	A	R	23	NE	5	180	35		N/A
[redacted]	801	Pac. Golden Plover	[redacted]	[redacted]				U	31	SE	5				
[redacted]	807	Ruddy Turnstone	[redacted]	[redacted]				U	25	SW	5				
[redacted]	531	Pac. Golden Plover	[redacted]	[redacted]				U	25	SW	5				
[redacted]	735	Pac. Golden Plover	[redacted]	[redacted]				U	21	SE	0				
[redacted]	525	Ruddy Turnstone	[redacted]	[redacted]				U	41	NE	5				
[redacted]	605	Ruddy Turnstone	[redacted]	[redacted]				U	30	NE	5				
[redacted]	602	Zebra Dove	[redacted]	[redacted]				U	30	NE	5				
[redacted]	803	Pac. Golden Plover	[redacted]	[redacted]				U	34	NW	5				
[redacted]	537	Pac. Golden Plover	[redacted]	[redacted]				U	28	NW	5				
[redacted]	857	Pac. Golden Plover	[redacted]	[redacted]				U	32	NW	5				
[redacted]	2035	Feral Cat	[redacted]	[redacted]				U	34	NW	5				
[redacted]	524	Sanderling	[redacted]	[redacted]				U	24	SW	5				
[redacted]	541	Pac. Golden Plover 3	[redacted]	[redacted]				U	44	NE	5				
[redacted]	1002	Short-eared Owl	[redacted]					U	34	NW	5				
[redacted]	1037	Pac. Golden Plover	[redacted]	[redacted]				U	29	NW	5				
[redacted]	602	Pac. Golden Plover 2	[redacted]	[redacted]	[redacted]	B737		R	32	NE	0	120	0	$1,000	PILOT WINDSHIELD - PT. SIDE
[redacted]	911	Pac. Golden Plover	[redacted]	[redacted]				U	27	NW	5				
[redacted]	517	Pac. Golden Plover	[redacted]	[redacted]				U	22	NW	9				
[redacted]	2148	Common Barn Owl	[redacted]	[redacted]	[redacted]	B737	LR	R	41	NE	5	120	0	$1,000	LT. INBOARD LEADING EDGE FLAP
[redacted]	900	Unidentified	[redacted]	[redacted]	[redacted]	B737	A	R	37	NE	5	190	40	$1,000	UPPER NOSE DOWE
[redacted]	1205	Pac. Golden Plover	[redacted]	[redacted]				U	33	E	5				

	530	Pac. Golden Plover					U	21	NE	5				
	537	Black-necked Stilt					U	18	NE	0				
	1831	Black-necked Stilt					U	34	NE	5				
	730	Pac. Golden Plover					U	25	N	5				
	746	Short-eared Owl					U	25	N	5				
	830	Pac. Golden Plover					U	30	NE	9				
	1115	Feral Pigeon				DC-9	TO	R	39	E	9	150	10	N/A
	637	Pac. Golden Plover						U	44	NE	5			
	526	Black-necked Stilt						U	12	NE	5			
	520	Pac. Golden Plover						U	27	E	5			
	522	Pac. Golden Plover						U	22	E	9			
	1302	Pac. Golden Plover						U	28	NE	5			
	533	Pac. Golden Plover 2						U	41	NE	5			
	1450	Pac. Golden Plover						U	34	NE	5			
	1117	Unidentified				8-3	A	R	21	NE	5	180	25	$1,000 UNDER CARRIAGE NOSE DOME
	523	Pac. Golden Plover 2						U	18	NE	5			
	531	Common Barn Owl				B737	LR	R	23	SW	9	110	0	$1,000 T O P O F AIRCRAFT
	2138	Unidentified				B737	LR	R	20	NW	5	100	0	$1,000 TOP PILOT WINDSHIELD
	2032	Common Barn Owl				DC-10	LR	R	16	N	5	120	0	$1,000 INGESTION #1 ENGINE
	750	Black-necked Stilt						U	38	E	9			
	1715	European Skylark				B737	LR	R	28	NE	5	120	0	$1,000 N\A
	1531	Gray Francolin						U	38	E	5			
	1400	Feral Pigeon						U	32	NE	5			
	1000	Common Barn Owl						U	35	NE	9	120	0	
	830	Nutmeg Mannikin 4				DC-9	LR	R	40	NE	5			N/A
	605	Black-necked Stilt						U	29	NE	5			
	715	Common Barn Owl						U	29	NE	5			
	1940	Unidentified				B737	LR	R	30	NE	5	100	0	N/A
	525	Pac. Golden Plover						U	33	NE	5			
	1205	Pac. Golden Plover						U	24	NE	5			
	600	Unidentified				B737	TO	R	35	NE	5	200	12	$1,000 #1 ENGINE INGESTION
	1601	Pac. Golden Plover						U	32	NE	5			
	1801	BC Night Heron				DC-9	TO	U	35	E	5	150	10	$1,000 N/A

[redacted]	1603	Unidentified	[redacted]	[redacted]	[redacted]	DC-9	TO	R	22	NW	5	130	0	$1,000	N/A
[redacted]	2001	Common Barn Owl	[redacted]	[redacted]				U	26	SW	5				
[redacted]	1740	Common Barn Owl	[redacted]	[redacted]	[redacted]	B737	LR	R	34	SW	5	120	0	$1,000	N/A
[redacted]	520	Common Barn Owl	[redacted]	[redacted]				U	33	SW	5				
[redacted]	1910	Unidentified	[redacted]	[redacted]	[redacted]	L-1011	TO	R	25	SW	5	190	20		
[redacted]	546	Common Barn Owl	[redacted]	[redacted]				U	16	N	5				
[redacted]	2000	Common Barn Owl	[redacted]	[redacted]	[redacted]	DC-9	TO	R	20	NE	5	110	0	$106,750	INGESTION #1 ENGINE
[redacted]	1146	Common Barn Owl	[redacted]	[redacted]	[redacted]	B737	TO	R	21	E	5				
[redacted]	1015	Unidentified	[redacted]	[redacted]	[redacted]	B737	LR	R	40	SE	5	120	0	N/A	#1 ENGINE PROPELLER
[redacted]	1935	Unidentified	[redacted]	[redacted]	[redacted]	Prop	LR	R	33	SW	5	110	0		
[redacted]	1145	Unidentified	[redacted]	[redacted]	[redacted]	B737	LR	R	28	NE	5	130	5	$1,000	INGESTION #2 ENGINE
[redacted]	555	Black-necked Stilt	[redacted]	[redacted]				U	40	E	5				
[redacted]	1947	Common Barn Owl	[redacted]	[redacted]	[redacted]	DC-9	LR	R	28	NE	5	140	5	$1,000	N/A
[redacted]	600	Unidentified	[redacted]	[redacted]	[redacted]	DC-9	LR	R	25	NE	5	120	0	$1,000	N/A
[redacted]	1807	Black-necked Stilt	[redacted]	[redacted]				U	20	NE	5				
[redacted]	727	Unidentified	[redacted]	[redacted]	[redacted]	DC-9	LR	R	33	E	5	110	0	$1,000	N/A
[redacted]	1924	Unidentified	[redacted]	[redacted]	[redacted]	DC-9	LD	R				120	0	$1,000	
[redacted]	608	Common Barn Owl 2	[redacted]	[redacted]				U	36	NE	5				
[redacted]	2307	Wedgetail Shearwater	[redacted]	[redacted]				U	36	NE	5				
[redacted]	538	Pac. Golden Plover	[redacted]	[redacted]				U							
[redacted]	535	Pac. Golden Plover	[redacted]	[redacted]				U							
[redacted]	600	Wedgetail Shearwater	[redacted]	[redacted]				U							
[redacted]	622	Unidentified	[redacted]	[redacted]		B737	LD	R		S		120	0	$1,000	
[redacted]	600	Common Barn Owl	[redacted]	[redacted]				U							
[redacted]	840	Unidentified	[redacted]	[redacted]		ATR-42	LD	R		SW			0	$1,000	
[redacted]	910	Pac. Golden Plover	[redacted]	[redacted]				U							
[redacted]	1140	European Skylark	[redacted]	[redacted]				U							
[redacted]	600	Common Barn Owl	[redacted]	[redacted]				U							
[redacted]	1256	Pac. Golden Plover	[redacted]	[redacted]				U							
[redacted]	550	Zebra Dove	[redacted]	[redacted]				U							
[redacted]	1206	English Sparrow	[redacted]	[redacted]				U							
[redacted]	1400	Common Barn Owl	[redacted]					U							
[redacted]	530	Common Barn Owl	[redacted]	[redacted]				U							
[redacted]	815	Common Barn Owl	[redacted]	[redacted]	[redacted]	B737		R							HIT RADOME OF AIRCRAFT

[redacted]	1915	Unidentified	[redacted]	[redacted]		B737	LD	R			120	0	$1,000
[redacted]	1619	Unidentified	[redacted]	[redacted]		B737		R				50	$1,000
[redacted]	630	Zebra Dove	[redacted]	[redacted]	[redacted]	B737		R					
[redacted]	2037	Unidentified	[redacted]	[redacted]		C172	TO	R			70	10	
[redacted]	505	Pac. Golden Plover	[redacted]	[redacted]				U					
[redacted]	829	Unidentified	[redacted]	[redacted]		B737/200	TO	R	SW	20	160	10	$1,000
[redacted]	2030	Pac. Golden Plover	[redacted]	[redacted]	[redacted]	B737		R					
[redacted]	831	Unidentified	[redacted]	[redacted]		B737/200	LD	R	SE	20	120		$1,000
[redacted]	831	Unidentified	[redacted]	[redacted]		B737/200	TO	R	SW	20	165	10	$1,000
[redacted]	1715	Pac. Golden Plover	[redacted]	[redacted]				U					
[redacted]	1105	Unidentified	[redacted]	[redacted]		B737/200	TO	R	SW	30	220	600	$1,000
[redacted]	1200	Pac. Golden Plover						U					
[redacted]	755	Pac. Golden Plover	[redacted]	[redacted]				U					
[redacted]	844	Pac. Golden Plover	[redacted]	[redacted]				U					
[redacted]	531	Pac. Golden Plover	[redacted]	[redacted]				U					
[redacted]	543	Unidentified	[redacted]	[redacted]		DC-9	TO	R	SW	40	110	15	$1,000
[redacted]	700	Common Barn Owl		[redacted]				U					
[redacted]	657	Unidentified	[redacted]	[redacted]		ATR42		R	SW	50	120	300	$1,000

Codes:

SPP	Bird Species
RWY	Runway
LOC	Location on runway
COM	Carrier
MOD	Aircraft Model
POF	Phase of Flight
	LR - Landing Roll
	TO - Take off
	TP - Touch and Go
	A - Approach
	LD - Landing
R/U	Reported/Unreported
WSP	Wind Speed
WDI	Wind Direction
CLC	Cloud Cover
ASP	Air Speed
ALT	Altitude

10. Appendix 2. BIRDS FOUND ON THE AIRFIELD AT [redacted]

Species of birds that generally appear on or over [redacted] at some period through out the year.

SEED-EATING BIRDS

	Zebra dove	(*Geopelia striata*)
	Spotted dove	(*Streptopelia chinensis*)
	Chestnut mannikin	(*Lonchura malacca*)
	Nutmeg mannikin	(*Lonchura punctulata*)
	House finch	(*Carpodacus mexicanus*)

WATER BIRDS

++	Pacific golden-plover	(*Pluvialis fulva*)
++	Ruddy turnstone	(*Arenaria interpres*)
+*	Hawaiian duck (koloa)	(*Anas wyvilliana*)
+*	Black-necked stilt	(*Himantopus mexicanus knudseni*)
	Cattle egret	(*Bubulcus ibis*)
++	Black-crowned night heron	(*Nyticorax nyticorax*)

UPLAND BIRDS

+	Short-eared owl (pueo)	(*Asio flammeus sandwichensis*)
	Common barn owl	(*Tyto alba*)
	Ring-necked pheasant (*Phasianus colchicus*)	
	Eurasian skylark	(*Alauda arvensis*)

URBAN BIRDS

	Common myna	(*Acridotheres tristis*)
	House sparrow	(*Passer domesticus*)
	Java sparrow	(*Padda oryzivora*)
	Red-crested cardinal	(*Paroaria coronata*)
	Northern cardinal	(*Cardinalis cardinalis*)
	Northern mockingbird	(*Mimus polyglottus*)

MARINE BIRDS

++	Wedgetailed shearwater	(*Puffinus pacificus*)
++	Great frigatebird ('Iwa)	(*Fregata minor palmerstoni*)

+	endemic
++	indiginous
*	endangered
**	threatened